FOREWORD

Quality curriculum is basic to any educational programme. The written curriculum must provide the structure and substance of what is taught to all students. The written curriculum is a guide to teachers to ensure that the knowledge, skills, competencies and resources students need in order to learn are provided during instruction.

In particular, it is acknowledged that knowledge is virtually infinite in that it is continually changing and expanding as "new" knowledge is developed and "old" knowledge is refined. In addition the skills and competencies that students need change as the environment in the total community changes. It is important therefore that a school system has a structure for the instructional programme that provides direction, focus, flexibility and state-of-the-art thinking about each content area.

Because of its strategic geographical position, Bermuda has been influenced continuously by the changes in the relationship between the continents bordering the Atlantic -- North and South America, Africa and Europe. The current interest in the globalization of the world community allows Bermuda to build on its strength in international relations. It is essential that our students become accustomed to viewing the entire world as the area in which they must live and grow. They must integrate knowledge across all subjects in preparation for their adult life. Our curriculum guides must be viewed from this perspective.

A team of teachers, education officers and other persons within the school system and community, drawing from their collective experience in working with young people, has developed this curriculum guide. Input from community representatives on each Curriculum Advisory Committee has assisted us in Bermudianizing the curriculum. All of the contributors share both the pride and the responsibilities of authorship. This guide represents the essential elements of education in Bermuda's senior schools.

J. T. Christopher, Ph.D.
Chief Education Officer

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CONTENTS

RESOURCES

OVERVIEW

The aim of the senior school is to provide for the academic achievement and personal development necessary to prepare students for work, further education and productive citizenry in the 21st Century. In keeping with this aim, the senior school curriculum builds on the middle level programme and is organized around four (4) career pathways: arts and communications, applied technologies, health & human services and international business and tourism.

The senior school curriculum, composed of a rigorous programme of study, sets high expectations for students by emphasizing mastery of complex academic and technical concepts. The programme is based on the belief that all students make every effort to succeed when in an environment that fosters and encourages success, regardless of their background or previous level of achievement.

The curriculum guide contains three (3) sections beginning with the Introduction. The stated twelve goals of education direct instructional outcomes in all senior school subjects and programmes. Specifically, a curriculum framework has been approved for each subject and is to be used as the basis for the subject specific philosophy, goals and subgoals, performance indicators and scope and sequence. Effective utilization of this framework will establish continuity and progression of instruction throughout all year levels.

The second section of this guide delineates the senior school programme of instruction and contains the following: subject's rationale, course description, requirements and outline, correlation matrix and modules for each course offered. It is expected that all teachers will focus instruction on the established curriculum objectives outlined in the modules. The final section of this guide contains an appendix of valuable resources for teachers.

GOALS OF EDUCATION

In Bermuda, the Goals of Education provide the direction for senior level education. These twelve (12) goals enable senior level students to:

- develop responsiveness to the dynamic process of learning
- develop resourcefulness, adaptability and creativity in learning and living
- acquire the basic knowledge and skills needed to comprehend and express ideas through words, numbers and other symbols
- develop a wellness approach to life
- gain satisfaction from participating in and appreciating the various forms of artistic expression
- develop a feeling of self-worth
- develop values related to personal and ethical beliefs and to the common welfare of society
- develop an understanding of the role of the individual within a family unit, the role of the family within society and the role of our society in a global context
- develop a sense of personal responsibility in society at the national and international levels
- acquire skills that contribute to self-reliance in solving practical problems in everyday life
- acquire skills and attitudes that will lead to satisfaction and productivity in a career
- develop respect for the environment and a commitment to the wise use of resources.

CAREER PATHWAYS

The curriculum at the senior level will be organized around four (4) career pathways: arts and communications, applied technologies, health and human services and international business and tourism. Career pathways are clusters of occupations/careers that are grouped because many of the people in them share similar interests and strengths. All pathways include a variety of occupations that require different levels of education and training. Career pathways help students focus on and prepare for the future. In addition, teachers, counsellors and other adults can better support students as they direct their energies toward their established goal.

The senior school graduation requirements are subsumed within each pathway and include four years of English language arts and three years of mathematics, science and social studies. Students also are required to take physical education, health education, computer studies, business studies, family studies or design and technology and at least one of the arts.

Additionally, information technology, library information, career education, learning support and other student service programmes will be offered to all senior level students. It is expected that the implemented curriculum will be based on the premise that all students can learn and that instruction should be differentiated to meet the unique needs of the learner. Further, it is expected that the senior school curriculum will be implemented from a Bermudianized and multicultural perspective as much as is feasible.

BERMUDA SCHOOL CERTIFICATE (BSC)

From September 1999 all students who successfully complete the graduation requirements will be awarded the Bermuda School Certificate (BSC). Students must acquire 116 credits; the 70 required credits from the chart below and an additional 46 credits from student selected courses.

SUBJECTS	COURSE LEVELS				Total Requirements
	100	200	300	400	
English Language Arts	4	4	4	4	16
Mathematics	4	4	4	-	12
Science	4	4	4	-	12
Social Studies	4	4	4	-	12
Physical Education	2	2	2	-	6
Health Education	2	-	-	2	4
The Arts*	2	-	-	-	2
Business Studies	2	-	-	-	2
Computer Studies	2	-	-	-	2
EITHER: Family Studies OR Design Technology	2 or 2	-	-	-	2 or 2
TOTALS	28	18	18	6	70

*A further two credits will be required in the Arts when the new facility at The Berkeley Institute is completed.

How will the courses be organized?

All 100 level courses will be mandatory.
200-400 level courses will be organized under broad career pathways:

Applied Technologies
Arts and Communications
Health and Human Services
International Business and Tourism

Within each Career Pathway students will choose courses in line with their intended career choice.

How are course grades obtained?

A variety of assessments, including written tests, portfolios and practical assignments will be used to indicate achievement of course objectives. Each assessment instrument is detailed in the curriculum document. Students need a pass grade (D) in each course to be awarded credit.

What do the grades mean?

GRADE	% SCORES	MEANING OF GRADE	GRADE POINT
A	90 and above	Outstanding	4.0
B	80 -89	Good	3.0
C	70 -79	Satisfactory	2.0
D	60 - 69	Pass	1.0
F	59 and below	Failing Grade	0.0

What is a Grade Point Average (GPA)?

The GPA is the total of grade points achieved in all courses taken by the student divided by the number of courses taken.

$$\text{GPA} = \frac{\textbf{grade points for all courses}}{\textbf{number of courses taken}}$$

Can students graduate and go directly to College or University?

Students will be able to enter the Bermuda College or another college or university directly from the senior school programme provided they meet that college's or university's entry requirements. Admission will depend upon the courses the student has taken, the grades obtained and overall grade point average.

Will students who enter the system from abroad or from a local private institution be given credit towards the BSC?

Students coming from a recognized institution will be given credit for course work successfully completed at that institution.

SENIOR SCHOOL COURSES AT A GLANCE

English Language Arts (EL)	Mathematics (MT)
English Language & Literature I **(R)** English Language & Literature II **(R)** English Language & Literature III English Language & Literature IV Journalism & Publications Literature of Africa, Bermuda & the Caribbean Reading & Study Skills Speech & Debate Writer's Workshop	Foundations of Mathematics **(R)** Mathematics Laboratory (no credit) Advanced Mathematics Applied Mathematics I Applied Mathematics II Applied Mathematics IIIA Applied Mathematics IIIB Business Mathematics I Business Mathematics II Integrated Mathematics I Integrated Mathematics II Introductory Calculus
Science (SC)	**Social Studies (SS)**
Science I **(R)** Science II **(R)** Applied Biology & Chemistry Applied Physics Biology I Biology II Chemistry I Chemistry II Earth Science Environmental Science I Environmental Science II Human Biology Introduction to Horticulture Marine Science Physics I Physics II	Bermuda Social Science: An Overview **(R)** Politics & Law in Action **(R)** Comparative Religion and Ethics Introduction to African History Introduction to American History Preserving our Heritage Physical and Human Geography I Physical and Human Geography II Physical and Human Geography III World History

Business Studies (BS)	Computer Science (CS)
Business Essentials I **(R)**	Computer Science I **(R)**
Accounts I	Computer Science II
Accounts II	Computer Programming I
Business & Personal Law	Computer Programming II
Business Essentials II	Information Technology Projects
Computer Keyboarding & Business Applications	Inside the Computer
Economics	Multimedia
Insurance	Network Technology
International Business	Presentation Tools
Marketing	Web-Page Design
Office Technology	
Office Technology & Business Application	
Small Business Management	
Travel & Tourism	

Design & Technology (DT)	Family Studies (FM)
Design & Technology	Exploring Family Living
Design & Realization I	Child Care & Development I
Design & Realization II	Child Care as a Profession II
Design & Realization III	Discovering Food & Nutrition
Electronics Technology I	Exploring Careers in Design & Textiles
Electronics Technology II	Exploring Careers in Nutrition & Hospitality
Electronics Technology III	Fashion & Textile Design
Graphic Communication I	Interior Decorating
Graphic Communication II	Meal Management & Hospitality
Graphic Communication III	Personal Care I
Transportation Technology I	Personal Care II
Transportation Technology II	Textile Design
Transportation Technology III	

Health (HE)	Physical Education (PE)
Health & Wellness **(R)** Health Issues**(R)** Tobacco, Alcohol & Other Drugs (A)* First Aid CPR (A)* Relationships & Human Sexuality (B)** Diseases, Prevention & Control (B)** Health Occupations ***/**Courses labeled A or B will run consecutively as a pair.**	Physical Education I **(R)** Physical Education II **(R)** Physical Education III **(R)** Physical Education IV
Foreign Languages (FL)	**Functional Skills (FC)**
French/Spanish/Portuguese I French/Spanish/Portuguese II French/Spanish/Portuguese III French/Spanish/Portuguese IV Foreign Languages for International Business	Functional Skills I Functional Skills II Functional Skills III Functional Skills IV

Music (MU)	Visual Art (VR)
Music in Society **<u>Instrumental Music</u>** Instrumental Ensemble Instrumental Independent Study Jazz Band Keyboard Lab Music Technology Show Band Ensemble **<u>Vocal Music</u>** Concert Choir Vocal Independent Study Vocal Ensemble	Visual Art in Society Ceramics Drawing & Painting Drawing, Painting & Printed Works Photography Three Dimensional Visual Art
Dance (DN)	**Theatre (TH)**
Dance in Society Ballet, Modern, Tap & Jazz I Ballet, Modern, Tap & Jazz II Dance & Sports Dance Production Popular & Social Dance Dance Company World Dance Forms	Theatre in Society Acting I Acting II General Communication Play Directing Play Production Scriptwriting Technical Theatre Video Arts

SCIENCE PHILOSOPHY

Science Education is a process by which students are provided with the opportunity to explore and investigate our world through instructional approaches which will not only meet the need and learning style of each student but also be linked to other areas of learning. The fundamental goal is to prepare all students to be scientifically literate and be empowered to make informed choices concerning personal, societal, environmental and technological issues. Science Education should foster an appreciation and a sense of responsibility for our future.

SCIENCE

CONCEPTUALIZING THE HISTORY AND NATURE OF SCIENCE	EXPLORING THE NATURE OF SCIENTIFIC INQUIRY	DEMONSTRATING POSITIVE ATTITUDES TOWARDS SCIENCE	ADVOCATING FOR ENVIRONMENTAL RESPONSIBILITY
GOAL 1	GOAL 2	GOAL 3	GOAL 4

CONTENT AREAS

- SYSTEMS
- CHANGE
- CAUSE AND EFFECT

SCIENCE EDUCATION
GOALS AND SUBGOALS

GOAL 1 **STUDENTS WILL CONCEPTUALIZE THE HISTORY AND NATURE OF SCIENCE.**

Subgoal 1.1 Evaluate how science has evolved over time through contributions of persons from diverse cultures

Subgoal 1.2 Use scientific knowledge to explain common themes in science and to show the connections between sciences and other disciplines

Subgoal 1.3 Evaluate the impact of scientific knowledge on personal health and health technologies

Subgoal 1.4 Conceptualize the interdependence of mathematics, science and technology

Subgoal 1.5 Analyze how scientists use a variety of methods to investigate nature and solve problems

GOAL 2 **STUDENTS WILL EXPLORE THE NATURE OF SCIENTIFIC INQUIRY.**

Subgoal 2.1 Formulate questions and develop hypotheses to explain behaviour of objects and events

Subgoal 2.2 Design and conduct a scientific inquiry to collect valid and reliable data to test a law, theory or hypothesis

Subgoal 2.3 Make precise observations and measurements; present data and results clearly, appropriately accurately in multiple ways

Subgoal 2.4 Use technology to improve investigations and communication of outcomes

Subgoal 2.5 Construct explanations using logic and data, recognizing the limitations of scientific knowledge

Subgoal 2.6 Evaluate alternative explanations about scientific claims

Subgoal 2.7 Defend a scientific argument and the results of a scientific inquiry

Subgoal 2.8 Evaluate information selected from multiple sources: investigations, computer data bases, print, the Internet, video and other non print media

GOAL 3 **STUDENTS WILL DEMONSTRATE POSITIVE ATTITUDES TOWARDS SCIENCE.**

Subgoal 3.1 Formulate a plan to use science in home, school and community life

Subgoal 3.2 Recognize pattern and aesthetics in the environment

Subgoal 3.3 Analyze the application of ethical principles to science

Subgoal 3.4 Evaluate career options that relate to science

GOAL 4 **STUDENTS WILL ADVOCATE FOR ENVIRONMENTAL RESPONSIBILITY.**

Subgoal 4.1 Advocate for environmental stewardship

Subgoal 4.2 Evaluate the use of scientific information to make judgments on environmental issues

GOAL 1	**Students will conceptualize the history and nature of science.**			
SCIENCE	**PERFORMANCE INDICATORS**			
Sub Goals	**PS – P3** **Learning Phase A**	**P4 - P6** **Learning Phase B**	**M1 - M3** **Learning Phase C**	**S1 - S4** **Learning Phase D**
1.1 Evaluate how science has evolved over time through contributions of persons from diverse cultures	recognize the difference between science today and early science knowledge	compare science knowledge and techniques used by early scientists with those used by today's scientists	analyze the impact of scientific theories and knowledge on humans and the contributions of scientists over time	evaluate how science has evolved over time through contributions of persons from diverse cultures
1.2 Use scientific knowledge to explain common themes in science and show connections between science and other disciplines	acquire scientific knowledge during investigations of nature, toys and technology	use scientific knowledge to solve problems, to explain patterns in nature and to examine how things work	use scientific information to show connections among different sciences, mathematics and other disciplines	use scientific knowledge to explain common themes in science and show connections between science and other disciplines
1.3 Evaluate the impact of scientific knowledge on personal health and health technologies	describe how to keep healthy, common health problems and actions which cause them	relate the understanding of science to personal health	relate the increase in scientific knowledge to the improvement of personal health and development of health technologies	evaluate the impact of scientific knowledge on personal health and health technologies
1.4 Conceptualize the interdependence of mathematics, science and technology	recognize how mathematics and technology are used in science investigation	describe how science methods and knowledge are used to make new things and to improve the way we live and work	show how mathematics is a tool of science and how science is applied through technology	conceptualize the interdependence of mathematics, science and technology
1.5 analyze how scientists use a variety of methods to investigate nature and solve problems	know that scientists investigate problems or puzzles of nature	recognize the approaches that scientists use to solve problems and investigate nature	differentiate among methods that scientists use to solve problems and investigate nature	analyze how scientists use a variety of methods to investigate nature and solve problems

GOAL 2	Students will demonstrate the nature of scientific inquiry.			
SCIENCE (1 of 2)	PERFORMANCE INDICATORS			
Sub Goals	PS – P3 Learning Phase A	P4 - P6 Learning Phase B	M1 - M3 Learning Phase C	S1 - S4 Learning Phase D
2.1 Formulate questions and develop hypotheses to explain behaviour of objects and events	pose simple questions about the environment and suggest answers	refine questions so that they can be investigated and develop possible solutions	develop problems and use prior knowledge to make predictions about an investigation	formulate questions and develop hypotheses to explain behaviour of objects and events
2.2 Design and conduct a scientific inquiry to collect valid and reliable data to test a law theory or hypothesis	follow simple instructions in written, graphic or pictorial form and make careful observations and measurements	choose a range of variables to use and make careful observations and measurements	identify and make sufficient measurements of key variables	design and conduct a scientific inquiry to collect valid and reliable data to test a law theory or hypothesis
2.3 Make precise observations and measurements; present data and results clearly, appropriately accurately in multiple ways	report observations made during an investigation orally or in written, or pictorial form	report observations, measurements and results without bias and in alternative ways	record observations, measurements and results clearly appropriately and in multiple ways	make precise observations and measurements; present data and results clearly, appropriately accurately in multiple ways
2.4 Use technology to improve investigations and communication of outcomes	use simple tools safely to measure and observe	select appropriate instruments and use them safely and correctly to carry out a fair test	use technological tools and scientific instruments to improve investigation and reporting of outcomes	use technology to improve investigations and communication of outcomes

GOAL 2	Students will demonstrate the nature of scientific inquiry.			
SCIENCE (2 of 2)	**PERFORMANCE INDICATORS**			
Sub Goals	**PS – P3 Learning Phase A**	**P4 - P6 Learning Phase B**	**M1 - M3 Learning Phase C**	**S1 - S4 Learning Phase D**
2.5 Construct explanations using logic and data recognizing the limitations of scientific knowledge	use data to answer questions	make explanations based on observations or data	draw conclusions based on prior knowledge and data gathered from an investigation	construct explanations using logic and data recognizing the limitations of scientific knowledge
2.6 Evaluate alternative explanations about scientific claims	compare data and explanations about objects and events and distinguish between fact and opinion	explore explanations based on data gathered, make more observations and look for better reasons if necessary; distinguish between fact and opinion	critique scientific arguments by examining data and results of an investigation and noting sources of inconsistencies and bias	evaluate alternative explanations about scientific claims
2.7 Defend a scientific argument and the results of a scientific inquiry	explain observations by a suitable communications medium	explain observations, procedures and results by a suitable communications medium	report processes, summarize data in various forms and form a logical argument about relationships in an investigation	defend a scientific argument and the results of a scientific inquiry
2.8 Evaluate information selected from multiple sources: investigations, computer data bases, print, the Internet, video and other non print media	obtain information from print and non print sources and investigations	obtain information from investigations, print, multimedia and the Internet	select information from multiple sources: investigations, computer data bases, print, the Internet, video and other non print media	Evaluate information selected from multiple sources: investigations, computer data bases, print, the Internet, video and other non print media

GOAL 3	**Students will demonstrate positive attitudes towards science.**			
SCIENCE	**PERFORMANCE INDICATORS**			
Sub Goals	**PS – P3 Learning Phase A**	**P4 - P6 Learning Phase B**	**M1 - M3 Learning Phase C**	**S1 - S4 Learning Phase D**
3.1 Formulate a plan to use science in home, school and community life	describe how science relates to home, school and community life	show interest in the use of science in home, school and community life	value science in home, school and community life	formulate a plan to use science in home, school and community life
3.2 Value patterns and aesthetics in the environment	observe patterns in nature	appreciate the pattern and aesthetics of nature	cherish the patterns and aesthetics of nature	value patterns and aesthetics in the environment
3.3 Analyze the application of ethical principles to science	choose safe practices	appreciate how ethical principles apply to science in everyday life	integrate ethical principles and behaviours to science related issues in everyday life	analyze the application of ethical principles to science
3.4 Evaluate career options that relate to science	identify careers in science	explore local science careers and their value to Bermudian society	assess skills that are involved in science careers	evaluate career options that relate to science

GOAL 4	Students will advocate for environmental responsibility.			
SCIENCE	**PERFORMANCE INDICATORS**			
Sub Goals	**PS – P3 Learning Phase A**	**P4 - P6 Learning Phase B**	**M1 - M3 Learning Phase C**	**S1 - S4 Learning Phase D**
4.1 Advocate for environmental stewardship	show respect for themselves and others and their properties	participate in school and community environmental projects	choose a project which fosters environmental stewardship	advocate for environmental stewardship
4.2 Use scientific information to make judgements on environmental issues	displays a good environmental practice at home and school	investigate local and global environmental issues to formulate a balanced viewpoint	analyze local and global issues to formulate a balanced point of view	evaluate the use of scientific information to make judgements on environmental issues

CHANGE	SCIENCE SCOPE AND SEQUENCE			
	PS – P3 **Learning Phase A**	**P4- P6** **Learning Phase B**	**M1 - M3** **Learning Phase C**	**S1 - S4** **Learning Phase D**
Life Science	• animals and plants • changing the environments of animals and plants	• adaptation • food chains	• biodiversity	• biological evolution • behaviour of organisms • genetics adaptations/ mutation
Physical Science	• liquid and solid states of water • changes in materials • recycling materials	• energy uses • interconversions of states of water • air as a gas • making of new materials	• changes in properties of matter • properties of matter • interactions of energy and matter • energy transformation	• interactions of energy and matter • energy and matter • periodicity • endothermic and exothermic reactions
Earth and Space Science	• weather • seasons • composition of earth's materials (soil, water, air)	• earth's origin • bio-geography: population distribution • Bermuda's topography	• earth's oceans • plate tectonics • climate changes • erosion	• space and earth origin theories

SYSTEMS (1 of 2)	SCIENCE SCOPE AND SEQUENCE			
	PS – P3 Learning Phase A	**P4- P6 Learning Phase B**	**M1 - M3 Learning Phase C**	**S1 - S4 Learning Phase D**
Life Science	• plant and animal diversity • needs of living things	• life cycles • classification • cells in living things	• cells and multicellular organisms • human systems • land and marine ecology	• cells • molecular basis of heredity • anatomy • physiology • human systems • taxonomy of organisms • ecology
Physical Science	• describing matter • sorting of objects • measuring matter	• forms of energy - heat - light - electricity - magnetism • measuring properties of materials • conservation of weight	• particulate theory of matter • force and motion - buoyancy - balance - weight distribution • physical, chemical, biological properties of matter • forms of energy • energy systems - engines - fuels - hydroelectric - geothermal	• structure of atoms • properties of atoms • forces and motion • law of conservation of energy • chemical reactions • solution chemistry • electric circuitry • thermodynamics • periodic table of elements

SYSTEMS (2 of 2)	SCIENCE SCOPE AND SEQUENCE			
	PS – P3 **Learning Phase A**	**P4- P6** **Learning Phase B**	**M1 - M3** **Learning Phase C**	**S1 - S4** **Learning Phase D**
Earth and Space Science	• objects in the sky - sun - moon - stars	• structure of earth and solar systems • geothermal systems - volcanoes - hot springs - geysers • the atmosphere • earth's water	• solar system • earth's systems • water cycle • rock cycle	• stars and galaxies

CAUSE AND EFFECT (1 of 2)	SCIENCE SCOPE AND SEQUENCE			
	PS – P3 Learning Phase A	**P4- P6 Learning Phase B**	**M1 - M3 Learning Phase C**	**S1 - S4 Learning Phase D**
Life Science	• plants and animals • effects of environments and conservation	• adaptation and survival • senses • life cycles	• interdependence of organisms • life cycles • migration and behaviour • nutrient cycles • senses	• interdependence of organisms • matter and energy in a living system • chemical and energy interactions in cells and organisms • life cycles
Physical Science	• constructing materials • making things go • pushes and pulls • sound and vibration	• simple machines • how things move • conduction (heat) • earth's gravity	• chemical changes • conservation and use of energy • electrical and magnetic forces • consumer chemistry	• chemical changes • conservation of energy • increase in disorder • bonding - ionic crystals - molecular crystals • sound • forces • electromagnetic waves

CAUSE AND EFFECT (2 of 2)	SCIENCE SCOPE AND SEQUENCE			
	PS – P3 Learning Phase A	**P4- P6 Learning Phase B**	**M1 - M3 Learning Phase C**	**S1 - S4 Learning Phase D**
Earth and Space Science	• weather • seasons • sun warming - land - air - water	• measuring weather • predicting weather • climate • atmosphere	• the earth • energy in earth's systems • geochemical cycles • conservation of natural resources - waste management • geophysical cycles - earthquakes - hurricanes - tornadoes • weather atmosphere, climate • space time relationships	• the earth • energy in earth's systems • geochemical cycles

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INTRODUCTION TO SENIOR SCHOOL CURRICULUM

The senior school curriculum (S1 - S4) recognizes the distinct needs of the middle to late adolescent learner (14 to 18 years) and is based on the necessity of working consciously with the many developmental changes of students during this phase. It is a time to build on the foundation laid in the middle school by preparing students for work, further education and productive citizenry in the 21st Century.

As members of the senior school community, students have an opportunity to choose from a number of options and to participate in a variety of activities. The more involved students become in the life of the school, the more meaning school will have. Students will get the most from their educational experiences if their choices reflect their personal needs, interests, and talents. Students should select carefully those courses which offer the greatest opportunity for learning and which serve to better individual education and career goals.

Following are some of the characteristics of senior school students:

- intellectual habits increase
- thought processes become more abstract
- awareness of complexity of issues increases; rejection of simplistic explanations
- thought becomes more comprehensive
- ability to hypothesize and analyze increases
- thought becomes less egocentric
- interest in laws that regulate society increases
- ability to focus attention for long periods, increases (i.e. on topics of interest)

The senior school curriculum is a written guide that identifies the goals and curriculum objectives which teachers establish for students to achieve. It makes visible the articulation necessary for preschool through senior level programmes so that students do not have large gaps in their understanding, skills and competencies. Its scope and sequence also allows teachers to plan linkages across the curriculum so those cross-curricular connections can be made more easily between and among various subjects.

Given the above characteristics, the senior school curriculum is intended to provide students opportunities to:

- discuss, explore, investigate and hypothesize
- find solutions to real problems
- utilize both concrete and abstract reasoning skills
- process information at formal operations level

The following section outlines the curriculum to be taught in Bermuda's senior schools.

Senior Level Education

Goal:

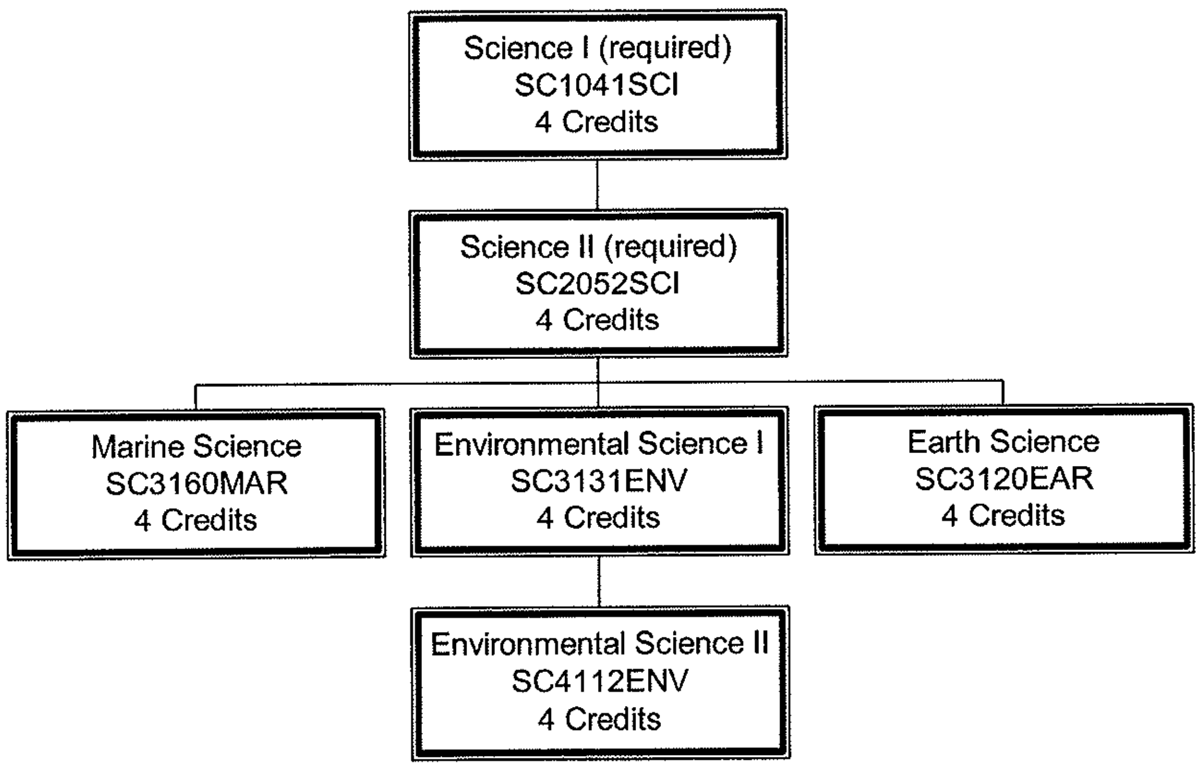
To ensure students become critical and analytical readers, logical and insightful thinkers, and concise users of visual, written and oral language.

SENIOR SCHOOL SCIENCE RATIONALE

The senior school science programme will allow students to examine and question scientific issues, events and the world around them, using a systematic process of inquiry. Senior science students will also become aware of powerful ideas that underscore the interdependence of mathematics, science and technology. As students strive towards scientific literacy, they will develop an understanding of the history and nature of science and scientific inquiry, have a positive attitude toward science and become advocates for the environment. They will also establish a firm basis of both scientific knowledge and habits of mind, which they can apply to future science courses, careers and everyday life.

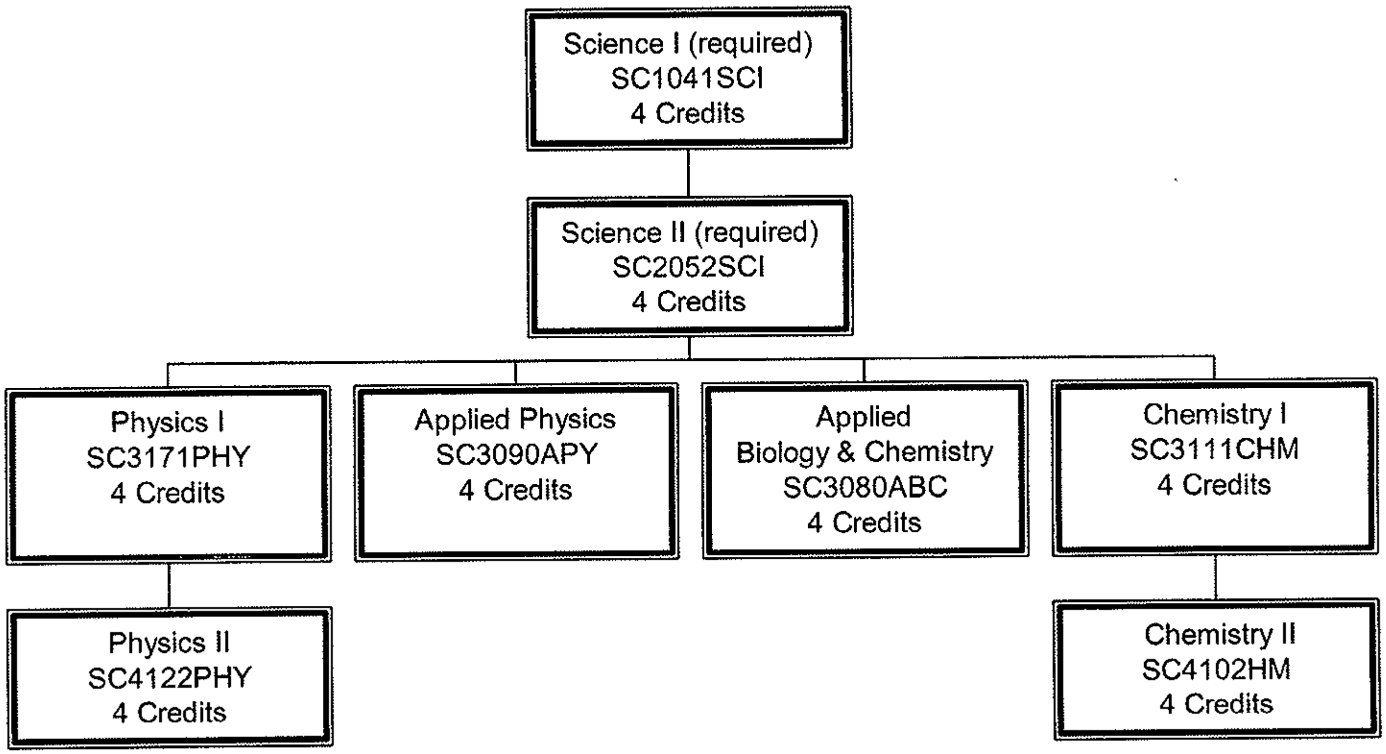
SENIOR SCHOOL SCIENCE COURSES

(Earth Science)



SENIOR SCHOOL SCIENCE COURSES

(Physical Science)



SENIOR SCHOOL SCIENCE COURSES

(Life Science)

- Science I (required)
SC1041SCI
4 Credits
  - Science II (required)
SC2052SCI
4 Credits
    - Applied Biology & Chemistry
SC3080ABC
4 Credits
    - Human Biology
SC3140HUM
4 Credits
    - Biology I
SC3101BIO
4 Credits
      - Biology II
SC4092BIO
4 Credits
    - Introduction to Horticulture
SC3150HOR
4 Credits
    - Marine Science
SC3160MAR
4 Credits

COURSE DESCRIPTIONS

Science (SC)

Science I (required course) **SC1041 SCI**
Prerequisite: None 4 credit (s)

S1 level (s)

This course is intended to broaden and strengthen students' understanding of scientific concepts and habits of mind introduced during middle and primary school science programmes. The goals of science education - history and nature of science, scientific inquiry, positive attitudes and advocacy for the environment - will provide the framework for the continued study of topics in life, physical, and earth sciences. Students will be engaged in laboratory work that includes analysis and communication of results. The course will also relate science to everyday experiences.

Science II (required course) **SC2052 SCI**
Prerequisite: Science I 4 credit (s)

S2 level (s)

Science II is designed to give senior school students additional preparation prior to choosing from the variety of science courses which lead towards their career goals in college or the world of work. This course is the second of the two foundation courses. The course is designed to continue the development of problem solving and laboratory skills through the study of six topics in physical and life and earth sciences.

Applied Biology and Chemistry **SC3080 ABC**
Prerequisite: Science II 4 credit (s)

S3-S4 level (s)

This course introduces students to a variety of biological and chemical principles and relates them to the real world. The opportunity exists in this course to combine biology and chemistry modules in units that meet the interests and need of the individual class. Laboratory investigations, demonstrations, fieldtrips and videos will be used to enhance student understanding of the concepts. Opportunities for careers in related areas will be presented during the course.

Applied Physics **SC3090 APY**
Prerequisite: Science II 4 credit (s)

S3-S4 level (s)

This course introduces students to basic concepts of physics that will better enable them to understand the world around them. Students will study matter and energy through hands-on laboratory activities and technical applications.

Biology I **SC3101 BIO**
Prerequisite: Science II 4 credit (s)

S3 level (s)

This first senior biology course builds on life science modules in Science I and II. This course provides an insight into biodiversity exchange of energy and matter in organisms, the cycling of matter and energy flow in nature. It is a required course for students who wish to study biology at college level and a prerequisite for Biology II. The essential development of reasoning and problem solving skills is enhanced by laboratory investigations and class discussions.

Biology II **SC4092 BIO**
Prerequisite: Biology I 4 credit (s)

S4 level (s)

Biology II is a course geared to students who intend to pursue the study of biological sciences at college level. It is a more rigorous course than Biology I and it expands the treatment of many topics introduced in earlier courses. It is strongly recommended that students should have completed or be currently taking a senior chemistry course, as the principles of bio-chemistry will be included. Success in this senior level biology course typically requires good reasoning and mathematical skills. Laboratory activities, discussion and research are an integral part of this course. An individual project is a required part of the assessment in this senior course.

Chemistry I **SC3111 CHM**
Prerequisite: Science II 4 credit (s)

S3 level (s)

This introductory chemistry course provides a foundation for students who intend to study advanced courses in chemistry and biology in preparation for careers in health sciences and engineering. It builds on physical science principles such as matter, bonding and chemical reactions met in the two senior foundation science courses. The introduction to the mole and chemical calculations will require students to apply algebraic methods to equations. Students will be actively involved in the development of chemical concepts through laboratory experiences, demonstrations and multimedia. References will be made to careers involving chemistry.

Chemistry II **SC4102 CHM**
Prerequisite: Chemistry I 4 credit (s)

S4 level (s)

This course is designed to prepare students for smooth entry to introductory college chemistry courses. It is intended for students who have a strong background in mathematics and science. Chemistry II further develops concepts such as atomic structure, organic chemistry and chemical reactions. Equilibrium, energy changes and redox reactions are introduced for the first time. There is an emphasis on laboratory investigations. References are made to societal applications and opportunities for related careers. An individual project is a required part of the assessment in this senior course.

Earth Science **SC3120 EAR**
Prerequisite: Science II 4 credit (s)

S3 level (s)

This introductory course will provide students with the opportunity to study the dynamic nature of the earth and the universe. Students will investigate the processes that shape Bermuda's landscape, earth's structures and oceans. Laboratory investigations and fieldwork are an essential part of this course.

Environmental Science I **SC3131 ENV**
Prerequisite: Science II 4 credit (s)

S3 level (s)

Environmental Science is the study of the interrelationships of organisms and their environment. This course extends student understandings about the environment that were studied during senior school foundation science courses. Some of the areas covered include methods of environmental science, how ecosystems work, various biomes and the impact of people on the environment. Particular reference will be made to issues of importance to Bermuda. Field work and laboratory are essential components of this course.

Environmental Science II **SC4112 ENV**
Prerequisite: Environmental Science I 4 credit (s)

S4 level (s)

Concepts from Environmental Science I are expanded in this course. Topics studied include energy resources and uses; earth's physical resources such as water, minerals and soils; and biotic resources including food production. Students will examine issues of local and international importance such as land conservation, environmental health hazards, fisheries, eco-tourism and local and global strategies used to protect the environment. An individual project is a required part of the assessment in this senior course.

Human Biology **SC3140 HUM**
Prerequisite: Science II 4 credit (s)

S3 level (s)

This biology course provides insight into the functioning of the human body. Students will revisit cell structure and processes as they study the nutritional, digestive, excretory, respiratory cardiovascular, reproductive and sensory systems. The impact of disease, the environment, licit and illicit drugs on the human body will be examined.

Introduction to Horticulture **SC3150 HOR**
Prerequisite: Science II 4 credit (s)

S3 level (s)

Horticulture is a special branch of agriculture, which includes the study of fruits, vegetables, flowers, shrubs and trees. This introductory course will build upon basic biological concepts met in earlier senior school courses. Students will use the school garden and modern greenhouse to study plant pathology; methods of propagation and vegetables and flowers; Bermuda lawns and golf courses. Field trips will be used to extend learning beyond the school facilities.

Marine Science
Prerequisite: Science II

SC3160 MAR
4 credit (s)

S3 level (s)

This course is intended to be integrated study of marine habitats. An integrated approach to science will be used using the ocean around us. Topics covered include the geology of the ocean, the ecology and biology of the coral reef, waves and ocean chemistry. Application will be made of these topics to current issues (e.g. Fisheries, aqua-culture, etc.).

Physics I
Prerequisite: Science II

SC3171 PHY
4 credit (s)

S3 level (s)

This course is designed to provide students with a sound foundation of principles and techniques of physics. It builds upon concepts developed in physical science modules of Science I and Science II. It is a prerequisite for Physics II and is recommended for students who wish to study sciences, engineering and mathematics at the college level. Opportunities for careers in physics will be presented. An S3 mathematics course is strongly recommended.

Physics II
Prerequisite: Physics I

SC4122 PHY
4 credit (s)

S4 level (s)

This is a college preparatory course intended for students who will study physics and related courses upon completion of senior school. Students will meet major concepts of physics and apply them to specific problems. The ability to understand simple algebraic, trigonometric and graphical relationships is essential to successful completion of this course. The laboratory component will stress science processes and skills and career opportunities will be highlighted. An individual project is a required part of the assessment in this senior course.

Science I

Course Code: SC1041SCI

MINISTRY OF EDUCATION
Bermuda
2000

CAUSE AND EFFECT (1 of 2)	SCIENCE SCOPE AND SEQUENCE			
	PS – P3 Learning Phase A	**P4- P6 Learning Phase B**	**M1 - M3 Learning Phase C**	**S1 - S4 Learning Phase D**
Life Science	• plants and animals • effects of environments and conservation	• adaptation and survival • senses • life cycles	• interdependence of organisms • life cycles • migration and behaviour • nutrient cycles • senses	• interdependence of organisms • matter and energy in a living system • chemical and energy interactions in cells and organisms • life cycles
Physical Science	• constructing materials • making things go • pushes and pulls • sound and vibration	• simple machines • how things move • conduction (heat) • earth's gravity	• chemical changes • conservation and use of energy • electrical and magnetic forces • consumer chemistry	• chemical changes • conservation of energy • increase in disorder • bonding - ionic crystals - molecular crystals • sound • forces • electromagnetic waves

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Science I **4 credit (s)**
120 hour (s)

Prerequisite (s): None **S1 level (s)**

Course Code: SC1041SCI ☒ **required or** ☐ **elective**

Course Description

The S1 course is intended to broaden and strengthen students' understanding of scientific concepts and habits of mind introduced during middle and primary school science programmes. Our goals of science education - history and nature of science, scientific inquiry, positive attitudes and advocacy for the environment - will provide the framework for the continued study of topics in life, physical, earth and space sciences. Students will be engaged in laboratory work that includes analysis and communication of results. The course will also relate science to everyday experiences.

Course Requirements

The requirements for this course are as follows:

Performance Assessments: - laboratory investigations/activities, (a minimum of 4) - laboratory skills tests, observations, oral presentation Rubrics are provided for marking.	**40%**
Product Assessments: - chapter assignments, short quizzes, reports, data analysis, posters/collages, models, games, portfolios, etc. (The assessment can be class work or homework. Rubrics are provided for marking. One module can be replaced by a significant product assessment instead of a written test.)	**30%**
Written Assessments: At least five written tests based on content stated in modules. The weighting for each module test is given in the module resources. The total for each written test should be 50 marks and should include: ▪ no more than 20 multiple choice questions 20 marks (maximum) ▪ written section 30 marks (minimum) This section should contain each of the following components: ▪ short answers (including situation or diagram set questions) ▪ data analysis ▪ interpreting science skills ▪ critical thinking (contextual questions) & open ended	**30%**
Total	**100%**

Course Resources

Maton, Anthea, et al. Exploring Earth Science. New Jersey: Prentice Hall, 1997.

Maton, Anthea, et al. Exploring Physical Science. New Jersey: Prentice Hall, 1997.

Maton, Anthea et al. Exploring Life Science. New Jersey: Prentice Hall, 1997.

Course Outline

Module Title	# Double Periods
A. Nature of Science	2
- branches of science - scientific method - measurement - safety	
B. Nature and Variety of Living Things	20
- characteristics of living things - cells - classification - modern taxonomy	
C. Nature and Structure of Matter	20
- materials and properties - mixtures and pure substances - atomic structure - periodic table -chemical reactions	
D. Heat	8
- heat as a form of energy - temperature and heat - transmission of heat - heat energy and everyday life	
E. Sound and Light	15
- waves - visible light - electromagnetic spectrum - optical instruments - sound waves - applications	
F. Solar System	10
- stars and galaxies - solar system	

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check one: S1 ☒ S2 ☐ S3 ☐ S4 ☐

Science I

GOALS		SUBGOALS		MODULE & CURRICULUM CORRELATION MATRIX					
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity	x	x		x	x	x
		1.2	Connections	x	x	x	x	x	x
		1.3	Health	x		x	x	x	x
		1.4	Inter-relationship/Mathematics Science Technology	x	x	x	x	x	
		1.5	Problem Solving			x	x	x	x
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis	x	x	x	x	x	x
		2.2	Design	x	x	x	x	x	x
		2.3	Data Collection	x	x	x	x	x	x
		2.4	Technology Use	x	x	x	x	x	x
		2.5	Explanations/limitation	x	x	x	x	x	x
		2.6	Explanations/alternatives	x	x	x	x	x	x
		2.7	Communications/Results	x	x	x	x	x	x
		2.8	Research	x	x	x	x	x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science	x	x		x	x	
		3.2	Value, Environment	x	x			x	x
		3.3	Ethical, Applications	x	x	x		x	
		3.4	Career Options	x	x		x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship			x	x	x	x
		4.2	Environmental Applications			x	x	x	x
CONTENT STRUCTURE		Change		x	x		x	x	x
		Cause & Effect		x		x	x	x	x
		System		x			x	x	x
		Life Science		x	x	x	x	x	x
		Physical Science		x		x		x	x
		Earth Science		x					x
		MODULE		**A**	**B**	**C**	**D**	**E**	**F**

MODULE KEY

A - Nature of Science
B - Nature and Variety of Living Things
C - Nature and Structure of Matter
D - Heat
E - Sound and Light
F - Introduction to Astronomy

SCIENCE

Course Title: SCIENCE I

Module Title: Nature of Science

Number of Periods: 2 double periods

Sequence Reference: SC1041SCI-A

Senior School Level

S1	S2	S3	S4
☒	☐	☐	☐

Subgoal Emphasis:

- 1.1 - 1.5 Nature and History of Science
- 2.4 - 2.8 Scientific Inquiry
- 3.1 - 3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science
- Physical Science
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- identify broad branches of science
- use the scientific method
- select and use laboratory equipment appropriately
- identify sources of error in measurement techniques
- appreciate the importance of safety in the laboratory
- research the accomplishments of one scientist

Content Detail:

- branches of science: life, physical, earth and space
- scientific method
- measurement (mass, volume, etc.)
  - tools
  - techniques
  - errors
- safety
- scientists

Module Evaluation:

- **Performance Assessments:**
  - checklists/inventories
  - laboratory activities
  - teacher observation
  - interviews
  - debates
- **Product Assessments:**
  - data handling (statistics)
  - surveys and reports
  - posters, models, poems and essays
  - portfolio assessment: personal journal, sample works
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas
(if any):

- N/A

Special Resources
(materials, equipment & community involvement):

- School library information centre
- Department of Education Resource Centre (laser discs, videos, software, etc.)
- newspaper, magazine articles
- site visits: BBSR, BAMZ, Bermuda College
- guest speakers: local scientists, science lecturers
- cross curricular connections: mathematics, language arts
- websites: refer to next page

GLOSSARY:

- refer to text

WEBSITES

http://www.schoolnet.ca/math/sci
http://www.pacificnet.net/~mandel/
http://www.freeserve.net/education/examinerevision/gcse/science/sgtopics.html

REFERENCES - TEACHER:

Fronk, Robert H., et al. Holt Physical Science. Austin Texas: Holt, Rinehart and Winston, 1994.

Maton, Anthea, et al. Exploring Physical Science. Teacher's Edition. New Jersey: Prentice Hall, 1997.

Thompson, Marilyn, et al. Merrill Physical Science. Ohio: Glencoe/McGraw-Hill, 1995.

REFERENCES - STUDENT:

Maton, Anthea, et al. Exploring Physical Science. New Jersey: Prentice Hall, 1997.

SCIENCE

Course Title: SCIENCE I

Module Title: Nature and Variety of Living Things

Number of Periods: 20 double periods

Sequence Reference: SC1041SCI-B

Senior School Level

S1	S2	S3	S4
☒	☐	☐	☐

Subgoal Emphasis:

- 1.1 - 1.5 Nature and History of Science
- 2.1 - 2.5, 2.8 Scientific Inquiry
- 3.1 - 3.5 Positive Attitudes
- 4.1 - 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- analyze the characteristics of living things
- explain cell theory
- analyze the structure and function of cells
- differentiate between animal and plant cells
- illustrate cell processes
- justify the position that cells are the building blocks of nature
- appreciate classification as a tool of biologists
- apply biological system of classification to organisms
- select an example of an organism from each kingdom to illustrate the system of classification

Content Detail:

- characteristics of living things: mechanisms
- cell structure and functions of organelles
- cell reproduction
- cells as building blocks: cell, tissues, organs, organ systems, organisms
- classification: historical overview
- modern taxonomy (local organisms)
  - monerans
  - protists
  - fungi
  - plants (with/without seeds)
  - animals (vertebrates and invertebrates)

Module Evaluation:

- **Performance Assessments:**
  - teacher observation
  - lab activities
  - data collection/data analysis
  - presentation - project/demonstration
  - debate/discussion
- **Product Assessments:**
  - science journal
  - posters/essays/etc
  - portfolio
- **Written Assessments:**
  - quiz/test/assignment

Prerequisite Skill Areas

(if any):

- N/A

Special Resources

(materials, equipment & community involvement):

- school library information centre
- Department of Education Resource Centre (laser discs, videos, software)
- newspaper, magazine articles
- site visits: BAMZ classes
- guest speakers: laboratory technicians - medical, Agriculture & Fisheries; Bio-diversity Project team
- cross curricular connections: mathematics
- websites: www.cells.alive.com
- http://www.school.discovery.com
- http:www.seawifs.gsfc.nasa.gov/scripts/jason.html

GLOSSARY:

- refer to text

REFERENCES - TEACHER:

Fronk, Robert H., et al. Holt Life Science. Austin Texas: Holt, Rinehart and Winston, 1994.

Maton, Anthea, et al. Exploring Life Science. Teacher's Edition. New Jersey: Prentice Hall, 1997.

Thompson, Marilyn, et al. Merrill Life Science. Ohio: Glencoe/McGraw-Hill, 1995.

REFERENCES - STUDENT:

Maton, Anthea, et al. Exploring Life Science. New Jersey: Prentice Hall, 1997.

SCIENCE

Course Title: SCIENCE I

Sequence Reference: SC1041SCI-C

Module Title: Nature and Structure of Matter

Number of Periods: 20 double periods

Senior School Level

S1	S2	S3	S4
☒	☐	☐	☐

Subgoal Emphasis:

- 1.2 - 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.3 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- describe materials in terms of physical properties
- illustrate phase changes in terms of particle model of matter
- distinguish between chemical properties and chemical changes
- differentiate amongst mixtures, elements and compounds
- identify and write the chemical symbol or molecular formula of common elements and compounds
- outline the historical development of the structure of the atom
- illustrate the structure and components of atoms and molecules
- predict the properties of the elements based on their positions in the periodic table
- investigate changes that occur during common chemical reactions
- describe chemical reactions using word equations

Content Detail:

- materials and properties
- chemical and physical changes
  - phase changes
  - chemical properties and changes
- types of mixtures
- pure substances: elements and compounds
  - symbols and formulas
- atomic structure
  - historical development
  - subatomic particles
  - mass number and atomic number
- periodic table
  - historical overview
  - design
  - metals and nonmetals
  - properties of families
  - predicting properties
- chemical reactions
  - describing changes
  - writing word equations

Module Evaluation:

- **Performance Assessments:**
  - teacher observation
  - lab activities
  - presentation - project/demonstration
  - debate/discussion
- **Product Assessments:**
  - science journal
  - posters/essays/etc
  - portfolio: data collection/data analysis
- **Written Assessments:**
  - quiz/test/assignment

Prerequisite Skill Areas

(if any):

- N/A

Special Resources

(materials, equipment & community involvement):

- library information centre
- Department of Education Resource Centre (laser discs, videos, software)
- newspaper, magazine articles,
- site visits: forensics lab; metal workshop, jeweller's workshop, pottery kiln, cookery department
- cross curricular connections: mathematics, design and technology and food and nutrition
- websites: http://www.chem.unsw.edu.au/highschool/teachers.html

GLOSSARY:

- refer to text

REFERENCES - TEACHER:

Fronk, Robert H., et al. Holt Physical Science. Austin, Texas: Holt, Rinehart and Winston, 1994.

Maton, Anthea, et al. Exploring Physical Science. Teacher's Edition. New Jersey: Prentice Hall, 1997.

Thompson, Marilyn, et al. Merrill Physical Science. Ohio: Glencoe/McGraw-Hill, 1995.

REFERENCES - STUDENT:

Maton, Anthea, et al. Exploring Physical Science. New Jersey: Prentice Hall, 1997.

SCIENCE

Course Title: SCIENCE I	**Sequence Reference:** SC1041SCI-D
Module Title: Heat	**Senior School Level:** S1 ☒ S2 ☐ S3 ☐ S4 ☐
Number of Periods: 8 double periods	

Subgoal Emphasis:	**Content Focus**
• 1.1 - 1.5 Nature and History of Science • 2.1 - 2.4, 2.8 Scientific Inquiry • 3.1, 3.4 Positive Attitudes • 4.1, 4.2 Advocate for Environment	• Systems • Change • Cause and Effect • Physical Science

Curriculum Objectives:

At the end of this module, students will:

- recognize heat as a form of energy
- explain temperature using kinetic energy and particle model of matter
- explain the impact of changes of temperature on states of matter
- distinguish between heat and temperature
- describe how heat energy is used in everyday life

Content Detail:

- heat as a form of energy
- temperature and heat
  - kinetic theory
  - measurement
- states of matter and changes in temperature
- transmission of heat
  - conduction
  - convection
  - radiation
- impact of heat energy on everyday life
  - heating and cooling systems
  - use of specific materials: Teflon, etc.
  - ozone layer
  - thermal pollution
  - suspended animation

Module Evaluation:

- **Performance Assessments:**
  - teacher observation
  - lab activities
  - data collection/data analysis
  - presentation - project/demonstration
  - debate/discussion
- **Product Assessments:**
  - science journal
  - posters/essays/etc
  - portfolio
- **Written Assessments:**
  - quiz/test/assignment

Prerequisite Skill Areas

(if any):

- N/A

Special Resources

(materials, equipment & community involvement):

- school library information centre
- Department of Education Resource Centre (laser discs, videos, software)
- newspaper, magazine articles
- site visits: air conditioning rooms, boiler rooms
- guest speakers: airconditioning & refrigeration technicians, meteorologists
- cross curricular connections: food and nutrition, geography, design and technology and mathematics
- websites: see other modules and physics courses

GLOSSARY:

- refer to text

REFERENCES - TEACHER:

Fronk, Robert H., et al. Holt Physical Science. Austin, Texas: Holt, Rinehart and Winston, 1994.

Maton, Anthea, et al. Exploring Physical Science. Teacher's Edition. New Jersey: Prentice Hall, 1997.

Thompson, Marilyn, et al. Merrill Physical Science. Ohio: Glencoe/McGraw-Hill, 1995.

REFERENCES - STUDENT:

Maton, Anthea, et al. Exploring Physical Science. New Jersey: Prentice Hall, 1997.

SCIENCE

Course Title: SCIENCE I	**Sequence Reference:** SC1041SCI-E
Module Title: Sound and Light	
Number of Periods: 15 double periods	

Senior School Level

S1	S2	S3	S4
☒	☐	☐	☐

Subgoal Emphasis:

- 1.1 - 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1 - 3.5 Positive Attitudes
- 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- describe and explain the properties of visible light
- describe the laws of reflection of visible light and explain their application to everyday light
- describe the process of refraction
- describe the types of electromagnetic radiation
- compare the properties of visible light to be properties of other types of electromagnetic radiation
- describe how sound waves are produced and transmitted
- explain applications of sound and waves in everyday life

Content Detail:

- waves: characteristics, nature, interactions of waves
- visible light: reflection, refraction
- electromagnetic spectrum: infrared, ultraviolet, x-rays, microwaves, radiowaves
- colour and wave length
- application of principles of light in everyday optical instruments: eye as a light detector, lasers, glasses, telescopes, CD's etc.
- sound waves: production, transmission
- applications of sound
  - ear as a sound detector, ultrasound, sonar, etc.
  - microwave towers

Module Evaluation:

- **Performance Assessments:**
  - teacher observation
  - lab activities
  - data collection/data analysis
  - presentation - project/demonstration
  - debate/discussion
- **Product Assessments:**
  - science journal
  - posters/essays/etc
  - portfolio
- **Written Assessments:**
  - quiz/test/assignment

Prerequisite Skill Areas

(if any):

- N/A

Special Resources

(materials, equipment & community involvement):

- school library information centre
- Department of Education resource centre (laser discs, videos, software)
- newspaper, magazine articles
- site visits: KEMH technicians, lighthouse, recording studio
- guest speakers; KEMH imaging department/ultrasound technicians, optometrists, lighthouse keepers, audiologist
- cross curricular connections: music, design and technology and mathematics
- websites: see other modules and physics courses

GLOSSARY:

- refer to text

REFERENCES - TEACHER:

Fronk, Robert H., et al. Holt Physical Science. Austin, Texas: Holt, Rinehart and Winston, 1994.

Maton, Anthea, et al. Exploring Physical Science. Teacher's Edition. New Jersey: Prentice Hall, 1997.

Thompson, Marilyn, et al. Merrill Physical Science. Ohio: Glencoe/McGraw-Hill, 1995.

REFERENCES - STUDENT:

Maton, Anthea, et al. Exploring Physical Science. New Jersey: Prentice Hall, 1997.

SCIENCE

Course Title: SCIENCE I

Module Title: Introduction to Astronomy

Number of Periods: 10 double periods

Sequence Reference: SC1041SCI-F

Senior School Level

S1	S2	S3	S4
☒	☐	☐	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.4 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.2, 3.4 Positive Attitudes
- 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- describe the organization of the solar system
- describe the technologies used to explore our solar system and beyond
- appreciate the relative sizes and distances of objects in the universe
- explain the classification of groups of stars
- describe the life cycle of our sun
- describe the current theory of the formation and evolution of our solar system and the universe
- illustrate the views of different cultures of the origins of the universe
- evaluate the pros and cons of space travel

Content Detail:

- solar system: historical models, inner planets, outer planets, other objects
- technologies: telescopes, binoculars, cameras; satellites, space probes
- sizes and distances: absolute and apparent sizes; measuring parallax, light years
- Hertzsprung - Russell diagram
- stages of life cycle
- formation of our solar system, Big Bang, cultural theories and myths
- funding (space travel vs aid for developing countries), manned vs unmanned space travel, life on other planets

Module Evaluation:

- **Performance Assessments:**
  - teacher observation
  - lab activities
  - data collection/data analysis
  - presentation - project/demonstration
  - debate/discussion
  - interviews
- **Product Assessments:**
  - personal health journal
  - posters/essays/etc
  - portfolio
- **Written Assessments:**
  - quiz/test/assignment

Prerequisite Skill Areas

(if any):

- N/A

Special Resources

(materials, equipment & community involvement):

- newspaper, magazine articles
- library information centre
- resource centre (laser discs, videos, software, etc.)
- site visits: Bermuda Astronomical Society
- guest speakers: astronomer, meteorologist
- cross curricular connections: geography, mathematics, art, foreign language (cultures)
- websites:http//tommy.jsc.nasa.gov/~woodfill/SPACEED/SEHHTML/seh.html [see Earth Science course]

GLOSSARY:

- refer to text

REFERENCES - TEACHER:

Frank, Robert H., et al. Holt Earth Science. Austin, Texas: Holt, Rinehart and Winston, 1994.

Maton, Anthea, et al. Exploring Earth Science. Teacher's Edition. New Jersey: Prentice Hall, 1997.

Thompson, Marilyn, et al. Merrill Earth Science. Ohio: Glencoe/McGraw-Hill, 1995.

REFERENCES - STUDENT:

Maton, Anthea, et al. Exploring Earth Science. New Jersey: Prentice Hall, 1997.

Science II

Course Code: SC2052SCI

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Science II — **4 credit (s)**, **120 hour (s)**

Prerequisite (s): Science I — **S2 level (s)**

Course Code: SC2052SCI — ☒ **required or** ☐ **elective**

Course Description

Science II is designed to give senior school students additional preparation prior to choosing the variety of science courses which lead towards their career goals in college or the world of work. It completes the foundation of knowledge and skills for the senior school pure sciences. As in the first senior science course, Science II continues to develop problem solving and laboratory skills through the study of six topics in physical, life and earth sciences.

Course Requirements

The requirements for this course are as follows:

Performance Assessments: - laboratory investigations/activities (a minimum of **FOUR** per module) - laboratory skills tests, observations - rubrics are provided for scoring	**40%**
Product Assessments: Chapter assignments, reports, data analysis, posters/collages, models, games, portfolios, etc. Rubrics are provided for scoring.	**30%**
Written Assessments: Written tests should be based on content cited in modules. The weighting for each module test is shown in the course outline. The total for each written test should be **50 marks** • No more than 20 multiple choice questions 20 marks (maximum) • Written section 30 (at least) (this section should contain each of the following components • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions	**30%**
Total	**100%**

Course Resources

Avakian, Robert et al. Science Interactions : Course 4 (teacher's wrap around edition) New York: Glencoe McGraw- Hill , 1999.
Beckett, Brian and Gallagher RoseMarie, Coordinated Science: Biology. Oxford: Oxford University Press, 1999.
Bethel, George, Coordinated Science Teacher's Guides (Biology, Chemistry & Physics). Oxford: Oxford University Press, 1999.
Ford, Brent et al. Project Earth Science Meteorology. Washington D.C.: NSTA, 1994.
Ford, Brent et al. Project Earth Science Physical Oceanography. Washington D.C.: NSTA, 1994.
Gallager RoseMarie et al. Coordinated Science: Chemistry Oxford: Oxford University Press, 1999.
Maton, Anthea et al. Exploring Earth Science New York: Prentice Hall, 1995.
Maton, Anthea et al. Exploring Life Science New York: Prentice Hall, 1995.
Maton, Anthea et al. Exploring Physical Science New York: Prentice Hall, 1995.
Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.
Pople, Stephen and Whitehead, Peter Coordinated Science: Physics. Oxford: Oxford University Press, 1999.
Smith, P. Sean, Project Earth Science Astronomy. Washington D.C.: NSTA, 1992.

Course Outline

Module Title — **# Double Periods**

A. Chemical Reactions 14
- ionic and molecular compounds
- chemical reactions

B. Force and Motion 10
- speed, velocity, acceleration
- force, mass and acceleration
- work and power

C. Electricity 12
- static electricity and electric current
- circuits
- power
- magnetic effect of an electric current

D. Reproduction 14
- sexual & asexual reproduction
- principles of inheritance
- modern reproductive technologies

E. Ecology 10
- flow of matter and energy
- characteristics of ecosystems
- impact of man

F. Weather and Bermuda's Water Systems 15
- water cycle & water systems
- factors causing weather
- meteorological data: analysis and prediction

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check one: S1 ☐ S2 ☒ S3 ☐ S4 ☐

Science II

GOALS		SUBGOALS		MODULE & CURRICULUM CORRELATION MATRIX					
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity		x				
		1.2	Connections				x	x	x
		1.3	Health	x			x	x	x
		1.4	Inter-relationship/Mathematics Science Technology	x	x	x	x	x	
		1.5	Problem Solving	x	x	x	x	x	x
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis	x	x	x	x	x	x
		2.2	Design	x	x	x	x	x	x
		2.3	Data Collection	x	x	x	x	x	x
		2.4	Technology Use	x	x	x	x	x	x
		2.5	Explanations/limitation	x	x	x	x	x	x
		2.6	Explanations/alternatives				x	x	
		2.7	Communications/Results				x	x	
		2.8	Research	x	x	x	x	x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science	x	x	x		x	x
		3.2	Value, Environment			x		x	x
		3.3	Ethical, Applications			x	x	x	
		3.4	Career options	x	x	x	x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship					x	x
		4.2	Environmental Applications			x	x	x	x
CONTENT STRUCTURE		Change		x	x	x	x	x	x
		Cause & Effect		x	x	x	x	x	x
		Systems			x	x	x	x	x
		Life Science					x	x	
		Physical Science		x	x	x			
		Earth and Space Science						x	x
		MODULE		**A**	**B**	**C**	**D**	**E**	**F**

MODULE KEY

A - Chemical Reactions
B - Force and Motion
C - Electricity
D - Reproduction
E - Ecology
F - Weather and Bermuda's Water Systems

SCIENCE

Course Title: SCIENCE II	**Sequence Reference:** SC2052SCI-A
Module Title: Chemical Reactions	
Number of Periods: 14 double periods	

Senior School Level

S1	S2	S3	S4
☐	☒	☐	☐

Subgoal Emphasis:

- 1.3 - 1.5 Nature and History of Science
- 2.1- 2.5, 2.8 Scientific Inquiry
- 3.1, 3.4 Positive Attitudes

Content Focus:

- Change
- Cause and Effect
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- name and write formulas for ionic and molecular compounds
- demonstrate the bonding in various substances and relate structure to properties
- differentiate among acids, bases and salts
- investigate various types of chemical reactions
- write balanced chemical equations
- investigate energy changes in chemical reactions
- identify factors that impact on the rate of chemical reactions
- research the use of chemical reactions in everyday life

Content Detail:

- symbols, oxidation number, formulas
- bonding in:
  - ionic and covalent compounds
  - diamond and graphite
  - metals
- acids, bases and salts
  - properties (pH, reaction with metals)
  - names and formulas
- chemical reactions
  - synthesis, decomposition, replacement, acid-base
  - writing and balancing equations
  - identification of substances: carbon dioxide, water, oxygen, hydrogen
  - energy changes
- energy in chemical reactions: heat and light
- factors affecting rate of chemical reactions:
  - temperature, particle size, concentration
- everyday examples of chemical reactions: cooking, rusting of iron, enzymes in the body, taking prescription and over the counter medications

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas (if any):

- using the periodic table: symbols, names, families, trends
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources (materials, equipment & community involvement):

- Department of Education resource centre: laser disc: Windows on Science, LOGAL software
- site visits/ guest speakers: welders, jewelers, pharmacists, electroplating services, Bermuda Industrial Gases
- curricular connections: family and consumer science
- web sites : see next page

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- investigating chemical reactions and writing representative equations (word and symbol)
  - heating substances(decomposition) ($CuCO_3$)
  - making and collecting gases, investigating their physical and chemical properties, chemical tests (oxygen, carbon dioxide, hydrogen)
  - the reactivity of metals using displacement reactions (Mg, Fe, Cu and their aqueous salt solutions)
  - neutralization using acid base titration to calculate concentrations (given formulas)
- investigating the Law of Conservation of Mass using displacement reactions and/or combustion of magnesium
- preparing samples of salts using dilute acids and bases, writing equations for the reactions
- investigating temperature change in reactions : neutralization reactions, dissolving sodium thiosulphate in water, displacement reactions
- investigate the reaction of marble chips and dilute hydrochloric acid to determine factors affecting the rate of reaction (particle size, temperature, concentration of acid)
- investigate everyday examples of chemical reactions: fermentation, soap making, cooking
- analyse data: pH of rain water; Bermuda Inshore waters : Tynes Bay, Castle Harbour; Hamilton Harbour
- research chemists and their contributions: Lavoisier, Curie etc
- investigate medicines and their reactions and interactions, (alkaseltzer and water etc)

INTERNET SITES:

- **http://www.schoolnet.ca/math/sci**
- **http://www.chem.unsw.edu.au/highschool/teachers.htm**
- http://ezinfo.ethz.ch/eth/d-chem/tech_chem/olympiad.html
- http://www.wonka.com/Invention Room/game-world.html
- http://rampages.onramp.net/~jaldr/
- ftp://ftp.ncsa.uiuc.edu/education/chemviz
- gopher://www.cchem.berkeley.edu:80/hget/
- http://quanta.phy.ohiou.edu/./othersites.html

REFERENCES - TEACHER:

Avakian, Robert et al. Science Interactions : Course 4 (teacher's wrap around edition) New York: Glencoe McGraw-Hill, 1999.

Bethel, George, Coordinated Science Teacher's Guides (Biology, Chemistry & Physics). Oxford: Oxford University Press, 1999.

Gallager RoseMarie et al. Coordinated Science: Chemistry Oxford: Oxford University Press, 1999.

Mahon et al. Exploring Physical Science New York: Prentice Hall, 1995.

REFERENCES - STUDENT:

Avakian, Robert et al. Science Interactions : Course 4 New York: Glencoe McGraw- Hill , 1999.

Gallager RoseMarie et al. Coordinated Science: Chemistry Oxford: Oxford University Press, 1999.

Mahon et al. Exploring Physical Science New York: Prentice Hall, 1995.

SCIENCE

Course Title: SCIENCE II

Module Title: Force and Motion

Number of Periods: 14 double periods

Sequence Reference: SC2052SCI-B

Senior School Level

S1	S2	S3	S4
☐	☒	☐	☐

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.1- 2.5, 2.8 Scientific Inquiry
- 3.1, 3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- explain the quantitative difference between speed, distance and time
- analyze the quantitative relationship between displacement, time and velocity
- analyze the quantitative relationship between force mass and acceleration
- apply concepts of force, work and power

Content Detail:

- speed = distance/time taken
- plotting distance - time graphs
- instantaneous and average velocity; calculating velocity from displacement time graphs
- acceleration – change in velocity/time taken; calculation of acceleration from a velocity time graph
- balanced and unbalanced forces
- Newton's Laws of Motion
- gravity: weight = mass x gravity
- force = mass x acceleration
- work = force x distance
- power = work done /time taken

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols, formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- Department of Education resource centre (laser disc: Windows on Science, LOGAL)
- site visits/ guest speakers: garage; TCD vehicle testing
- curricular connections: design technology, mathematics
- web sites : see next page

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:
- measure acceleration of free fall
- measure acceleration using ticker timers , motion sensors etc
- investigate force pairs using two spring scales
- investigate own power output (climbing stairs, lifting objects etc) connecting weight, forces, work and power
- design and carry out investigations to measure the average velocity of bicycle or moped riders
- interview police traffic officer to determine how laser guns work
- present a report on Sir Isaac Newton's investigations that resulted in the Newton's Laws of Motion

INTERNET SITES:
http://www.supercars.net/ click on the "0 – 60 link and " slower cars link"
http://www.physics.umd.edu/rgroups/ripe/research.html

REFERENCES - TEACHER:
Avakian, Robert et al. Science Interactions: Course 4. (teacher's wrap around edition) New York: Glencoe McGraw-Hill , 1999.
Bethel, George. Coordinated Science Teacher's Guides. (Biology, Chemistry & Physics). Oxford: Oxford University Press, 1999.
Maton, Anthea et al. Exploring Physical Science. New York: Prentice Hall, 1995.
Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.
Pople, Stephen and Whitehead, Peter, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

REFERENCES - STUDENT:
Avakian, Robert et al. Science Interactions : Course 4. New York: Glencoe McGraw- Hill , 1999.
Maton, Anthea et al. Exploring Physical Science. New York: Prentice Hall, 1995.
Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.
Pople, Stephen and Whitehead, Peter, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

SCIENCE

Course Title: SCIENCE II

Module Title: Electricity

Number of Periods: 14 double periods

Sequence Reference: SC2052SCI-C

Senior School Level

S1	S2	S3	S4
☐	☒	☐	☐

Subgoal Emphasis:

- 1.4, 1.5 Nature and History of Science
- 2.1-2.5, 2.8 Scientific Inquiry
- 3.1- 3.4 Positive Attitudes
- 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- explain the production and properties of electrostatic charge
- distinguish between static electricity and an electric current
- determine the relationships between current, voltage and resistance in different types of circuits
- appreciate the safety considerations of electricity in the home and community
- determine the relationship between power, voltage and current
- explain the magnetic effect of an electric current
- apply principles of electricity and magnetism to a simple electric motor

Content Detail:

- electrostatic charge: movement of electrons; charging by contact and induction; everyday examples (photocopying), lightning
- electric current: flow of free electrons in metals; flow of ions during electrolysis; charge = current x time
- basic characteristics of series and parallel circuits
  - drawing and interpreting symbols for circuit diagrams
  - water pipe analogy
- a.c. vs. d.c. current
- measurement of voltage and current, Ohm's Law
- terms: volt, ampere, joule, watt, kilowatt
- household circuits, wiring plugs & safety features (fuses, circuit breakers);
- power = current x voltage
- generation and transmission of electricity; environmental impact
- magnetic fields and forces; electromagnets; electric motors

Module Evaluation:

- **Performance Assessments:**
  laboratory activities, skills tests, checklists, debates/discussions, interviews

- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis

- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- Department of Education Resource Centre (laser disc: Windows on Science, LOGAL)
- site visits/ guest speakers: BELCO, electricians, electrical engineers, Bermuda College Physics laboratory, building site during electrical installations
- cross curricular connections: design technology, mathematics
- web sites : see next page

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:
- investigate parallel and series circuits, position ammeter and voltmeter correctly and read measurements accurately
- investigate the effect of a variable resistor in controlling the brightness of a bulb in a circuit
- trace the generation and transmission of electrical energy from fuel at BELCO to output in an electrical appliance in the home
- investigate the relationship between a wire's length and its resistance; current and potential difference (Ohm's law)
- design and carry out an investigation to determine how much electricity is used in the home during a day
- compare the use of electricity in different places: home, school, businesses
- research the history of the invention of the light bulb including Thomas Edison who patented it and Lewis Howard Latimer who improved it
- interview BELCO meter man and demonstrate how to read an electric meter.
- write a pamphlet to explain to an M3 student how to read and understand a BELCO bill

WEB SITES:
http://www.energy.ca.gov/education/story/story-htm/chapter02.html
http://www.miamisci.org/af/sln/frankenstein/safety.html
http://schoolnet2.carleton.ca/english/math_sci/phys/electric_club/
http://phys.udallas.edu/

REFERENCES - TEACHER:
Avakian, Robert et al. Science Interactions: Course 4 (teacher's wrap around edition) New York: Glencoe McGraw-Hill , 1999.
Bethel, George, Coordinated Science Teacher's Guides (Biology, Chemistry & Physics). Oxford: Oxford University Press, 1999.
Maton, Anthea et al. Exploring Physical Science New York: Prentice Hall, 1995.
Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.
Pople, Stephen and Whitehead, Peter. Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

REFERENCES - STUDENT:
Avakian, Robert et al. Science Interactions: Course 4 New York: Glencoe McGraw- Hill , 1999.
Bethel, George, Coordinated Science Teacher's Guides (Biology, Chemistry & Physics). Oxford: Oxford University Press, 1999.
Mahon et al. Exploring Physical Science New York: Prentice Hall, 1995.
Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.
Pople, Stephen and Whitehead, Peter, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

SCIENCE

Course Title: SCIENCE II

Module Title: Reproduction

Number of Periods: 14 double periods

Sequence Reference: SC2052SCI-D

Senior School Level

S1	S2	S3	S4
☐	☒	☐	☐

Subgoal Emphasis:

- 1.2- 1.5 Nature and History of Science
- 2.1-2.8 Scientific Inquiry
- 3.3, 3.4 Positive Attitudes
- 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- illustrate the principles of sexual reproduction in humans and flowering plants
- distinguish between sexual and asexual reproduction
- explain how gender is determined in humans
- apply the principles that govern the inheritance of traits to solve simple problems involving genetics
- discuss impact of advances in the area of reproductive technologies

Content Detail:

- sexual reproduction
  - humans: overview of male and female reproductive systems, menstrual cycle and roles of hormones, stages -conception to birth; factors that affect fetal development: alcohol and drugs, disease(rubella), radiation, carcinogens
  - flowering plants: parts of the flower, agents of pollination, process of fertilization
- asexual reproduction: fission, budding, vegetative
- determination of gender in humans- X and Y chromosomes
- principles of inheritance - Mendel, terms, Punnett squares; inherited diseases
- reproductive technologies: cloning, genetic engineering

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc.)
  - assignments

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- Department of Education resource centre (laser discs: Windows on Science ; video: The Living Body
- site visits/guest speakers: health care providers at KEMH, Victoria Street Women's Clinic, Department of Agriculture and Fisheries laboratory technicians & botanists
- curricular connections: family and consumer science, health education
- websites: see next page

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- research the work of Gregor Mendel
- issues for discussion/ debate: artificial insemination of women over fifty; cloning of animals to provide organs for man; genetic engineering of hardier plants to alleviate world hunger
- dissect or watch demonstration or simulation of dissection of small animal to investigate reproductive system
- construct models of human reproductive system(s)
- use Punnett squares to analyze traits seen in your family

WEB SITES:

http://www.asap.unielb.edu.au/hstm/hstm_bio.htm
http://www.whitlock.com/kcj/quill/
http://curry.edschool.virginia/~insttech/frog/
http://www.csc.fi/cgi-bin/topbio

REFERENCES - TEACHER:

Beckett, Brian and Gallagher, RoseMarie, Coordinated Science: Biology. Oxford: Oxford University Press, 1999.
Bethel, George, Coordinated Science Teacher's Guides. (Biology). Oxford: Oxford University Press, 1999.
Maton Anthea et al. Exploring Life Science. New York: Prentice Hall, 1995.

REFERENCES - STUDENT:

Beckett, Brian and Gallagher, RoseMarie, Coordinated Science: Biology. Oxford: Oxford University Press, 1999.
Maton Anthea et al. Exploring Life Science. New York: Prentice Hall, 1995.

SCIENCE

Course Title: SCIENCE II

Module Title: Ecology

Number of Periods: 10 double periods

Sequence Reference: SC2052SCI-E

Senior School Level

S1	S2	S3	S4
☐	☒	☐	☐

Subgoal Emphasis:

- 1.2- 1.5 Nature and History of Science
- 2.1-2.8 Scientific Inquiry
- 3.1- 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life and Earth Science

Curriculum Objectives:

At the end of this module, students will:

- explain the energy flow through an ecosystem
- illustrate the cycling of matter in an ecosystem
- analyze the roles of the components of ecosystems
- explain the mechanism of bio-accumulation
- explain the variety, distribution and relative abundance of organisms in an ecosystem
- analyze the impact of man on an ecosystem

Content Detail:

- sun as principal source of energy
- cycling of matter
  - carbon cycle: soil bacteria and fungi as decomposers, fossil fuel production, photosynthesis, respiration, combustion of organic matter
  - nitrogen cycle & water cycle
- ecosystems: marine, rainforest, freshwater etc; biotic factors; abiotic factors: temperature, light, water, soil
- roles: consumer, producer, decomposer
- food chains and food webs, trophic levels, pyramid of numbers
- accumulation of DDT, mercury, etc.
- adaptation, competition, predation
- impact of man: global issues: acid rain and soil, greenhouse effect, depletion of rain forests, use of pesticides; Bermuda issues: preservation of the coral reef, over-fishing, inshore waters, impact of cruise ships, incineration and recycling etc.

Module Evaluation:

- **Performance Assessments:**
  laboratory activities, skills tests, checklists, debates/discussions, interviews

- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis

- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- DOE Resource Centre (laser disc: Windows on Science, LOGAL)
- site visits/ guest speakers: Paget Marsh, Spittal Pond, BBSR, BAMZ
- cross curricular connections: design technology, mathematics
- websites : see next page

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:
- design and make a test tube aquarium – make continuous observations of habitat
- examine owl pellets to determine where they fit in their ecosystem
- investigate component processes of the carbon cycle
- design and carry out an investigation to show that soil bacteria and fungi are decomposers
- design a model of a water cycle for primary school students
- create a model of an ecosystem found in Bermuda
- discuss the environmental impacts of closing the landfill (Pembroke Dump) and building the Tynes Bay incinerator
- use Bermuda census data to note trends in population growth over the last twenty years
- collect and analyze data about the waste stream at your school or home and suggest methods of reducing waste
- review recent research about the decline of toads in Bermuda and plan your own investigation to investigate this problem.

INTERNET SITES:
http://www.bbsr.edu.edu
http://www.bamz.org
http://www.inform.umd.edu/PBIO/PBIO/pbioNew/lec6.html
http://www.digmark.net/iatech/unesco/biofaw.htm
http://me-www.jrc.it/./
http://oberon.edu.sfu.ca/splash/tank.htm
http://library.advanced.org/11922/habitats/habitats.htm
http://www.digimark.net/iatech/unesco/biofaq.htm
http://me-www.jrc.it/./
http://seawifs.gsfc.nasa.gov/scripts/jason.html
www.globe.net
http://www.nationalgeographic.com

REFERENCES - TEACHER:
Avakian, Robert et al. Science Interactions: Course 4 (teacher's wrap around edition) New York: Glencoe McGraw-Hill , 1999.
Beckett, Brian and Gallagher, RoseMarie, Coordinated Science: Biology. Oxford: Oxford University Press, 1999.
Bethel, George, Coordinated Science Teacher's Guide (Biology). Oxford: Oxford University Press, 1999.
Maton, Anthea et al. Exploring Life Science New York: Prentice Hall, 1995.

REFERENCES - STUDENT:
Avakian, Robert et al. Science Interactions : Course New York: Glencoe McGraw- Hill , 1999.
Beckett, Brian and Gallagher, RoseMarie, Coordinated Science: Biology. Oxford: Oxford University Press, 1999.
Maton, Anthea et al. Exploring Life Science New York: Prentice Hall, 1995.

SCIENCE

Course Title: SCIENCE II

Module Title: Weather and Bermuda's Waters

Number of Periods: 15 double periods

Sequence Reference: SC2052SCI-F

Senior School Level

S1	S2	S3	S4
☐	☒	☐	☐

Subgoal Emphasis:

- 1.2, 1.4, 1.5 Nature and History of Science
- 2.1-2.5 Scientific Inquiry
- 3.1, 3.2, 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- explain the water cycle
- analyze water systems in Bermuda
- identify factors that interact to cause weather
- analyze meteorological data to predict future weather conditions

Content Detail:

- the water cycle: components and heat transfer
- water systems in Bermuda: water lens and wells, impact of pollution and drought, ocean and brackish water, reverse osmosis and distillation, domestic collection (roofs and tanks), conservation and purification (domestic)
- heat transfer
- global wind patterns
- severe weather: hurricanes and thunderstorms
- meteorological analysis: weather maps and symbols

Module Evaluation:

- **Performance Assessments:**
  laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- Department of Education resource centre (laser discs, videos, software, etc.)
- site visits/guest speakers: Bermuda Weather Bureau; government wells, reverse osmosis technician, water trucker, environmental officer, Health department laboratory (environmental), Watlington WaterWorks
- cross curricular connections: geography
- web sites: see next page

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- investigate water usage in your home, school
- collect and analyze data about fresh water (salinity, dissolved oxygen, pH etc) from around the island
- make and use a psychometer to measure relative humidity
- design and carry out an experiment to compare the amount of dissolved solids in samples of water collected from different sites
- use weather data to predict local weather over the next week
- activities from Project Earth Science Meteorology (NSTA, 1994)
    - Activity 8 Density of Air
    - Activity 9 Why do Winds Whirl
    - Activity 11 Design a water cycle model for a student at the primary level
- research and explain to the class how pure water is obtained from brackish water at Watlington Water Works
- draw or make an annotated model of a thunderstorm or hurricane to share in a primary school classroom

WEB SITES:

- http://www.intellicast.com/weather/usa
- www.globe.org
- http://www.intellicast.com/weather/intl/
- http://www.mobot.org/MBGnet/fresh/cycle/index.htm
- http://www.igsnet.com/
- http://cirrus.sprl.umich.edu/wxnet/
- http://www.accuweather.com
- http://www.webcrawler.com/select/wea.05.html

REFERENCES - TEACHER:

Avakian, Robert et al. Science Interactions: Course 4. (teacher's wrap around edition) New York: Glencoe McGraw-Hill , 1999.
Ford, Brent et al. Project Earth Science Meteorology. Washington D.C.: NSTA, 1994.
Ford, Brent et al. Project Earth Science Physical Oceanography. Washington D.C.: NSTA, 1994.
Maton, Anthea et al. Exploring Earth Science. New York: Prentice Hall, 1995.

For the following books & articles see appendix
Rowe, Mark: An Explanation of the Geology of Bermuda. Bermuda: Bermuda Government, 1998.
Vacher, H.L. & Rowe M. Geology and Hydrogeology of Carbonate Islands. Netherlands: Elsevier Science,1997.

REFERENCES – STUDENT:

Avakian, Robert et al. Science Interactions: Course 4. New York: Glencoe McGraw- Hill , 1999.
Ford, Brent et al. Project Earth Science Meteorology. Washington D.C.: NSTA, 1994.
Ford, Brent et al. Project Earth Science Physical Oceanography. Washington D.C.: NSTA, 1994.
Maton, Anthea et al. Exploring Earth Science. New York: Prentice Hall, 1995.

Applied Biology and Chemistry

Course Code: SC3080ABC

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Applied Biology and Chemistry **4 credit (s)**
120 hour (s)

Prerequisite (s): Science II **S3 – S4 level (s)**

Course Code: SC3080ABC ☐ **required or** ☒ **elective**

Course Description

This course introduces students to a variety of biological and chemical principles and relates them to the real world. The opportunity exists in this course to combine biology and chemistry modules in units that meet the interests and need of the individual class. Laboratory investigations, demonstrations, fieldtrips and videos will be used to enhance student understanding of the concepts. Opportunities for careers in related areas will be presented during the course.

Course Requirements

The requirements for this course are as follows:

Performance Assessments: - laboratory investigations/activities - laboratory skills tests, observations, debates, discussions, interviews - rubrics are provided for marking	**30%**
Product Assessments: - chapter assignments, reports, data analysis, posters,, models, games, portfolios - rubrics are provided for marking	**20%**
Written Assessments: Written tests should be based on content cited in modules. The weighting for each module test is shown in the course outline. Written tests should consist of a variety of assessment components including: • multiple choice questions (not greater than 20 % of the test total) • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions	**20%**
Final Assessment:	**30%**
Total	**100%**

Course Resources

Avakian, Robert et al. Science Interactions Course 4 (Teacher Wraparound Edition) . New York: Glencoe McGraw-Hill, 2000.
CORD. Applications in Biology/ Chemistry: Natural Resources. Texas: CORD Communications, 1990.
CORD Applications in Biology/ Chemistry: Air. Texas: CORD Communications, 1990.
CORD Applications in Biology/ Chemistry: Disease. Texas: CORD Communications, 1990.
CORD Applications in Biology/ Chemistry: Nutrition. Texas: CORD Communications, 1990.
Adds, John et al. Food and Health. London: Thomas Nelson & Sons, 1999.

Course Outline

Module Title	# Double Periods	Module Title	# Double Periods
A Food and Health	25	**B. Disease and Health**	25
- dietary requirements - human digestive system - food production - preservation of food - cooking and chemical changes		-homeostasis -socioeconomic factors and incidence of disease -cardiovascular system -communicable and non-communicable diseases -disease prevention and control in Bermuda	
C. The Atmosphere	15	**D. Resources**	25
- Components - Oxygen and carbon dioxide - Carbon and nitrogen cycles - respiration and ventilation - air pollution		-renewable and non renewable resources -petrochemical industry -limestone use in Bermuda -extraction and uses of metals	

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check: S1 ☐ S2 ☐ S3 ☒ S4 ☒

Applied Biology and Chemistry

GOALS		SUBGOALS		MODULE & CURRICULUM CORRELATION MATRIX			
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity	x		x	x
		1.2	Connections	x		x	x
		1.3	Health	x	x	x	x
		1.4	Inter-relationship/Mathematics Science Technology	x	x	x	x
		1.5	Problem Solving	x	x	x	x
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis	x	x	x	x
		2.2	Design	x	x	x	x
		2.3	Data Collection	x	x	x	x
		2.4	Technology Use	x	x	x	x
		2.5	Explanations/limitation			x	
		2.6	Explanations/alternatives				
		2.7	Communications/Results				
		2.8	Research	x	x	x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science	x	x	x	x
		3.2	Value, Environment				
		3.3	Ethical, Applications				
		3.4	Career options	x	x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship				
		4.2	Environmental Applications				
CONTENT STRUCTURE		Change		x	x	x	x
		Cause & Effect		x	x	x	x
		Systems		x	x	x	x
		Life Science		x	x	x	
		Physical Science				X	
		Earth and Space Science				x	x
		MODULE		**A**	**B**	**C**	**D**

MODULE KEY

A - Food and Health
B - Disease and Health
C - The Atmosphere
D - Resources

SCIENCE

Course Title: APPLIED BIOLOGY AND CHEMISTRY

Module Title: Food and Health

Number of Periods: 25 double periods

Sequence Reference: SC3080ABC-A

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☒

Subgoal Emphasis:

- 1.2 – 1.5 Nature and History of Science
- 2.1 – 2.4, 2.8 Scientific Inquiry
- 3.1, 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for Environment

Content Focus:

- Change
- Cause & Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- investigate requirements of a balanced diet
- relate the structure of nutrients to their function as chemicals in the body
- illustrate the structure and function of components of the human digestive system
- distinguish between chemical and mechanical processes of digestion
- examine the process of photosynthesis
- compare the challenges of food production in industrialized and developing nations
- investigate the use of biotechnology in food production
- assess methods used to reduce spoilage of food
- investigate the processes occurring during cooking

Content Detail:

- requirements: calorie needs; components of a balanced diet; disorders & risks: obesity, anorexia etc.
- nutrients: types: water, carbohydrates, lipids, proteins, minerals, vitamins; functions: raw materials, energy source, helping to regulate body's process; chemical tests
- human digestive system: structures: mouth, to anus including liver and pancreas; functions: ingestion, digestion, absorption, assimilation, egestion, disorders
- processes of digestion:- mechanical: teeth (particle size reduction); peristalsis; chemical: role of enzymes; role of bile; role of stomach acid; breakdown products of carbohydrates, fats and proteins
- photosynthesis: transformation of light to chemical energy ,manufacture of carbohydrates, reactants and products (include equation), factors affecting rates (light intensity, temperature etc.), importance to life
- food production: yield, access to technology, soil, pests, finances, civil unrest, farming techniques etc
- biotechnology : bacteria in yoghurt making, yeast in bread making, wine making, genetic engineering to produce a crop that is disease or pest resistant
- food preservation: freezing, drying, canning, food additives, pasteurization, irradiation; food poisoning
- cooking as a chemical change; how kitchen technology works (microwave, pressure cooker etc.)

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports, portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- resource centers: school & DOE: print materials, videos, laser discs etc
- site visits/guest speakers: nutritionist, chef, physician, farmer, Dunkley's dairy; Department of Agriculture et
- cross curricular: food and consumer science, health education

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:
- compare calorific needs of persons of various ages (baby, older adult etc)
- make a model of the human digestive system
- present a proposal supporting the removal of debt from developing countries in order to reduce hunger
- investigate the factors that affect the rate of photosynthesis
- investigate the changes that occur during fermentation of grape juice
- carry out food tests on common foods in a cafeteria diet
- investigate the incidence of food poisoning in Bermuda

REFERENCES - TEACHER:
Avakian Robert et al. Science Interactions Course 4. (Teacher Wraparound Edition) . New York: Glencoe McGraw-Hill, 2000.
CORD Applications in Biology/ Chemistry : Nutrition. Texas: CORD Communications, 1990.

REFERENCES – STUDENT:
Avakian Robert et al. Science Interactions Course 4. New York: Glencoe McGraw-Hill, 2000.
CORD Applications in Biology/ Chemistry : Nutrition. Texas: CORD Communications, 1990.

SCIENCE

Course Title: APPLIED BIOLOGY AND CHEMISTRY

Module Title: Disease and Health

Number of Periods: 25 double periods

Sequence Reference: SC3080ABC-B

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☒

Subgoal Emphasis:

- 1.3 – 1.5 Nature and History of Science
- 2.1 – 2.5, 2.8 Scientific Inquiry
- 3.1, 3.4 Positive Attitudes

Content Focus

- Change
- Cause & Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- assess the importance of the maintenance of a stable internal environment
- relate socio-economic factors to incidence of certain kinds of disease
- illustrate the processes by which pathogens cause disease
- explain the structure and function of the cardiovascular system
- investigate the nature of chronic diseases prevalent in Bermuda
- determine how a genetic disease is passed from parent to offspring
- evaluate the body's mechanisms for fighting infection
- analyze methods of diagnosing, preventing and treating diseases in Bermuda

Content Detail:

- homeostasis: definition, importance; systems that maintain constant internal environment: carbon dioxide and water (lungs); water, salts and waste (kidneys); blood glucose (pancreas and liver) temperature (skin); impact of disease (diabetes, kidney disease, asthma)
- socioeconomic factors: public health services, education, personal hygiene, access to medical services, standard of living
- pathogens and disease: types of pathogens: viruses (colds etc); bacteria (strep throat etc); fungi (athlete's foot etc); protozoa (malaria etc); parasitic worms; modes of transmission : contact, food and water, airborne, vectors
- cardiovascular system: heart, arteries, veins, capillaries, blood pressure and pulse measurement, benefits of regular exercise
- causes, symptoms and treatment of cardiovascular diseases, diabetes, cancer etc.
- genetic diseases
- body's mechanisms : physical barriers, inflammatory response, immune system
- methods: diagnosing (blood, urine tests etc.) imaging (X-ray, ultra sound etc.)
  - public health efforts, immunization, drugs (including chemotherapy), alternative therapies

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports, portfolio, data collection/data analysis
- **Written Assessment:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- school library & Department of Education resource centre: print materials, videos, laser discs etc.
- site visits/guest speakers: physicians, imaging technicians, medical laboratory technicians, health promotions officer, epidemiologist
- curricular connections: health education, biology
- Internet: www.apha.org ; www.cancer.org

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS

- design a questionnaire to assess a young person's risk of cardiovascular disease
- design and carry out an investigation to compare the blood pressure: males vs. females; S1 vs. S3 students; before and after exercise
- collect samples of bacteria from sites around the school (door knobs, trash receptacle lids, faucets etc) and have them analyzed at a local medical laboratory. Make a presentation to the student council about transmission of disease at the school site.
- evaluate the usefulness of a medical website for high school students
- investigate the impact of the aeges egypti mosquito on the Bermuda population during the 1940's and propose a method of involving school students in the campaign to rid the island of the pest in the year 2000.
- research the incidence of genetic diseases in Bermuda

REFERENCES - TEACHER:

Avakian Robert et al. Science Interactions Course 4. (Teacher Wraparound Edition) . New York: Glencoe McGraw-Hill, 2000

Marshall, Jacqueline, Applications in Biology/ Chemistry : Disease and Wellness. Texas: CORD Communications, 1990

REFERENCES – STUDENT:

Avakian Robert et al. Science Interactions Course 4. New York: Glencoe McGraw-Hill, 2000.

Marshall, Jacqueline, Applications in Biology/ Chemistry: Disease and Wellness. Texas: CORD Communications, 1990.

SCIENCE

Course Title: APPLIED BIOLOGY AND CHEMISTRY

Module Title: The Atmosphere

Number of Periods: 15 double periods

Sequence Reference: SC3080ABC-C

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☒

Subgoal Emphasis:

- 1.1-1.5 Nature and History of Science
- 2.1 - 2.4, 2.8 Scientific Inquiry
- 3.1 , 3.5 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus:

- Change
- Cause and Effect
- Systems
- Earth, Life &Physical Science

Curriculum Objectives:

At the end of this module, students will:

- examine the structure of the atmosphere and explain the roles of the component gases
- explore methods of measuring atmospheric pressure and relative humidity
- prepare and examine the properties of oxygen and carbon dioxide
- illustrate the processes involved in the cycling of carbon and nitrogen
- compare the methods by which plants and animals use the gases in the atmosphere
- outline the manufacture and commercial uses of gases from liquid air
- assess the environmental impact of air pollution, locally and globally
- evaluate measures being taken in Bermuda and globally to reduce air pollution

Content Detail:

- the atmosphere: layers, gases, atmospheric pressure, temperature in the atmospheric layers
- measurement of atmospheric conditions: wet and dry bulb thermometers, barometer, altimeter
- oxygen and carbon dioxide: laboratory preparation, chemical tests, reactions with metals
- carbon cycle: photosynthesis, respiration; exchange of carbon dioxide and oxygen between air and water
- nitrogen cycle: nitrogen fixation, nitrification
- human respiratory system, cellular respiration, photosynthesis; aquatic plants and animals
- manufacture of gases: fractional distillation of liquid air; commercial uses: pneumatics, hospitals, fuels
- air pollution (gases and particulates); sources (combustion of fossil fuels, refrigerants); impacts (greenhouse effect, global warming, smog, depletion of the ozone layer, acid rain, respiratory illnesses)
- reduction measures: Air Quality Controls, Clean Air Act (Bermuda), redesign of vehicle exhaust systems, alternative fuels

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports, portfolio, data collection/data analysis
- **Written Assessment:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- libraries: school, resource center (videos & laser discs)
- video: Air and Other Gases
- visits/speakers: Tynes Bay, BELCO, Dept of Environment officers, TCD vehicle testers, mechanics, meterologist BBSR scientists
- curricular connections: chemistry, geography

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS
- prepare oxygen and carbon dioxide gases and investigate their physical and chemical properties
- design and make an instrument to measure relative humidity
- interview an officer from Department of the Environment to determine the extent of Bermuda's pollution problems
- sample particulates at various sites to determine extent of air pollution from exhausts
- predict trends in rainfall and relative humidity based on data given monthly by Department of Agriculture and Fisheries newsletter
- investigate respiration rates of aquatic plants

REFERENCES - TEACHER:
Avakian Robert et al. Science Interactions Course 4 (Teacher Wraparound Edition) . New York: Glencoe McGraw-Hill, 2000.

CORD Applications in Biology/ Chemistry. Air and Other Gases Texas: CORD Communications, 1991.

REFERENCES - STUDENT:
Avakian Robert et al. Science Interactions Course 4. New York: Glencoe McGraw-Hill, 2000.

CORD Applications in Biology/ Chemistry. Texas: CORD Communications, 1990.

SCIENCE

Course Title: APPLIED BIOLOGY AND CHEMISTRY	**Sequence Reference:** SC3080ABC-D
Module Title: Earth's Resources	
Number of Periods: 10 double periods	**Senior School Level** S1 ☐ S2 ☐ S3 ☒ S4 ☒

Subgoal Emphasis:

- 1.1-1.5 Nature and History of Science
- 2.1 - 2.4, 2.8 Scientific Inquiry
- 3.1 , 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- classify various resources as renewable or non-renewable
- relate the physical properties of crude oil to the method used for extraction and refining
- investigate the petrochemical industry as a source of fuels and chemicals
- justify the replacement of limestone with concrete block as a building material in Bermuda
- relate the extraction method of a metal to its reactivity
- illustrate the relationship of the uses of metals to their structure and properties of metals
- evaluate methods by which limited resources might be saved

Content Detail:

- renewable and non renewable resources: metals, ores, fossil fuels, rainforests, water etc; sources,
- crude oil: formation & exploration; composition & physical properties; classification of hydrocarbons; extraction & refining
- petrochemical industry
  - hydrocarbon fuels , cracking, combustion
  - plastics : polymerisation
- Bermuda limestone
  - formation & properties, historical use as a building material (advantages and disadvantages)
  - sources and extraction methods
  - current use, cost & scarcity
  - replacement with concrete block, alternatives
- metal reactivity and extraction
  - comparison -two appropriate metals Al, Fe, Cu
- structure, properties and uses of metals
- metallic bonding
- saving limited resources: reduce, reuse, recycle, alternative sources of energy etc.

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports, portfolio, data collection/data analysis
- **Written Assessment:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc.
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- libraries: school, resource center (videos & laser discs)
- visits/speakers: Tynes Bay, BELCO, quarry
- curricular connections: design technology; geography, earth science

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- investigate combustion of alkanes and alkenes
- build a model of fractional distillation of petroleum
- design and carry out an investigation to compare the physical and chemical properties of concrete and limestone
- interview staff at a limestone slate quarry
- prepare an analysis of the comparative costs of roofing with limestone slate and SK roofing materials
- use displacement reactions to determine the relative reactivities of three or more metals

REFERENCES - TEACHER:

Avakian Robert et al. Science Interactions Course 4. (Teacher Wraparound Edition) . New York: Glencoe McGraw-Hill, 2000.

Applications in Biology/ Chemistry. Natural Resources. Texas: CORD Communications, 1990.

REFERENCES - STUDENT:

Avakian Robert et al. Science Interactions Course 4. New York: Glencoe McGraw-Hill, 2000.

Applications in Biology/ Chemistry. Texas: CORD Communications, 1990.

Applied Physics

Course Code: SC3090APY

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE COURSE OVERVIEW

Title: Applied Physics — **4 credit (s)**, **120 hour (s)**

Prerequisite (s): Science II, Integrated Mathematics 1 — **S3 level (s)**

Course Code: SC3090APY — ☐ **required or** ☒ **elective**

Course Description

This course introduces students to basic concepts of physics that will better enable them to understand the world around them. Students will study matter and energy through hands-on laboratory activities and technical applications.

Course Requirements

The requirements for this course are as follows:

Performance Assessments: - laboratory investigations/activities, debates, discussions, interviews - laboratory skills tests, observations - rubrics are provided for scoring	**30%**
Product Assessments: - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios, etc. - rubrics are provided for scoring	**20%**
Written Assessments: Written tests should be based on content cited in modules. The weighting for each module test is shown in the course outline. Written tests should consist of a variety of assessment components including: • multiple choice questions (not greater than 20 % of the test total) • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions	**20%**
Final Assessment:	**30%**
Total:	**100%**

Course Resources

Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.

Pople, Stephen, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

Mahon et al Exploring Physical Science. New York: Prentice Hall, 1995.

Avakian, Robert et al. Science Interactions Course 4. (teacher's wrap around edition) New York: Glencoe McGraw- Hill , 1999.

Course Outline

Module Title	# Double Periods
A. Measurement	10
B. Forces and Pressure	10
C. Thermal Energy	15
D. Magnets, Motors and Generators	10
E. Introduction to Electronics	15
F. Flight	15

A. Measurement 10
- scientific notation
- SI units
- measurement tools

B. Forces and Pressure 10
- moments
- stretching and compressing
- pressure in solids and fluids

C. Thermal Energy 15
- kinetic theory
- thermal expansion
- conduction, convection and radiation
- specific heat capacity
- latent heat

D. Magnets, Motors and Generators 10
- magnetic effect
- electromagetics

E. Introduction to Electronics....................15
- electronic circuits
- logic gates
- telecommunications
- electron beam

F. Flight 15
- Newton's 2nd law of motion
- gravity, light, drag, thrust
- historical development
- birds, seeds, insects

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check: S1 ☐ S2 ☐ S3 ☒ S4 ☒

Applied Physics

GOALS		SUBGOALS		MODULE & CURRICULUM CORRELATION MATRIX					
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity	x	x	x		x	x
		1.2	Connections		x	x	x		x
		1.3	Health			x			
		1.4	Inter-relationship/Mathematics Science Technology	x	x	x	x	x	x
		1.5	Problem Solving		x	x	x	x	x
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis		x	x	x	x	x
		2.2	Design		x	x	x	x	x
		2.3	Data Collection	x	x	x	x	x	x
		2.4	Technology Use	x	x	x	x	x	x
		2.5	Explanations/limitation	x	x	x	x	x	x
		2.6	Explanations/alternatives		x	x			
		2.7	Communications/Results		x	x			
		2.8	Research	x	x	x		x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science		x	x	x	x	x
		3.2	Value, Environment		x				
		3.3	Ethical, Applications			x			x
		3.4	Career options	x	x	x	x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship			x			
		4.2	Environmental Applications			x			
CONTENT STRUCTURE		Change		x	x	x	x	x	x
		Cause & Effect			x	x	x	x	x
		Systems		x	x	x	x	x	x
		Life Science			x				
		Physical Science		x	x	x	x	x	x
		Earth and Space Science							
		MODULE		**A**	**B**	**C**	**D**	**E**	**F**

MODULE KEY

A - Measurement
B - Forces and Pressure
C - Thermal Energy
D - Magnet, Motors and Generators
E - Introduction to Electronics
F - Flight

SCIENCE

Course Title: APPLIED PHYSICS

Module Title: Measurement

Number of Periods: 10 double periods

Sequence Reference: SC3090APY-A

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☒

Subgoal Emphasis:

- 1.1, 1.4 Nature and History of Science
- 2.3- 2.5, 2.8 Scientific Inquiry

Content Focus:

- Change
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- use scientific notation
- use SI units
- measure physical quantities
- demonstrate the measurement and calculation of density
- demonstrate use of measurement tools
- illustrate how spreadsheets are used to collate and represent data
- manipulate simple algebraic equations

Content Detail:

- scientific notation
  - significant figures
- SI units : mass, time, length, volume
- physical quantities: number and unit
- density: regular and irregular solids etc
- measurement tools: micrometer, vernier calipers, balances, various meters etc
- spreadsheets: input of data, output - charts and graphs
- algebraic equations
  $d = m/v$
  $s = d/t$

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs, LOGAL etc.
- cross curricular connections: mathematics, design technology
- guest speakers/site visits: engineers, Bermuda College Applied Technology department
- general web sites: http://www.schoolnet.ca/math/sci
  http://www.pacificnet.net/~mandel/
  http://www.imsa.edu/edu/

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.

Pople, Stephen, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

Mahon et al Exploring Physical Science. New York: Prentice Hall, 1995.

Avakian, Robert et al. Science Interactions: Course 4. (teacher's wrap around edition) New York: Glencoe McGraw- Hill, 1999.

REFERENCES - STUDENT:

Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.

Pople, Stephen, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

Mahon et al Exploring Physical Science. New York: Prentice Hall, 1995.

Avakian, Robert et al. Science Interactions: Course 4. New York: Glencoe McGraw-Hill, 1999.

SCIENCE

Course Title: APPLIED PHYSICS

Module Title: Forces and Pressure

Number of Periods: 10 double periods

Sequence Reference: SC3090APY-B

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☒

Subgoal Emphasis:

- 1.1, 1.2, 1.4, 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1, 3.2, 3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- investigate the turning effect of a force
- illustrate the principle of moments
- determine the centre of gravity of an object
- investigate stretching and compressing forces
- investigate pressure in solids and fluids

Content Detail:

- turning effects of a force (moments)
- principle of moments : conditions for equilibrium, problem solving
- centre of gravity
  - stability
  - experiments and calculations
- stretching and compressing forces: terms(load, extension); Hooke's Law, elastic limit
- pressure: P = F/a; units; applications (deep sea diving), construction, hydraulic brakes, atmospheric pressure & barometers, manometers; hydraulics vs pneumatics; Archimedes' principle, law of floatation, Bernoulli's principle

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols, formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs etc.
- curricular connections: mathematics, design technology
- guest speakers/site visits: pilots, divers, engineers

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.

Pople, Stephen, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

Mahon et al Exploring Physical Science. New York: Prentice Hall, 1995.

Avakian, Robert et al. Science Interactions: Course 4. (teacher's wrap around edition) New York: Glencoe McGraw-Hill , 1999.

REFERENCES- STUDENT:

Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.

Pople, Stephen, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

Mahon et al Exploring Physical Science. New York: Prentice Hall, 1995.

Avakian, Robert et al. Science Interactions: Course 4. New York: Glencoe McGraw- Hill , 1999.

SCIENCE

Course Title: APPLIED PHYSICS

Sequence Reference: SC3090APY-C

Module Title: Thermal Energy

Number of Periods: 15 double periods

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☒

Subgoal Emphasis:

- 1.1 - 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1, 3.3, 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for Environment

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- illustrate the kinetic theory model
- compare thermal expansion of solids, liquids and gases
- differentiate among thermal energy, heat and temperature
- investigate conduction, convection and radiation
- explain specific heat capacity and latent heat
- assess the impact of release of thermal energy into the environment

Content Detail:

- kinetic theory: phases of matter, Brownian movement, particle energy
- thermal expansion: water and ice; bimetallic strip, thermometer, electric wires; bridges, automotive radiators
- thermal energy vs. heat and temperature
  - historical perspective
  - measurement and units
- conversions - celsius, kelvin, Fahrenheit
- conduction: definition, conductors and insulators, using insulating materials (homes etc), explanation (free electrons)
- convection: definition, hot water systems, refrigerators and air-conditioners, space heaters
- thermal radiation: emitters and absorbers, greenhouse effect, solar panels
- specific heat capacity: Energy = mc ΔT
- latent heat - explanation using kinetic theory
- thermal energy and the environment: sources (burning of fossil fuels), production of green house gases, pollution (water and air); environmentally safe alternatives

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports, portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols, formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs etc.
- curricular connections: mathematics, design technology, chemistry
- guest speakers/site visits: BELCO, air-conditioning companies, plumbers, Bermuda College Department of Applied Technology

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.

Pople, Stephen, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

Mahon et al Exploring Physical Science. New York: Prentice Hall, 1995.

Avakian, Robert et al. Science Interactions: Course 4. (teacher's wrap around edition) New York: Glencoe McGraw-Hill , 1999.

REFERENCES – STUDENT:

Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.

Pople, Stephen, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

Mahon et al. Exploring Physical Science. New York: Prentice Hall, 1995.

Avakian, Robert et al. Science Interactions: Course 4. New York: Glencoe McGraw-Hill , 1999.

SCIENCE

Course Title: APPLIED PHYSICS

Sequence Reference: SC3090APY-D

Module Title: Magnets, Motors and Generators

Number of Periods: 10 double periods

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☒

Subgoal Emphasis:

- 1.2, 1.4, 1.5 Nature and History of Science
- 2.1 - 2.5 Scientific Inquiry
- 3.1, 3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- investigate the magnetic effect of an electric current
- demonstrate the operation of electromagnetic devices
- compare the operation and application of a simple DC motor and an AC generator

Content Detail:

- magnetic effect:
  - right hand rule
  - making a magnet
  - demagnetizing a magnet
- electromagnets
  - simple electromagnet
  - magnetic relays
  - circuit breakers
  - electric bells
- DC motor: components, operation, application
- AC generator: components, operation, application

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols, formulas etc.
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs etc.
- cross curricular connections: mathematics, design technology
- guest speakers/site visits: design technology teacher, Bermuda College Applied Technolgy department, automechanics, BELCO, engineers

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.

Pople, Stephen, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

Mahon et al Exploring Physical Science. New York: Prentice Hall, 1995.

Avakian, Robert et al. Science Interactions: Course 4 (teacher's wrap around edition) New York: Glencoe McGraw-Hill , 1999.

REFERENCES – STUDENT:

Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.

Pople, Stephen, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

Mahon et al Exploring Physical Science. New York: Prentice Hall, 1995.

Avakian, Robert et al. Science Interactions: Course 4. New York: Glencoe McGraw- Hill , 1999.

SCIENCE

Course Title: APPLIED PHYSICS

Module Title: Introduction to Electronics

Number of Periods: 15 double periods

Sequence Reference: SC3090APY-E

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.2,1.4,1.5 Nature and History of Science
- 2.1-2.5, 2.8 Scientific Inquiry
- 3.1,3.4 Positive Attitudes
- 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- investigate electronic circuits
- describe the function of logic gates
- explain the nature of waves
- describe components and functions of telecommunication systems
- examine applications of electron beams

Content Detail:

- electronic circuits: electronic control systems, feedback and automatic control, components(resistors etc), power supply (AC or DC)
- logic gates: functions in appliances; AND, OR & NOT gates, combining gates
- waves: review transverse & longitudinal waves; speed, frequency, wavelength and amplitude; the wave equation; wave effects: reflection, refraction & diffraction; sound waves
- telecommunication systems
  - types (television, radio, telephone)
  - analog vs. digital transmission
  - optic fibre technology
  - storing and retrieving information (records, tapes, CD's)
- radio and satellite communication
- electron beams: thermionic emission, oscilloscopes, computer monitors, TV & X-ray tubes

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols, formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs etc.
- cross curricular connections: mathematics, design technology
- guest speakers/site visits: engineers, Bermuda College Applied Technology department

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.

Pople, Stephen, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

Mahon et al Exploring Physical Science. New York: Prentice Hall, 1995.

Avakian, Robert et al. Science Interactions: Course 4. (teacher's wrap around edition) New York: Glencoe McGraw- Hill , 1999.

REFERENCES- STUDENT:

Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.

Pople, Stephen, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

Mahon et al Exploring Physical Science. New York: Prentice Hall, 1995.

Avakian, Robert et al. Science Interactions: Course 4. New York: Glencoe McGraw- Hill , 1999.

SCIENCE

Course Title: APPLIED PHYSICS

Module Title: Flight

Number of Periods: 15 double periods

Sequence Reference: SC3090APY-F

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1,1.2,1.4,1.5 Nature and History of Science
- 2.1 - 2.5, 2.8 Scientific Inquiry
- 3.2.3.4 Positive Attitudes

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- investigate the relationship between force, mass and acceleration
- explain the concept of momentum
- explain the four basic forces that act on an airplane in flight
- trace the historical development of man's inventions of flying devices
- relate the flight of an airplane to that of birds, seeds and insects

Content Detail:

- Newton's 2nd law of motion
  - force = ma
- momentum = mv
- four forces:
  - gravity: acceleration under gravity, weight, terminal speed
  - lift: overcoming gravity ; wing area and angle; wing shape (Bernoulli and Coanda effects); gliders
  - drag: size and shape of object; air density, speed
  - thrust: propellers and jet engines
  - integration of forces to produce level flight
- historical development : gliders to rocket
- application of forces (gravity, lift, drag & thrust) to bird flight and seed dispersal by adapted seeds (with parachutes or wings)

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- School library & DOE Resource Centre: print material, videos, laser discs etc.
- curricular connections: computer studies, design technology, mathematics
- guest speakers/site visits: airport : pilots, control tower, aircraft mechanics

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.

Pople, Stephen, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

Mahon et al Exploring Physical Science. New York: Prentice Hall, 1995.

Avakian, Robert et al. Science Interactions: Course 4. (teacher's wrap around edition) New York: Glencoe McGraw- Hill, 1999.

REFERENCES- STUDENT:

Pople, Stephen, Complete Physics. Oxford: Oxford University Press, 1999.

Pople, Stephen, Coordinated Science: Physics. Oxford: Oxford University Press, 1999.

Mahon et al Exploring Physical Science. New York: Prentice Hall, 1995.

Avakian, Robert et al. Science Interactions: Course 4. New York: Glencoe McGraw- Hill, 1999.

Biology I

Course Code: SC3101BIO

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Biology I — **4 credit (s)**, **120 hour (s)**

Prerequisite (s): Science II — **S3 level (s)**

Course Code: SC3101BIO — ☐ **required or** ☒ **elective**

Course Description

The first senior biology course builds on life science modules in Science I and II. This course provides an insight to biodiversity, exchange of energy and matter in organisms, the cycling of matter and energy flow in nature. It is a required course for students who wish to study biology at college level and it is a prerequisite for Biology II. The essential development of reasoning and problem solving skills is enhanced by laboratory investigations and class discussions.

Course Requirements

The requirements for this course are as follows:

Product Assessments: - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews - rubrics are provided for scoring	**30%**
Product Assessments: - project (research, extended investigation, additional optional biology topic) **10%** - chapter assignments, reports, data analysis, models, portfolios, etc. **10%** - rubrics are provided for scoring	**20%**
Written Assessments: Written tests should be based on content cited in modules. The weighting for each module test is shown in the course outline. Written tests should consist of a variety of assessment components including: • multiple choice questions (not greater than 20 % of the test total) • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions	**20%**
Final Assessment	**30 %**
Total	**100%**

Course Resources

Johnson, George B & Raven H. Peter, Biology : Principles and Explorations. New York: Holt, Rinehart and Winston, 1996.

Kaskel et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999

Biggs, Alton et al. Biology the Dynamics of Life. New York; Glencoe/McGraw Hill, 2000.

Adds, J et al. Cell Biology and Genetics : Nelson and Sons, 1999.

Adds, J et al. The Organism and the Environment: Nelson and Sons, 1999.

Adds, J et al. Systems and their Maintenance: Nelson and Sons, 1999.

Adds, J et al. Microorganisms and Biotechnology : Nelson and Sons, 1999.

Adds, J et al. Food and Health: Nelson and Sons, 1999.

Adds, J et al. Applied Plant and Animal Biology: Nelson and Sons, 1999.

Course Outline

Module Title	# Double Periods	Module Title	# Double Periods
A. Biodiversity	25	**B. Cycling of Matter and Energy Flow in Nature**	25

A. Biodiversity 25
- cells, cell groupings
- biological molecules
- movement across cell membranes
- characteristics, classification and relationships of living things

B. Cycling of Matter and Energy Flow in Nature 25
- hydrologic, carbon and nitrogen cycles
- photosynthesis
- cellular respiration
- impact of humans

C. Exchange of Energy and Matter in Organisms 25
- homeostasis
- digestion
- excretion
- transport
- breathing & respiration

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check one: S1 ☐ S2 ☐ S3 ☒ S4 ☐

Biology I

GOALS		SUBGOALS		MODULE & CURRICULUM CORRELATION MATRIX		
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity	x	x	x
		1.2	Connections	x	x	x
		1.3	Health	x	x	x
		1.4	Inter-relationship/Mathematics Science Technology	x	x	x
		1.5	Problem Solving	x	x	x
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis	x	x	x
		2.2	Design	x	x	x
		2.3	Data Collection	x	x	x
		2.4	Technology Use	x	x	x
		2.5	Explanations/limitation	x	x	
		2.6	Explanations/alternatives	x	x	
		2.7	Communications/Results	x	x	
		2.8	Research	x	x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science		x	x
		3.2	Value, Environment	x	x	
		3.3	Ethical, Applications		x	
		3.4	Career options	x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship			
		4.2	Environmental Applications			
CONTENT STRUCTURE		Change		x	x	x
		Cause & Effect		x	x	x
		Systems		x	x	x
		Life Science				
		Physical Science				
		Earth and Space Science				
		MODULE		**A**	**B**	**C**

MODULE KEY

A - Biodiversity
B - Cycling of Matter and Energy Flow in Nature
C - Exchange of Energy and Matter in Organisms

SCIENCE

Course Title: BIOLOGY I	**Sequence Reference:** SC310BIO-A
Module Title: Biodiversity	
Number of Periods: 25 double periods	**Senior School Level:** S1 ☐ S2 ☐ S3 ☒ S4 ☐

Subgoal Emphasis:

- 1.1 - .5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.2, 3.4 Positive Attitudes
- 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- explain the structure functions and interactions of cell organelles
- explain the basis for grouping cells in various ways
- compare the use of light microscopes with the use of electron microscopes
- describe the structures and functions of biological molecules
- illustrate how materials are able to move in and out of cells through selectively permeable membranes
- explain the role of enzymes in cell activity
- explain the advantages of binomial nomenclature
- demonstrate how a taxonomic key is used to group and identify organisms
- identify characteristics shared by all living things using representative organisms from each of the five kingdoms, including the animal phyla
- explain the close associations or relationships which have developed among various species in the biosphere

Content Detail:

- cell activity: cell organelles – membrances ribosomes, cytoplasm, nucleus, mitochondria, vacuole; grouping: plant/animal; prokanyote and eukayote
- microscope use
- biological molecules
  - proteins (amino acids, peptide bond, globular and fibrous protein)
  - carbohydrates (alpha and beta glucose molecule, involvement of sugars triose, pentose, hexose) in photosynthesis, respiration and nucleic acid structure)
  - lipids (chemical and physical properties; structure and functions of triglyerides, phospholipids, cholesterol and steroids)
  - water (physical and chemical properties including solvent, low viscosity, specific heat capacity, density etc.
  - inorganic ions(definition and importance to plants and animals)
- enzymes (characteristics, function)
- movement across cell membranes: osmosis, diffusion, active transport
- living things: characteristics, classification and relationships

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- libraries: school, resource centre(videos & laser discs), KEMH, Dept of Agriculture and Fisheries
- visits/speakers: Dept of Agriculture, Spittal Pond, BBSR, BAMZ
- web sites: see next page

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS & PROJECTS:

- examine samples from a variety of cell types
- use the light microscope (including care parts function focusing technique field size measurement estimation of specimen size)
- use a biological key to identify organisms (microorganisms, weeds insects)
- design a key which can be used by others to identify items or organisms
- investigation : arthropods (observation of characteristics and measurement skills , data analysis etc)
- investigation: What happens to raisins in water?

WEB SITES:

http://www.cellsalive.com

http://micro.magnet.fsn.edu

http://www.geocities.com/CapeCanerval/529/index-s.html

http://golgi.harvar.edu/biopages/edures.html

http://ampere.scale.uiuc.edu/~m-lex6/cell/cell.html

http://esg-www.mit.edu:8001/bio/

http://www.comet.chv.va.us/QUILL/HIVO.html-ssi

http://www.worthington-biochem.com/introBiochem

REFERENCES – TEACHER:

Johnson, George B & Raven H. Peter, Biology : Principles and Explorations. (Teacher Annotated Edition) New York: Holt, Rinehart and Winston, 1996.

Kaskel, et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999

Biggs, Alton et al. Biology the Dynamics of Life. New York: Glencoe/McGraw Hill, 2000

Adds, J. et al. Cell Biology and Genetics: Nelson and Sons, 1999.

Adds, J. et al. The Organism and the Environment: Nelson and Sons, 1999.

Adds, J. et al. Systems and their Maintenance: Nelson and Sons, 1999.

Adds, J. et al. Microorganisms and Biotechnology: Nelson and Sons, 1999.

Adds, J. et al. Food and Health: Nelson and Sons, 1999.

Adds, J. et al. Applied Plant and Animal Biology: Nelson and Sons, 1999.

REFERENCES - STUDENT:

Johnson, George B. and Raven H. Peter, Biology: (Principles and Explorations) New York: Holt, Rinehart and Winston, 1996.

Kaskel, et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999.

Biggs, Alton et al. Biology the Dynamics of Life. New York: Glencoe/McGraw Hill, 2000.

SCIENCE

Course Title: BIOLOGY I

Module Title: Cycling of Matter & Energy Flow in Nature

Number of Periods: 25 double periods

Sequence Reference: SC3101BIO-B

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1 - 1.5 Nature and History of Science
- 2.1- 2.8 Scientific Inquiry
- 3.1 - 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- trace the movement of water through the biosphere along the pathways of the hydrologic cycle
- illustrate the biochemical cycling of carbon and nitrogen
- outline how photosynthetic organisms use specialized structures to absorb energy, remove water and other elements from the environment to synthesize large organic molecules for cell use
- explain how organisms engage in cellular respiration to obtain energy from larger energy rich molecules and that his respiration releases the building blocks of photosynthesis back into the environment
- explain how the equilibrium between the gas exchanges in photosynthesis and respiration can influence the composition of our atmosphere
- analyze the impact of human activities on the balance which exists in the biosphere

Content Detail:

- hydrologic cycle
- biogeochemical cycling of carbon and nitrogen
- photosynthesis (change from inorganic to organic molecule; solar energy changing to biochemical energy)
- - light reaction
- - Calvin cycle
- cellular respiration (
  -degradation of organic molecule giving energy and smaller molecule
  - release of building blocks of photosynthesis back to the atmosphere
- effects of photosynthesis and respiration on the composition of air
- impact of humans
  - photosynthetic and cellular respiratory activities
  - eutrophication
  - agriculture
  - historical impact

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- libraries: school, DOE resource center (videos & laser discs), Dept of Agriculture and Fisheries , BBSR
- visits/speakers: Dept of Agriculture and Fisheries, Ministry of Environment(hydrologist, waste engineers, Tynes Bay technicians and engineers, BBSR (acid rain, eutrophication, Outfalls, Harrington Sound data)
- Internet:

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- design and/or measure the rate of water consumption and/or loss in plants
- design and/or build a model for the hydrologic cycle
- design and perform an experiment to demonstrate that plant leaves contain a range of pigments – i.e. chromatography
- design and perform an experiment to demonstrate that plant leaves produce starch in the presence of light
- design a model of a closed biological system in equilibrium with respect to carbon dioxide, water and oxygen exchange e.g. a space station, a closed ecosystem in a bottle a 'biosphere'

WEBSITES

http://www.inform.umd.edu/PBIO/PBIO/pbioNew/lec6.html
http://gened.emc.maricopa.edu/bio/bio181/BIOBK/BioBookPS.html
http://photoscience.la.asu.edu/photsyn/default.html

REFERENCES - TEACHER:

Johnson, George B. and Raven H. Peter, Biology: Principles and Explorations. (Teacher Annotated Edition) New York: Holt, Rinehart and Winston, 1996.

Kaskel, et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999.

Biggs, Alton, et al. Biology the Dynamics of Life. New York: Glencoe/McGraw Hill, 2000.

Adds, J. et al. Cell Biology and Genetics: Nelson and Sons, 1999.

Adds, J. et al. The Organism and the Environment: Nelson and Sons, 1999.

Adds, J. et al. Systems and their Maintenance: Nelson and Sons, 1999.

Adds, J. et al. Microorganisms and Biotechnology: Nelson and Sons, 1999.

Adds, J. et al. Food and Health: Nelson and Sons, 1999.

Adds, J. et al. Applied Plant and Animal Biology: Nelson and Sons, 1999.

REFERENCES - STUDENT:

Johnson, George B. and Raven H. Peter, Biology: Principles and Explorations. New York: Holt, Rinehart and Winston, 1996.

Kaskel, et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999.

Biggs, Alton, et al. Biology the Dynamics of Life. New York: Glencoe/McGraw Hill, 2000.

SCIENCE

Course Title: BIOLOGY I

Module Title: Exchange of Energy & Matter in Organisms

Number of Periods: 25 double periods

Sequence Reference: SC3101BIO-C

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1-1.5 Nature and History of Science
- 2.1 - 2.4, 2.8 Scientific Inquiry
- 3.1 , 3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- illustrate how the body maintains a stable internal environment
- apply the principles of digestion to representative organisms including mammals, fungi and bacteria
- apply the principles of excretion to representative organisms including mammals including mammals, vascular plants and amoeba
- apply the principles of transport in representative organisms including mammals, vascular plants and amoeba
- distinguish between breathing and respiration
- apply the principles of ventilation in representative organisms including mammals, fish and amoeba

Content Detail:

- homeostasis: definition, importance; examples: blood glucose (pancreas and liver); water content (kidneys); temperature (skin) carbon dioxide and water (lungs)
- digestive systems (mammals, fungi & bacteria); types of nutrition (holophytic, holozoic, saphrophytic, parasitic / autotrophic heterotrophic); mammals: mechanical vs. chemical; digestive tract; glands(their secretions and role); fungi: saprophytic or parasitic; bacteria : saprophytic or parasitic
- excretory systems: mammal (kidney, skin, lungs); vascular plants (leaves); amoeba (diffusion through cell membrane); comparison: large organisms vs. small organisms (amoeba)
- breathing and respiration: respiration (definition, cellular respiration; aerobic vs. anerobic, generation of ATP); ventilation
- ventilation systems: renewing air and water in contact with respiratory surface; mammalian (breathing mechanisms & structures); fish (mechanism mouth through gills); pressure changes (lungs, diaphram etc); amoeba (diffusion)
- transport: mammals, heart and circulatory system; vascular plants: xylem and phloem; comparison mammalian vs. vascular plants etc.; comparison of transport in large organisms vs. small organisms (e.g. amoeba)

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- libraries: school, resource center (videos & laser discs), KEMH
- visits/speakers: Dept of Agriculture laboratory, BBSR, BAMZ, veterinarians, surgeons other medical personnel
- websites: http://sln2.fi.edu/biosci/preview/heartpreview.html

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS & PROJECTS:

- observe the principal features of the digestive, excretory, respiratory and circulatory system using models, computer simulations or dissections
- identify the structures of these systems from drawings or photos
- design and perform experiments to investigate the mechanics of breathing (lung volume, breathing rate etc.)
- summarize from models, computer simulations or a dissected organ the structure and direction of blood flow through a mammalian heart
- measure and interpret their own blood pressure and investigate the role of exercise in influencing blood pressure
- analysis of simulated urine samples (glucose, protein etc)
- fitness assessments and aerobic respiration
- anaerobic respiration – action of yeast in bread making
- dissections: sheep hearts, pigs kidneys, etc

REFERENCES – TEACHER:

Johnson, George B. & Raven H. Peter, Biology: Principles and Explorations. (Teacher Annotated Edition) New York: Holt, Rinehart and Winston, 1996.
Kaskel, et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999.
Biggs, Alton, et al. Biology the Dynamics of Life. New York; Glencoe/McGraw Hill, 2000.
Adds, J. et al. Cell Biology and Genetics: Nelson and Sons, 1999.
Adds, J. et al. The Organism and the Environment: Nelson and Sons, 1999.
Adds, J. et al. Systems and their Maintenance: Nelson and Sons, 1999.
Adds, J. et al. Microorganisms and Biotechnology: Nelson and Sons, 1999.
Adds, J. et al. Food and Health: Nelson and Sons, 1999.
Adds, J. et al. Applied Plant and Animal Biology: Nelson and Sons, 1999.

REFERENCES - STUDENT:

Johnson, George B & Raven H. Peter, Biology: Principles and Explorations. New York: Holt, Rinehart and Winston, 1996.
Kaskel, et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999.
Biggs, Alton, et al. Biology the Dynamics of Life. New York; Glencoe/McGraw Hill, 2000.

Biology II

Course Code: SC4092BIO

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: **Biology II** — **4 credit (s)**, **120 hour (s)**

Prerequisite (s): **Biology I**
Recommended: **Chemistry I, Integrated Mathematics II** — **S4 level (s)**

Course Code: **SC4092BIO** — ☐ **required or** ☒ **elective**

Course Description

Biology II is a course geared to students who have genuine interest in biology and intend to pursue the study of biological sciences at college level. It is a more rigorous course than Biology I and it expands the treatment of many topics introduced in earlier courses. It is strongly recommended that students should have completed or be currently taking a senior chemistry course, as the principles of biochemistry will be included. Success in this senior level biology course typically requires good reasoning and mathematical skills. Laboratory activities, discussion and research are an integral part of this course.

Course Requirements

The requirements for this course are as follows:

Performance Assessment - laboratory investigations/activities - laboratory skills tests, teacher observations, debates, discussions, interviews Rubrics are provided for scoring	**30%**
Product Assessments: - project (research, extended investigation, additional chemistry topic) **10%** - chapter assignments, reports, data analysis, models, portfolio **10 %** - rubrics are provided for scoring.	**20%**
Written Assessments: Written tests should be based on content cited in modules. The weighting for each module test is shown in the course outline. Written tests should consist of a variety of assessment components including: • multiple choice questions (not greater than 20 % of the test total) • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions	**20%**
Final Examination: Paper I compulsory (multiple choice and/or short answer) Paper II choice (structured questions, diagram or situation set questions, data analysis, essay etc.)	**30%**
Total:	**100%**

Course Resources

Johnson, George B & Raven H. Peter, Biology: Principles and Explorations. (Teacher Annotated Edition) New York: Holt, Rinehart and Winston, 1996.
Kaskel et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999.
Biggs, Alton et al. Biology the Dynamics of Life. New York; Glencoe/McGraw Hill, 2000.
Adds, J. et al. Cell Biology and Genetics. Nelson and Sons, 1999.
Adds, J. et al. The Organism and the Environment. Nelson and Sons, 1999.
Adds, J. et al. Systems and their Maintenance. Nelson and Sons, 1999.
Adds, J. et al. Microorganisms and Biotechnology. Nelson and Sons, 1999.
Adds, J. et al. Food and Health :Nelson and Sons, 1999.
Adds, J. et al. Applied Plant and Animal Biology. Nelson and Sons, 1999.

Course Outline

Module Title	# Double Periods	Module Title	# Double Periods
A. Systems Regulating Change in Humans & Other Organisms	25	**B. Reproduction and Development**	25
- homeostasis		- Human reproduction	
- nervous system		- sexual reproduction in flowering plants	
- endocrine system		- evolution	
- coordination in plants		- variation and speciation	
C. Genetics	25		
- Cell division			
- DNA			
- Mutations			

Subtotal 75
Optional double periods 15
Total double periods 90

SENIOR SCHOOL SCIENCE

check one: S1 ☐ S2 ☐ S3 ☐ S4 ☒

Biology II

GOALS		SUBGOALS		MODULE & CURRICULUM CORRELATION MATRIX		
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity	x	x	x
		1.2	Connections	x	x	x
		1.3	Health	x	x	x
		1.4	Inter-relationship/Mathematics Science Technology	x	x	x
		1.5	Problem Solving	x	x	x
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis	x	x	x
		2.2	Design	x	x	x
		2.3	Data Collection	x	x	x
		2.4	Technology Use	x	x	x
		2.5	Explanations/limitation	x	x	x
		2.6	Explanations/alternatives			x
		2.7	Communications/Results			x
		2.8	Research	x	x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science	x	x	x
		3.2	Value, Environment		x	x
		3.3	Ethical, Applications		x	x
		3.4	Career options	x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship			
		4.2	Environmental Applications			
CONTENT STRUCTURE		Change		x	x	x
		Cause & Effect		x	x	x
		Systems		x	x	x
		Life Science		x	x	x
		Physical Science				
		Earth and Space Science				
		MODULE		**A**	**B**	**C**

MODULE KEY

A - System Regulating Change in Humans and Other Organisms
B - Reproduction and Evolution
C - Genetics

SCIENCE

Course Title: BIOLOGY II

Module Title: Systems Regulating Change in Humans and Other Organisms

Number of Periods: 25 double periods

Sequence Reference: SC4092BIO-A

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1- 1.5 Nature and History of Science
- 2.1-2.5, 2.8 Scientific Inquiry
- 3.1, 3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- relate the importance of control and coordination systems to success as an organism

Content Detail:

- control systems: homeostasis, reflex actions,
- nervous system
  - neurons: sensory, motor and interneurons, ion distribution, influence of myelin
  - structure of synapse between two neurons; transfer of information by transmitter substance; effects of transmitters (noradrenaline, acetylchline)
  - CNS: cerebrum, cerebellum, medulla and spinal cord
  - peripheral nervous system: sympathetic, parasympathetic and reflex activity
  - the senses: eye, ear, chemical senses
  - impact of drugs on the nervous system: psychoactive drugs, addiction, narcotics and cocaine, nicotine and alcohol
- endocrine system
  - principle endocrine glands: location and function
  - change in target cells due to hormones (protein steroid and plant)
  - hormones, source glands & effects
- plants: roles of gibberellin and abscisic acid in the control of seed dormacy and germination

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews
- **Product Assessments:**
  - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios etc
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas (if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources (materials, equipment & community involvement):

- libraries: school, KEMH, DOE resource center (videos & laser discs),
- visits/speakers: KEMH, medical laboratory; Dept of Agriculture,
- websites:
  http://www.umanitoba.ca/faculties/science/biological_sciences/biolab.html
  http://www.schoolnet.ca/math/sci
  http://www.pacificnet.net/~mandel/
  http://www.freeserve.net/education/examinerevision/gcse/science/sgtopics.html

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- observe principal features of the brain using models, computer simulations, dissected mammalian brains
- investigate presence of urine in simulated urine or use computer simulation to investigate role of insulin in regulation of blood sugars
- investigate the effect of various conditions and substances on the germination of seeds

WEBSITES

http://personal.tmlp.com/jims57/tour/cell/cellhtm
http://linksnorth.com/nutrition
http://glinda.lrsm.upenn.edu/~weeks/neurons.html
http://psch.hanover.edu/krantz/neuronut.html
http:www.mecca.org/~tschief/AVIATION/ACADEMY/biolesson.htm
http://www.junctionet.com/~spinedr/nerves.html
http://www.nwice.cc.ia.us/chpt18a.htm
http://www.umanitoba.ca/faculties/science/biological_sciences/biolab.html
http://www.schoolnet.ca/math/sci
http://www.pacificnet.net/~mandel/
http://www.freeserve.net/education/examinerevision/gcse/science/sgtopics.html

REFERENCES - TEACHER:

Johnson, George B & Raven H. Peter, Biology: Principles and Explorations. (Teacher Annotated Edition) New York: Holt, Rinehart and Winston, 1996.
Kaskel, et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999.
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Adds, J. et al. Microorganisms and Biotechnology. Nelson and Sons, 1999.
Adds, J. et al. Food and Health. Nelson and Sons, 1999.
Adds, J. et al. Applied Plant and Animal Biology. Nelson and Sons, 1999.

REFERENCES - STUDENT:

Johnson, George B & Raven H. Peter, Biology: Principles and Explorations. New York: Holt, Rinehart and Winston, 1996.
Kaskel, et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999.
Biggs, Alton et al. Biology the Dynamics of Life. New York; Glencoe/McGraw Hill, 2000.
Adds, .J et al. Cell Biology and Genetics. Nelson and Sons, 1999.
Adds, J. et al. The Organism and the Environment: Nelson and Sons, 1999.
Adds, J. et al. Systems and their Maintenance: Nelson and Sons, 1999.
Adds, J. et al. Microorganisms and Biotechnology: Nelson and Sons, 1999.

SCIENCE

Course Title: BIOLOGY II

Module Title: Reproduction and Evolution

Number of Periods: 25 double periods

Sequence Reference: SC4092BIO-B

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1- 1.5 Nature and History of Science
- 2.1 - 2.5 Scientific Inquiry
- 3.1 – 3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- apply principles of reproduction in sample organisms
- trace the development of the modern theory of evolution and relate to supporting evidence
- identify the nature of variation (inherited or acquired) and the relationship with speciation

Content Detail:

- reproductive systems and survival of the species – humans and flowering plants
- human reproduction:
  - structure of sperm and egg cells: positions and structure of reproductive organs(male & female); fertilization, implantation; structure & functions of placenta, functions of the amnion; process of birth;
  - roles sites and impact of hormones: menstrual cycle, regulation of primary& secondary sex characteristics, testosterone, LH, FSH, estrogen, progesterone
  - pregnancy and birth; impact of birth control methods on possibility of conception
- sexual reproduction in flowering plants
  - basic structures and function: pistil, stamen pollen, ovules; production of embryo sacs and pollen grains, formation of gametes; processes of pollination and fertilization, seed development
- modern theory of evolution: historical development; supporting evidence: fossils, radioactive dating etc
- variation : inherited, acquired; variations within communities; speciation: formation of new species
- overview of Hardy Weinburg Principle

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews
- **Product Assessments:**
  - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios etc
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- libraries: school, resource center (videos & laser discs), KEMH, Dept of Agriculture and Fisheries
- visits/speakers: KEMH staff(obstetrician, gynaecologist, neo natal nurse etc) Dept of Agriculture and Fisheries, horticulturist, nursery technicians, plant laboratory technicians, botanists
- websites: http://bioinformatics.weizmann.ac.il/cards http://www.geocities.com/CapeCanaveral/Hangar/2160/index.html http://www.;library.thinkquest.org/18757/history of evolution.htm

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- observe principal features of mammalian reproductive system using models, computer simulations or dissection
- observe stages of embryo development using preserved material, models or computer stimulation
- analyze blood hormone data infer role of reproductive hormones
- microscopal examination of ovary and testis
- examine the structure of an insect pollinated flower
- research and present a paper explaining how birth control pills reduce the chance of conception
- make measurements of inherited and acquired variation amongst students and local plants
- perform experiments or simulations to demonstrate gene pool charge
- calculate and interpret problem solving exercise using the Hardy Weinberg Principle

WEBSITES:

http://www.ucmp.Berkeley.edu/
http://mathstat.usouthal.edu/~walwenda/hardy.html

REFERENCES - TEACHER:

Johnson, George B & Raven H. Peter, Biology: Principles and Explorations. (Teacher Annotated Edition) New York: Holt, Rinehart and Winston, 1996.
Kaskel, et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999.
Biggs, Alton et al. Biology the Dynamics of Life. New York; Glencoe/McGraw Hill, 2000.
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Adds, J. et al. Microorganisms and Biotechnology. Nelson and Sons, 1999.
Adds, J. et al. Food and Health. Nelson and Sons, 1999.
Adds, J. et al. Applied Plant and Animal Biology. Nelson and Sons, 1999.

REFERENCES - STUDENT:

Johnson, George B & Raven H. Peter, Biology: Principles and Explorations. New York: Holt, Rinehart and Winston, 1996.
Kaskel, et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999.
Biggs, Alton et al. Biology the Dynamics of Life. New York; Glencoe/McGraw Hill, 2000.
Adds, .J et al. Cell Biology and Genetics. Nelson and Sons, 1999.
Adds, J. et al. The Organism and the Environment: Nelson and Sons, 1999.
Adds, J. et al. Systems and their Maintenance: Nelson and Sons, 1999.
Adds, J. et al. Microorganisms and Biotechnology: Nelson and Sons, 1999.

SCIENCE

Course Title: BIOLOGY II

Module Title: Genetics

Number of Periods: 25 double periods

Sequence Reference: SC4092BIO-C

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1- 1.5 Nature and History of Science
- 2.1- 2.8 Scientific Inquiry
- 3.1-3.4 Positive Attitudes

Content Focus:

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- differentiate between mitosis and meiosis
- explain the gene-chromosome theory of inheritance and Mendel's theory
- describe how probability techniques (e.g. math product rule, Punnett square) are used to predict gene flow
- explain why sex-linked defects are more common in males than females
- explain the influence of multiple alleles and polygenic traits on inheritance patterns
- describe how genetic information is contained in the sequence of bases in a DNA molecule
- explain how a random change (mutation) in the sequence bases provides a source of genetic variability

Content Detail:

- cell division: mitosis and meiosis
- genetic variation/uniformity
- probability techniques
- ref gene flow
- mutations
- DNA and protein synthesis

Module Evaluation:

- **Performance Assessments**
  - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews
- **Product Assessments**
  - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios etc
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- libraries: school, resource center (videos & laser discs), KEMH, Dept of Agriculture and Fisheries
- visits/speakers: KEMH staff, Agriculture and Fisheries: botanists, BAMZ and BBSR scientists
- websites: http://www.biology.arizona.edu/
  also refer to other biology modules

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- observe stages of the cell cycle from prepared slides e.g. onion root tips
- prepare and interpret models of human karyotypes
- design and construct models of DNA to demonstrate the structure of base arrangement

REFERENCES - TEACHER:

Johnson, George B & Raven H. Peter, Biology: Principles and Explorations. (Teacher Annotated Edition) New York: Holt, Rinehart and Winston, 1996.

Kaskel, et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999.

Biggs, Alton et al. Biology the Dynamics of Life. New York; Glencoe/McGraw Hill, 2000.

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Adds, J. et al. Applied Plant and Animal Biology. Nelson and Sons, 1999.

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Kaskel, et al. Biology An Everyday Experience. New York: Glencoe/McGraw-Hill, 1999.

Biggs, Alton et al. Biology the Dynamics of Life. New York; Glencoe/McGraw Hill, 2000.

Adds, .J et al. Cell Biology and Genetics. Nelson and Sons, 1999.

Adds, J. et al. The Organism and the Environment: Nelson and Sons, 1999.

Adds, J. et al. Systems and their Maintenance: Nelson and Sons, 1999.

Adds, J. et al. Microorganisms and Biotechnology: Nelson and Sons, 1999.

Chemistry I

Course Code: SC3111CHM

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Chemistry I | **4 credit (s)**
120 hour (s)

Prerequisite (s): Science II, Integrated and Applied Mathematics I | **S3 level (s)**

Course Code: SC3111CHM | ☐ **required or** ☒ **elective**

Course Description

This introductory chemistry course provides a foundation for students who intend to study advanced courses in chemistry and biology in preparation for careers in health sciences and engineering. It builds on physical science principles such as matter, bonding and chemical reactions met in the two senior foundation science courses. The introduction to the mole and chemical calculations will require students to apply algebraic method to equations. Students will be actively involved in the development of chemical concepts through laboratory experiences, demonstrations and multimedia. References will be made to careers involving chemistry.

Course Requirements

The requirements for this course are as follows:

Performance Assessments: - laboratory investigations/activities - laboratory skills tests, observations, debates, discussions, interviews - rubrics are provided for scoring	**30%**
Product Assessments: - project (research, extended investigation, additional chemistry topic)**10%** - chapter assignments, reports, data analysis, , models, portfolios, **10%** - rubrics are provided for scoring	**20%**
Written Assessments: Written tests should be based on content cited in modules. The weighting for each module test is shown in the course outline. Written tests should consist of a variety of assessment components including: • multiple choice questions (not greater than 20 % of the test total) • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions	**20%**
Final Assessment:	**30%**
Total	**100%**

Course Resources

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry:Concepts and Applications. New York: Glencoe McGraw - Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw -Hill, 2000.

Bethel, George. Coordinated Science Teacher's Guides. (Chemistry) Oxford: Oxford University Press, 1999.

Gallager RoseMarie et al. Coordinated Science: Chemistry. Oxford: Oxford University Press, 1999.

Timberlake, Karen. Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

Tocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

Beavon, Rod, Structure and Bonding and the Periodic Table. Surrey: Thomas Nelson & Sons, 2000.

Beavon, Rod and Jarvis, Alan, Physical and Inorganic Chemistry: Applications. Surrey: Thomas Nelson & Sons, 2000.

Chapman, Brian, Organic Pathways: Synthesis and Analysis. Surrey: Thomas Nelson & Sons, 2000.

Jarvis, Alan, Principles of Physical and Organic Chemistry. Surrey: Thomas Nelson & Sons, 2000.

Course Outline

Module Title	# Double Periods
A. Chemistry Fundamentals	10
B. Atomic Structure and Periodic Table	14
C. Bonding, Structure and Properties	8
D. Gases	8
E. The Mole	15
F. Chemical Reactions	10
G. Introduction to Organic Chemistry	10

A. Chemistry Fundamentals......................10
- measurement
- laboratory techniques
- safety

B. Atomic Structure and Periodic Table .. 14
- physical and chemical properties
- purity
- elements compounds and mixtures
- chemical nomenclature
- law of definite proportions

C. Bonding, Structure and Properties 8
- Lewis structures
- chemical equations
- types of reactions
- rates of reactions

D. Gases..8
- kinetic theory
- characteristics
- Gas Laws

E. The Mole..15
- the mole
- mole mass inter-conversions
- calculations on formulae

F. Chemical Reactions............................. 10
- terms
- chemical equations
- types of reactions
- rates of reactions

G. Introduction to Organic Chemistry.........10
- unique nature of carbon
- hydrocarbons: alkanes and alkenes
- substitution and addition reactions
- impact of the use of organic compounds on society

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check one: S1 ☐ S2 ☐ S3 ☒ S4 ☐

Chemistry I

	GOALS		SUBGOALS	MODULE & CURRICULUM CORRELATION MATRIX						
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity	x		x	x		x	
		1.2	Connections	x						
		1.3	Health		x					
		1.4	Inter-relationship/Mathematics Science Technology	x	x	x	x	x	x	x
		1.5	Problem Solving	x	x	x	x	x	x	x
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis	x	x	x	x	x	x	x
		2.2	Design	x	x	x	x	x	x	x
		2.3	Data Collection	x	x	x	x	x	x	x
		2.4	Technology Use	x	x	x	x	x	x	
		2.5	Explanations/limitation	x	x	x	x	x		
		2.6	Explanations/alternatives	x		x			x	
		2.7	Communications/Results	x		x			x	
		2.8	Research	x	x	x	x		x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science	x	x					x
		3.2	Value, Environment		x					
		3.3	Ethical, Applications	x		x				
		3.4	Career options	x	x	x		x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship	x						x
		4.2	Environmental Applications	x						x
	CONTENT STRUCTURE		Change							
			Cause & Effect							
			System							
			Life Science							
			Physical Science	x	x	x	x	x	x	x
			Earth and Space Science							
			MODULE	**A**	**B**	**C**	**D**	**E**	**F**	**G**

MODULE KEY

A - Chemistry Fundamentals
B - Atomic Structure and Periodic Table
C - Bonding, Structure and Properties
D - Gases
E - The Mole
F - Chemical Reaction
G - Introduction to Organic Chemistry

CHEMISTRY

Course Title: CHEMISTRY I	**Sequence Reference:** SC3111CHM-A
Module Title: Chemistry Fundamentals	**Senior School Level**
Number of Periods: 10 double periods	S1 ☐ S2 ☐ S3 ☒ S4 ☐

Subgoal Emphasis:	**Content Focus**
• 1.1, 1.2, 1.4-1.5 Nature and History of Science • 2.1 – 2.8 Scientific Inquiry • 3.1, 3.3, 3.4 Positive Attitudes • 4.1, 4.2 Advocate for Environment	• Change • Systems • Physical Science

Curriculum Objectives:

At the end of this module, students will:

- demonstrate skills in measuring mass, volume and temperature using appropriate units
- recognize the imprecise nature of measurement
- present calculated results using the appropriate number of significant figures
- solve numerical problems using dimensional analysis
- select appropriate apparatus and techniques for laboratory activities and use safely and accurately
- relate characteristics of solids, liquids and gases to kinetic theories of matter
- examine and describe changes that occur when matter is heated combined or separated
- assess purity from melting point data
- classify substances as elements, compounds or mixtures
- identify and write chemical symbols and formulae
- appreciate the role of chemistry as a central science

Content Detail:

- measurement
  - apparatus; uncertainty; scientific notation; SI units or equivalent
- dimensional analysis
- experimental procedures
  - planning investigations; data collection and analysis; writing formal laboratory reports
- kinetic theory of matter: kinetic theory model; properties of solids, liquids, gases; changes of state; heating and cooling curves
- chemical and physical changes
- purity: boiling point, freezing point, melting point, assessing purity, importance in everyday life (sugar, salt, pharmaceuticals etc.)
- elements, compounds and mixtures: properties, metals and non metals, atoms, molecules and ions
- chemical symbols and formulae: symbols, ion, naming compounds, predicting formulae
- technology tools; oral and written presentations
- safety in the laboratory (video): safety rules; safety plans (exits, safety maps etc.); safety equipment, basic first aid, laboratory hazards
- chemistry as the central science
  - role of chemistry in other sciences; careers in using chemistry; chemistry in everyday life

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  - teacher observation, projects, demonstration, posters/essays/etc., portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas (if any):

- using scientific nomenclature, symbols, formulas etc.
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately, using technology: scientific calculator, computer applications, accessing websites

Special Resources (materials, equipment & community involvement):

- videos: lab safety, scientific method and measurement, accidents
- site visits/ guest speakers: pharmacists, KEMH & environmental health BBSR laboratories
- curricular connections: mathematics, nutrition
- internet:http://www.chem.unsw.edu.au/highschool/teachers.html
- http://www.schoolnet.ca/math/sci
- http://www.pacificnet.net/~mandel/

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS & ACTIVITIES & PROJECTS:

- research the use of chemistry in another culture
  - a device used to make iron in Africa which uses the chemical principle of a blast furnace e.g Haya iron smelting furnace(Debra Shore *Brown University Alumni* December 1978)
  - trace the alchemists quest for gold
- design an investigation to determine the quality of water from sites around your school
- given a sample of a hydrated salt, carry out an investigation to determine the % hydration
- analyze using label data, the components of various kitchen and garden chemicals. Relate to hazard warnings and justify their use or non-use in the home
- examine how a hair stylist uses chemistry in his career
- given samples of mixtures, design and carry out investigations to separate them into their components (e.g. iron, sulphur, copper turnings; sand and salt etc.)
- design and build a model for the kinetic theory that could be used to help M1 students distinguish between solids, liquids and gases
- interview a pharmacist to determine the importance of % purity of pharmaceuticals

REFERENCES - TEACHER:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry:Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw-Hill, 2000.

Bethel, George, Coordinated Science Teacher's Guides. (Chemistry) Oxford: Oxford University Press, 1999.

Gallager, RoseMarie, et al. Coordinated Science: Chemistry. Oxford: Oxford University Press, 1999.

Timberlake, Karen, Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

Tocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

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Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw-Hill, 2000.

Tocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

CHEMISTRY

Course Title: CHEMISTRY I

Sequence Reference: SC3111CHM-B

Module Title: Atomic Structure and the Periodic Table

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Number of Periods: 14 double periods

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.1 – 2.8 Scientific Inquiry
- 3.3 – 3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- trace the historical development of the models of the atom
- differentiate between subatomic particles based on the Bohr model of the atom
- use atomic number to calculate number of protons and electrons in an atom or ion
- explain how atoms of the same element may exist in different forms (isotopes)
- illustrate distribution of electrons in energy levels
- trace the historical development of the ordering of elements in the periodic table
- relate the atomic structure to position of the element in the periodic table
- analyze trends and similarities in groups and periods
- predict characteristics of elements based on position in the table and/or knowledge of characteristics of other members of the chemical family
- relate properties of elements (and isotopes) to uses in everyday life

Content Detail:

- historical perspective of the atom
  - Thomson, Rutherford, Bohr, advanced models
- the atom
  - subatomic particles: position, mass, charge
  - mass number, atomic number
  - isotopes: definition
  - atomic orbitals and suborbitals
  - calculations of number of subatomic particles
- periodic table structure
  - historical development (Mendeleev etc.)
  - structure: groups, periods, families
  - metals, nonmetals, metalloids
- chemical families: alkali metals, alkaline earth metals, halogens, noble gases, oxygen, carbon, sulphur
- uses of elements (including isotopes)

Module Evaluation:

- **Performance Assessments:**
  laboratory investigations, activities, skills tests, observations

- **Product Assessments:**
  - teacher observation, presentation – project/demonstration, posters/essays/etc., portfolio, data collection/data analysis

- **Written Assessments:**
  - written tests and quizzes

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, periodic table, symbols, formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- DOE Resource Centre -laser discs, videos, software
- site visits/guest speakers: BBSR labs and scientists, Bermuda College, forensic scientists (Police Scenes of Crime Office)
- curricular connections: physics
- websites:
  http://www.uky.edu/~holler/periodic/periodic.html
  http://www.shef.ac.uk/uni/academic/A-C/chem/web-elements/web-elements-home.html

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS & ACTIVITIES & PROJECTS:
- research the contributions of one scientist who helped to identify the subatomic particles
- critique an Internet site related to the Periodic Table and suggest how it could be used for senior school chemistry students
- choose a less known group or period (lanthanides etc) and make a class presentation about the elements involved
- carry out a series of investigations to show the similarity in properties of a particular periodic table group
- research contributions of black and/or female scientists
- debate the following issue
  - scientists should not have used the information about the atom to create an atomic bomb or any other weapon of destruction
- use flame tests to identify elements
- graph periodic properties

REFERENCES - TEACHER:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw - Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw -Hill, 2000.

Bethel, George, Coordinated Science Teacher's Guides. (Chemistry) Oxford: Oxford University Press, 1999.

Gallager, RoseMarie, et al. Coordinated Science: Chemistry Oxford: Oxford University Press, 1999.

Timberlake, Karen, Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

Tocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

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Chapman, Brian, Organic Pathways: Synthesis and Analysis. Surrey: Thomas Nelson & Sons, 2000.

Jarvis, Alan, Principles of Physical and Organic Chemistry. Surrey: Thomas Nelson & Sons, 2000.

REFERENCES - STUDENT:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw - Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw -Hill, 2000.

Tocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

CHEMISTRY

Course Title: CHEMISTRY I	**Sequence Reference:** SC3110CHM-C
Module Title: Bonding, Structure & Properties	
Number of Periods: 8 double periods	

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.1 - 2.5, 2.8 Scientific Inquiry
- 3.2, 3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- explain the formation of ionic, covalent and metallic bonds
- draw electron dot diagrams for atoms
- define valence electrons
- relate the importance of valence electrons to bonding
- illustrate bonding using electron dot (or dot and cross diagrams)
- deduce the type of bond from chemical formula
- describe the lattice structure of ionic compounds
- describe shapes of water, methane and ammonia molecules
- explain how intermolecular forces account for the properties of ionic and molecular compounds and metallic substances
- classify ionic, molecular and metallic substances according to their properties
- relate the structure of diamond and graphite to properties and uses

Content Detail:

- bonding
  - valence electrons
  - electron dot diagrams
  - losing gaining and sharing electrons
  - the metallic bond
  - electron dot (or dot and cross diagrams)
  - Lewis structures
- structure
  - NaCl lattice (ionic)
  - metallic lattices
  - shapes of molecules
  - intermolecular forces (Van Der Waal's, hydrogen bonding etc.)
  - diamond and graphite
- properties: solubility, melting point and conductivity
- predicting properties of unknown/new substances based on bonding

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  - teacher observation, presentation – project/demonstration, posters/essays/etc., portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas (if any):

- using scientific nomenclature, periodic table, symbols, formulas etc.
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
  - using technology: scientific calculator, computer applications, accessing websites

Special Resources (materials, equipment & community involvement):

- DOE Resource Centre -laser discs, videos, software
- site visits/guest speakers: scientists, jewelers, engineers
- curricular connections: physics
- websites: see previous modules

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS & ACTIVITIES & PROJECTS:

- investigate the physical properties of a variety of substances and classify them as ionic or molecular (solubility, melting point, conductivity)
- investigate careers that use chemistry
- use models (ball & stick etc) to create structures of various compounds
- relate the structure properties and uses of : buckminsterfullerene; gelatin, silicon and silicones
- grow sodium chloride crystals and model simple cubic structure using toothpicks and foam balls

REFERENCES - TEACHER:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry:Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry : New York: Glencoe McGraw -Hill, 2000.

Bethel, George, Coordinated Science Teacher's Guides (Chemistry) Oxford: Oxford University Press, 1999.

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Chapman, Brian, Organic Pathways: Synthesis and Analysis. Surrey: Thomas Nelson & Sons, 2000.

Jarvis, Alan, Principles of Physical and Organic Chemistry. Surrey: Thomas Nelson & Sons, 2000.

REFERENCES - STUDENT:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry:Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry : New York: Glencoe McGraw-Hill, 2000.

Gallager, RoseMarie et al. Coordinated Science: Chemistry Oxford: Oxford University Press, 1999.

Timberlake, Karen, Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

Tocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

SCIENCE

Course Title: CHEMISTRY I	**Sequence Reference:** SC3111CHM-D
Module Title: Gases	**Senior School Level**
Number of Periods: 8 double periods	S1 ☐ S2 ☐ S3 ☒ S4 x☐

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.1 - 2.5, 2.8 Scientific Inquiry
- 3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- use the kinetic theory of matter to distinguish gases from solids and liquids
- identify familiar substances that are gases
- examine the characteristics of gases
- predict the behaviour of gases based on Boyles' Law and Charles' law and the combined gas law
- Calculate the temperature, volume, pressure or number of moles of a gas using ideal gas laws

Content Detail:

- kinetic theory: gases, liquids, solids, interconversion of states
- familiar gases: elements (H_2, O_2, F_2, Cl_2) and compounds (CO_2, NH_3, HCL etc.)
- gas pressure, relationship with mass and volume, measuring pressure, pressure units and conversion
- Boyles' Law
- Charles' Law
- ideal gas equation

Module Evaluation:

- **Performance Assessments:**
  -laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  -chapter assignments, short quizzes, reports, data analysis, posters/collages, models, games, portfolios etc
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, periodic table, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- DOE Resource Centre (laser discs, videos, software, etc.)
- site visits/ guest speakers: Bermuda Industrial Gases, KEMH engineering department, BELCO
- curricular connections: mathematics, physics
- websites:
  http://www.chem.vt.edu/chem-ed/org-home.html
  http://www.vuw.ac.nz/non-loccal/chemis

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- investigate Charles' Law using a balloon full of air in ice water then hot water
- determine the molar volume of a sample of a gas

REFERENCES - TEACHER:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry:Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw-Hill, 2000.

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Beavon, Rod, Structure and Bonding and the Periodic Table. Surrey: Thomas Nelson & Sons, 2000.

Chapman, Brian, Organic Pathways: Synthesis and Analysis. Surrey: Thomas Nelson & Sons, 2000.

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Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw-Hill, 2000.

Bocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

CHEMISTRY

Course Title: CHEMISTRY I

Module Title: The Mole Concept

Number of Periods: 15 double periods

Sequence Reference: SC3111CHM-E

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.5 Nature and History of Science
- 2.1 - 2.5, 2.8 Scientific Inquiry
- 3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- explain relative atomic mass
- identify the mole as the unit for counting atoms, molecules or ions
- illustrate the magnitude of Avogadro number
- calculate the molar mass of an element or compound
- perform mole mass interconversions
- deduce the formulae of compounds from the composition by mass
- deduce a balanced equation for a chemical reaction given relevant information
- identify mole ratios of reactants and products from balanced chemical equations
- perform stoichiometric calculations related to chemical equations (including volumes of gases)
- experimentally determine the molar volume of a gas
- describe molarity as a measure of molar concentration
- perform calculations involving the mass of a solute volume of solution and molarity

Content Detail:

- the mole (illustrative example – Green Pea analogy, etc.)
- relative atomic mass and molar mass
  - mole mass interconversions
- calculations on formulae
  - percent composition
  - empirical and molecular formulas
  - experimental determination
  - relate to everyday substances (Merck Index)
- stoichiometric calculations from equations
  - reacting masses
  - Avogadros' hypothesis, molar volume of gases
  - experimental determinations
- molarity
  - mol/l[dm^3]
  - experimental
  - standard solutions
  - calculations

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  - teacher observation, presentation – project/demonstration, posters/essays/etc., portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websitesusing SI units
- reporting observations accurately
- using technology: calculator, spreadsheets and
- word processing tools
- accessing Internet sites

Special Resources
(materials, equipment & community involvement):

- DOE resource Centre (laser discs, videos, software, etc.)
- site visits/ guest speakers
- curricular connections: mathematics
- Internet sites:

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- determine the molar volume of a gas
- use acid base titration to determine unknown concentration
- determine % yield of a product of a displacement reaction

REFERENCES - TEACHER:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw-Hill, 2000.

Bethel, George,, Coordinated Science Teacher's Guides (Chemistry). Oxford: Oxford University Press, 1999.

Gallager, RoseMarie, et al. Coordinated Science: Chemistry. Oxford: Oxford University Press, 1999.

Timberlake, Karen, Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

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CHEMISTRY

Course Title: CHEMISTRY I

Module Title: Chemical Reactions

Number of Periods: 10 double periods

Sequence Reference: SC3111CHM-F

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.1 – 2.8 Scientific Inquiry
- 3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- explain chemical reactions in terms of bond breaking and new bond formation
- record changes occurring in chemical reactions
- deduce Law of Conservation of Mass
- balance chemical equations
- relate co-efficient in equation to relative number of molecules or mole ratio of reactants and products
- classify chemical reactions and predict products
- write balanced chemical equations – including subscripts
- explore factors that affect reaction rates

This module can be integrated with modules C & E

Content Detail:

- chemical reactions:
  - terms
  - reactants and products
  - bond breaking and making
- chemical equations:
  - balancing coefficients
  - subscripts(s), (g), (aq), (l)
  - stoichiometric calculations
  - Law of Conservation of Mass
- types of chemical reactions:
  - synthesis, decomposition, replacement combustion, acid-base neutralization
  - predicting products
  - energy changes - endothermic and exothermic
- rates: impact of temperature, concentration, particle size

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  - teacher observation, presentation – project/demonstration, posters/essays/etc., portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, periodic table, symbols formulas etc.
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- DOE Resource Centre -laser discs, videos, software
- site visits/ guest speakers: BELCO, Agriculture and Fisheries Laboratory, photographic labs, pool care technician, police Scenes of crime labs
- curricular connection: horticulture, mathematics
- websites **http://www.schoolnet.ca/math/sci** http://www.chem.unsw.edu.au/highschool/teachers.html

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS & ACTIVITIES & PROJECTS:
- investigate chemical reactions and predict products if possible
  - reaction of metals with acids
  - single displacement reactions
  - decomposition reaction
  - food tests
  - effect of catalysts (oxygen preparation etc)
- relate how humans create potential hazards as byproducts of chemical reactions (factory emissions, byproducts of extractions)
- investigate effectiveness of stomach antacids
- research the effect of catalytic converters on vehicles

REFERENCES - TEACHER:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw - Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry : New York: Glencoe McGraw -Hill, 2000.

Bethel, George, Coordinated Science Teacher's Guides. (Chemistry). Oxford: Oxford University Press, 1999.

Gallager, RoseMarie et al. Coordinated Science: Chemistry Oxford: Oxford University Press, 1999.

Timberlake, Karen, Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

Tocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

Beavon, Rod, Structure and Bonding and the Periodic Table. Surrey: Thomas Nelson & Sons, 2000.

Beavon, Rod and Jarvis, Alan, Physical and Inorganic Chemistry: Applications. Surrey: Thomas Nelson & Sons, 2000.

Chapman, Brian, Organic Pathways: Synthesis and Analysis, Surrey: Thomas Nelson & Sons, 2000.

Jarvis, Alan, Principles of Physical and Organic Chemistry. Surrey: Thomas Nelson & Sons, 2000.

REFERENCES - STUDENT:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw - Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw -Hill, 2000.

Tocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

CHEMISTRY

Course Title: CHEMISTRY I

Module Title: Introduction to Organic Chemistry

Number of Periods: 10 double periods

Sequence Reference: SC3111CHM-G

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1,1.4,1.5 Nature and History of Science
- 2.1 – 2.5, 2.8 Scientific Inquiry
- 3.4 Positive Attitudes
- 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- explain the multiple bonding character of the carbon atom
- draw structural formulas for 1-3 carbon hydrocarbon molecules
- relate carbon chemistry to products used in everyday life
- identify major sources of carbon compounds
- describe the extraction and refining of crude oil
- classify hydrocarbons as saturated and unsaturated
- write formula and state IUPAC name for carbon chains and branches up to ten carbon atoms of alkanes, alkenes and alkynes
- classify organic compounds based on structures, properties
- write balanced equations and predict reactions of alkanes and alkenes
- analyze environmental impact of organic compounds and their reactions

Content Detail:

- unique nature of carbon atom
  - multiple bonding, strength, straight, branched, ring, etc.
  - diversity of compounds and nomenclature of organic compounds
  - tetrahedral arrangement of 4 single bonds
- carbon products in everyday life – fuels, solvents, pharmaceuticals, plastics, pesticides, etc.
- organic compounds
  - sources of organic compounds: crude oil, etc.
  - alternate sources
  - terms: hydrocarbon, , cyclic, aromatic, homologous series, alkanes, alkenes, alkynes, acids and alcohols
  - names and formulae, isomers
  - relationship of structure to physical properties: chain length to melting point, etc.
  - reactions of alkanes and alkenes: substitution, addition, polymerisation
- environmental impact: combustion of fossil fuels, CFC's and the ozone layer etc.

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  - teacher observation, presentation – project/demonstration, posters/essays/etc., portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, periodic table, symbols, formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- DOE Resource Centre (laser discs, videos, software)
- site visits/guest speakers : BELCO engineers and environmental officer, BBSR organic chemists
- Internet sites:
  http://www.chem.vt.edu/chem-ed/org-home.html
  http://www.vuw.ac.nz/non-loccal/chemis

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- construct models of various hydrocarbons
- research the environmental impact of CFC's
- use chemical test to distinguish between alkanes and alkenes

REFERENCES - TEACHER:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry:Concepts and Applications. New York: Glencoe McGraw - Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry : New York: Glencoe McGraw -Hill, 2000.

Bethel, George, Coordinated Science Teacher's Guides. (Chemistry). Oxford: Oxford University Press, 1999.

Gallager, RoseMarie, et al. Coordinated Science: Chemistry. Oxford: Oxford University Press, 1999.

Timberlake, Karen, Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

Tocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

Beavon, Rod, Structure and Bonding and the Periodic Table. Surrey: Thomas Nelson & Sons, 2000.

Beavon, Rod and Jarvis, Alan, Physical and Inorganic Chemistry: Applications. Surrey: Thomas Nelson & Sons, 2000.

Chapman, Brian, Organic Pathways: Synthesis and Analysis. Surrey: Thomas Nelson & Sons, 2000.

Jarvis, Alan, Principles of Physical and Organic Chemistry. Surrey: Thomas Nelson & Sons, 2000.

REFERENCES - STUDENT:

N/A

Chemistry II

Course Code: SC4102CHM

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Chemistry II — **4 credit (s)**, **120 hour (s)**

Prerequisite (s): Chemistry I, Integrated Mathematics II — **S4 level (s)**

Course Code: SC4102CHM — ☐ **required or** ☒ **elective**

Course Description

This course is designed to prepare students for smooth entry to introductory college chemistry courses. It is intended for students who have a strong background in mathematics and science. Chemistry II further develops concepts such as atomic structure, organic chemistry and chemical reactions. Equilibrium, energy changes and redox reactions are introduced for the first time. There is an emphasis on laboratory investigations. References are made to societal implications and opportunities for related careers. An individual project is a required part of the assessment in this senior course.

Course Requirements

The requirements for this course are as follows:

Performance Assessments: - laboratory investigations/activities - laboratory skills tests, teacher observations, debates, discussions, interviews - rubrics are provided for scoring	**30%**
Product Assessments: - project (research, extended investigation, additional chemistry topic) **10%** - chapter assignments, reports, data analysis, models, portfolios, etc **10%** - rubrics are provided for scoring	**20%**
Written Assessments: Written tests should be based on content cited in modules. The weighting for each module test is shown in the course outline. Written tests should consist of a variety of assessment components including: • multiple choice questions (not greater than 20 % of the test total) • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions	**20%**
Final Examination: Paper I compulsory (multiple choice and/or short answer) Paper II choice (structured questions, diagram or situation set questions, data analysis, essay etc.)	**30%**
Total	**100%**

Course Resources

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw - Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw -Hill, 2000.

Timberlake, Karen, Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

Bocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

Beavon, Rod, Structure and Bonding and the Periodic Table. Surrey: Thomas Nelson & Sons, 2000.

Jarvis, Alan, Principles of Physical and Organic Chemistry. Surrey: Thomas Nelson & Sons, 2000.

Chapman, Brian, Organic Pathways: Synthesis and Analysis. Surrey: Thomas Nelson & Sons, 2000.

Beavon, Rod and Jarvis, Alan, Physical and Inorganic Chemistry: Applications. Surrey: Thomas Nelson & Sons, 2000.

Course Outline

Module Title	# Double Periods	Module Title	# Double Periods
A. Organic Chemistry - classification - functional groups - alcohols and carboxylic acids - polymers	10	**B. Water** - Lewis structures - chemical equations - types of reactions - rates of reactions	8
C. Acids Bases and Salts - properties - theories - strong and weak acids , bases - neutralization - applications	15	**D. Oxidation Reduction and Electrochemistry** -processes -oxidation numbers -redox equations -electrolytic and voltaic cells -Faraday's Laws	12
E. Thermochemistry - heat of reaction and enthalpy - energy levels - Hess' Law	15	**F. Reaction Rates and Chemical Equilibrium** - factors affecting rates - collision theory - Le Chatelier's Principle	15

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check one: S1 ☐ S2 ☐ S3 ☐ S4 ☒

Chemistry II

GOALS		SUBGOALS		A	B	C	D	E	F
				MODULE & CURRICULUM CORRELATION MATRIX					
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity	x	x	x	x	x	x
		1.2	Connections			x	x	x	
		1.3	Health		x	x	x		x
		1.4	Inter-relationship/Mathematics Science Technology	x	x	x	x	x	x
		1.5	Problem Solving	x	x	x	x		x
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis	x	x	x	x	x	x
		2.2	Design	x	x	x	x	x	x
		2.3	Data Collection	x	x	x	x	x	x
		2.4	Technology Use	x	x	x	x	x	x
		2.5	Explanations/limitation	x	x	x	x	x	x
		2.6	Explanations/alternatives				x		
		2.7	Communications/Results				x		
		2.8	Research	x	x	x	x	x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science						
		3.2	Value, Environment		x				
		3.3	Ethical, Applications						
		3.4	Career Options	x	x	x	x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship						
		4.2	Environmental Applications	x	x	x	x	x	
CONTENT STRUCTURE			Change	x	x	x	x	x	x
			Cause & Effect	x	x	x	x	x	x
			Systems	x	x	x	x	x	x
			Life Science						
			Physical Science	x		x	x	x	x
			Earth and Space Science						
			MODULE	**A**	**B**	**C**	**D**	**E**	**F**

MODULE KEY

A - Organic Chemistry
B - Water
C Acids Bases and Salts
D - Oxidation Reduction and Electrochemistry
E - Thermochemistry
F - Reaction Rates and Chemical Equilibrium

SCIENCE

Course Title: CHEMISTRY II

Module Title: Organic Chemistry

Number of Periods: 10 double periods

Sequence Reference: SC4102CHM-A

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.1 – 2.5, 2.8 Scientific Inquiry
- 3.4 Positive Attitudes
- 4.2 Advocate for the Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- distinguish between aliphatic and aromatic hydrocarbons; chain and cyclic hydrocarbons
- differentiate between the functional groups of substituted hydrocarbons, organic oxygen and nitrogen, halogens
- explore reactions of alcohols and carboxylic acids
- describe polymerization reactions

Content Detail:

- classification of hydrocarbons: aliphatic, aromatic hydrocarbons and cycloalkanes
- hydrocarbon derivatives:
  - halogen derivatives
  - alcohols: names, formulas, trends with increasing C-atoms, oxidation, formation of ethanol by fermentation
  - carboxylic acids: esterification
- polymerization: addition and condensation polymers

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews
- **Product Assessments:**
  - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios etc
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- resource centre (laser discs, videos, software, etc.)
- site visits/ guest speakers: Esso and Shell staff, Environmental Health Officer, BELCO environmental officer
- websites:
  http://herzberg.ca.sandia.gov/cgi-bin/carlbrowser.tcl
  http://www.polymers.com
  http://www.chem.vt.edu/chem-ed/org-home.html
  http://gpu.srv.ualberta.ca/~psgarbi/psgarbi.html
  http://www.vuw.ac.nz/non-local/chemis
  http://www.chem.unsw.edu.au/highschool/teachers.html
  http://www.schoolnet.ca/math/sci
  http://www.pacificnet.net/~mandel/
  http://www.freeserve.net/education/examinerevision/gcse/science/sgtopics.html

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS ACTIVITIES & PROJECTS

REFERENCES - TEACHER:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw-Hill, 2000.

Timberlake, Karen, Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

Bocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

Beavon, Rod, Structure and Bonding and the Periodic Table. Surrey: Thomas Nelson & Sons, 2000.

Chapman, Brian, Organic Pathways: Synthesis and Analysis. Surrey: Thomas Nelson & Sons, 2000.

Jarvis, Alan, Principles of Physical and Organic Chemistry. Surrey: Thomas Nelson & Sons, 2000.

REFERENCES - STUDENT:

Wistrom, Cheryl. Phillips, J. and Stozak, V. Chemistry: Concepts and Applications. New York: Glencoe McGraw - Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw -Hill, 2000.

Bocci, Salvatori and Viehland, Claudia, Holt Chemistry : Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

CHEMISTRY

Course Title: CHEMISTRY II	**Sequence Reference:** SC4102CHM-B
Module Title: Water	
Number of Periods: 8 double periods	

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1, 1.3 - 1.5 Nature and History of Science
- 2.1 - 2.5, 2.8 Scientific Inquiry
- 3.2, 3.4 Positive Attitudes
- 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- illustrate the physical properties of water
- relate the bonding of water to physical properties
- demonstrate the properties of water as a solvent
- investigate the hardness of water
- be aware of colligative properties of solutions
- illustrate the importance of water to life on earth

This module can be integrated with modules C & F

Content Detail:

- properties of water: density, states
- bonding and physical properties:
  - intermolecular - covalent bonding
  - intramolecular – hydrogen bonding, surface tension, capillary action, high specific heat, latent heat, heat of vaporization, fusion
- water as a solvent
  - polarity and hydrogen bonding ability
  - solubility charts and curves
  - concentrations and molarity
  - tests for ions in solutions
- hardness of water
- colligative properties: lowering vapour pressure, elevating boiling point, depressing freezing point, osmotic pressure
- importance of water

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews
- **Product Assessments:**
  - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios etc
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- DOE Resource Centre -laser discs, videos, software
- site visits/guest speakers: scientists, jeweler, engineer, hydrologist, oceanographer, BBSR labs, Government reverse osmosis plants, Watlington Water Works
- curricular connections: physics, biology, marine science
- websites : see previous chemistry modules

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS

- investigate the physical properties of water
- investigate the use of water as a biological molecule
- carry out chemical tests to identify cations and anions in solution

REFERENCES - TEACHER:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack. Merrill Chemistry. New York: Glencoe McGraw-Hill, 2000.

Bethel, George. Coordinated Science Teacher's Guides. (Chemistry) Oxford: Oxford University Press, 1999.

Gallager RoseMarie et al. Coordinated Science: Chemistry. Oxford: Oxford University Press, 1999.

Timberlake, Karen, Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

Bocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter New York: Holt, Rinehart and Winston, 2000.

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Jarvis, Alan, Principles of Physical and Organic Chemistry. Surrey: Thomas Nelson & Sons, 2000.

REFERENCES - STUDENT:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw -Hill, 2000.

Gallager, RoseMarie, et al. Coordinated Science: Chemistry. Oxford: Oxford University Press, 1999.

Bocci, Salvatori and Viehland, Claudia, Holt Chemistry. Visualizing Matter New York: Holt, Rinehart and Winston, 2000.

SCIENCE

Course Title: CHEMISTRY II

Module Title: Acids Bases and Salts

Number of Periods: 15 double periods

Sequence Reference: SC4102CHM-C

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1 – 1.5 Nature and History of Science
- 2.1 – 2.5, 2.8 Scientific Inquiry
- 3.4 Positive Attitudes
- 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- explore the properties of acids and bases
- distinguish between the Arrhenius and Bronsted-Lowry theories of acids and bases
- be aware of the Lewis theory of acids and bases
- identify acids, bases, conjugate acids and conjugate bases in reactions
- relate the properties of strong and weak acids to their degree of ionization
- investigate neutralization reactions
- illustrate the applications of acid - base chemistry

Content Detail:

- properties : taste & feel; pH, reactions with metals and carbonates etc
- theories of acids and bases:
  - Arrhenius – acid H^+ ; base OH^-
  - Bronsted - Lowry: proton donors, proton acceptors , conjugate bases, conjugate acids
- Lewis theory: donating and accepting electron pair
- identifying acids and bases etc; naming binary and ternary acids and bases; anhydrides etc.
- strong and weak acids & bases: degree of ionization strength vs. concentration; differences in behaviour, weak acid & base equilibrium; K_a,K_b, ionization of water, pH
- neutralization: formation of salts; naming of salts; ionic equations, titrations, hydrolysis
- applications: buffers, acid rain

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews
- **Product Assessments:**
  - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios etc
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- site visits/ guest speakers; BBSR , Bermuda College Environmental Health laboratories, environmental offices - Ministry of Health and BELCO
- curricular connections: mathematics
- websites: http:quanta.phy.ohiou.edu/./othersites.html
- ftp://ftp.ncsa.uiuc.edu/education/chemviz/
  http://rampages.onrmp.net/~jaldr
  http://hackenberry.chem.niu.edu:70/0/cheminf.html

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw-Hill, 2000.

Timberlake, Karen, Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

Bocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter New York: Holt, Rinehart and Winston, 2000.

Beavon, Rod, Structure and Bonding and the Periodic Table. Surrey: Thomas Nelson & Sons, 2000.

Jarvis, Alan, Principles of Physical and Organic Chemistry. Surrey: Thomas Nelson & Sons, 2000.

Chapman, Brian, Organic Pathways: Synthesis and Analysis. Surrey: Thomas Nelson & Sons, 2000.

Beavon, Rod and Jarvis, Alan, Physical and Inorganic Chemistry: Applications. Surrey: Thomas Nelson & Sons, 2000

REFERENCES - STUDENT:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw-Hill, 2000.

Bocci, Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

SCIENCE

Course Title: CHEMISTRY II

Sequence Reference: SC4102CHM-D

Module Title: Oxidation -Reduction and Electrochemisty

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Number of Periods: 12 double periods

Subgoal Emphasis:

- 1.1 – 1.5 Nature and History of Science
- 2.1 –2.8 Scientific Inquiry
- 3.4 Positive Attitudes
- 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- analyze the processes of oxidation and reduction
- assign oxidation numbers to atoms
- identify oxidizing and reducing agents in redox reactions
- balance redox equations
- investigate applications of oxidation – reduction reactions
- differentiate between electrolytic and voltaic cells
- explain processes occurring when electrical current is passed through an electrolyte
- predict identity of substances liberated during electrolysis
- use Faraday's laws to calculate the amounts of substances forming during electrolysis
- describe electrode reactions in electrolytic industrial processes

Content Detail:

- oxidation and reduction: electron loss, electron gain
- reducing and oxidizing agents
- oxidation numbers: definition, oxidation number rules
- redox reactions:
  - half reactions
- balancing equations
- applications: photography, Blast Furnace, bleaching, breathalyzer, lightning, corrosion etc.
- cells: electrolytic and voltaic, standard electrode potential, redox series, batteries and fuel cells, salt bridge
- movement of anions and cations in electrolytic cells
- products of electrolysis: factors affecting(state, position in redox series, concentration)
- Faradays laws: quantity of charge; mass or volume of substances liberated
- industrial processes: aluminium extraction,
- electrolytic purification of copper, electrolysis of brine, anodizing of aluminium

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews
- **Product Assessments:**
  - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios etc
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
  - using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- Resource Centre (laser discs, videos, software, etc.)
- site visits/ guest speakers: BELCO, electroplating businesses(bikes etc) photography labs, police (breathalyzer),
- curricular connections: physics, mathematics, design technology
- websites: http://www.ch.ic.ac.uk/gic/ http://www.chem.duke.edu/~elcooper/

GLOSSARY:

- refer to text

LABORATORYINVESTIGATIONS, ACTIVITIES & PROJECTS:

- research the contributions of Lavoisier, Faraday
- investigate the medical data that supports the need for antioxidants in the diet

REFERENCES -TEACHER:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw - Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw -Hill, 2000.

Timberlake, Karen, Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

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REFERENCES - STUDENT:

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Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw -Hill, 2000.

Bocci, Salvatori and Viehland, Claudia, Holt Chemistry Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

SCIENCE

Course Title: CHEMISTRY II

Sequence Reference: SC4102CHM-E

Module Title: Thermodynamics

Number of Periods: 15 double periods

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1, 1.2,1.4 Nature and History of Science
- 2.1 – 2.5, 2.8 Scientific Inquiry

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- calculate the amount of heat energy released or absorbed during reactions
- explain the relationship between heat of reaction and enthalpy change
- interpret energy diagrams
- explain relationship between activation energy and chemical change
- use Hess' law to solve problem

Content Detail:

- endothermic & exothermic reactions
- specific heat capacity, measuring heats of reaction
- enthalpy concept and determinations
- reaction pathways
- activation energy
- entropy and energy changes
- Hess' Law

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews
- **Product Assessments:**
  - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios etc
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- DOE Resource Centre (laser discs, videos, software)
- site visits/guest speakers: BELCO, Tynes Bay Incinerator, BBSR labs, Bermuda College
- curricular connections: physics, mathematics
- websites: see previous chemistry modules

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw-Hill, 2000.

Timberlake, Karen, Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

Bocci, Salvatori and Viehland, Claudia Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

Beavon, Rod, Structure and Bonding and the Periodic Table. Surrey: Thomas Nelson & Sons, 2000.

Jarvis, Alan, Principles of Physical and Organic Chemistry. Surrey: Thomas Nelson & Sons, 2000.

Chapman, Brian, Organic Pathways: Synthesis and Analysis. Surrey: Thomas Nelson & Sons, 2000

Beavon, Rod and Jarvis, Alan, Physical and Inorganic Chemistry: Applications. Surrey: Thomas Nelson & Sons, 2000.

REFERENCES - STUDENT:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry : New York: Glencoe McGraw-Hill, 2000.

Bocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

SCIENCE

Course Title: CHEMISTRY II	**Sequence Reference:** SC4102CHM-F
Module Title: Reaction Rates and Chemical Equilibrium	**Senior School Level**
Number of Periods: 15 double periods	S1 ☐ S2 ☐ S3 ☐ S4 ☒

Subgoal Emphasis:	**Content Focus**
• 1.1, 1.4, 1.5 Nature and History of Science • 2.1 – 2.5, 2.8 Scientific Inquiry • 3.4 Positive Attitudes	• Change • Cause and Effect • Systems • Physical Science

Curriculum Objectives:

At the end of this module, students will:

- list and describe the factors that influence the rate of reaction
- calculate the rate of reaction in terms
- discussion how collision theory explains reaction rates
- use Le Chatelier's principle to explain effects of changes in temperature, pressure concentration on equilibrium system
- calculate equilibrium constants

Content Detail:

- terms: reaction rate, stability of compounds, completion and reversible reactions, dynamic equilibrium, homogeneous and heterogeneous systems
- collision theory
- effects of temperature, concentration, particle size, nature of the reactants, catalysts, activation energy
- Le Chatelier's principle
- Applications - Haber process
- equilibrium constants

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews
- **Product Assessments:**
  - chapter assignments, short quizzes, reports, data analysis, posters/collages, models, games, portfolios etc
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- DOE Resource Centre (laser discs, videos, software)
- site visits/ guest speakers: engineers
- curricular connections: mathematics
- websites : see previous chemistry modules

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw-Hill, 2000.

Timberlake, Karen, Chemistry: An Introduction to General, Organic and Biological Chemistry. New York: Harper Collins Publishers, 1999.

Bocci, Salvatori and Viehland, Claudia Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

Beavon, Rod, Structure and Bonding and the Periodic Table. Surrey: Thomas Nelson & Sons, 2000.

Jarvis, Alan, Principles of Physical and Organic Chemistry. Surrey: Thomas Nelson & Sons, 2000.

Chapman, Brian, Organic Pathways: Synthesis and Analysis. Surrey: Thomas Nelson & Sons, 2000

Beavon, Rod and Jarvis, Alan, Physical and Inorganic Chemistry: Applications. Surrey: Thomas Nelson & Sons, 2000.

REFERENCES - STUDENT:

Wistrom, Cheryl. Phillips, J. and Stozak,V. Chemistry: Concepts and Applications. New York: Glencoe McGraw-Hill, 2000.

Smoot, Robert, Smith, Richard and Price, Jack, Merrill Chemistry. New York: Glencoe McGraw-Hill, 2000.

Bocci, Salvatori and Viehland, Claudia, Holt Chemistry: Visualizing Matter. New York: Holt, Rinehart and Winston, 2000.

Earth Science

Course Code: SC3120EAR

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Earth Science — **4 credit (s)**, **120 hour (s)**

Prerequisite (s): Science I — **S2-S3 level (s)**

Course Code: SC3120EAR — **☐ required or ☒ elective**

Course Description

This introductory course will provide students with the opportunity to study the dynamic nature of the earth and the universe. Students will investigate the processes that shape Bermuda's landscape, earth's structures and oceans. Laboratory investigations and fieldwork are an essential part of this course.

Course Requirements

The requirements for each module of this course are as follows:

Performance Assessments: - laboratory investigations/activities, - laboratory skills tests, observations, debates, discussions, interviews - rubrics are provided scoring	**20%**
Product Assessments: - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios, etc. This assessment can be class-work or homework - rubrics are provided for scoring	**20%**
Written Assessments: Written tests should be based on content stated in modules. The weighting for each module test is shown in the course outline. Written tests should consist of a variety of assessment components including: • multiple choice (not greater than 20 % of the test total) • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions	**20%**
Field Study	**10%**
Final Assessment:	**30%**
Total	**100%**

Course Resources

Feather R. and Synder S. Earth Science. Ohio: Glencoe McGraw Hill, 1999.

Mahon et al. Exploring Earth Science New York: Prentice Hall, 1995.

Padilla M.J., Miaoulis I., and Cyr M. Science Explorer Series. Astronomy, Weather and Climate. California: Prentice Hall, 1999.

Rowe, Mark, An Explanation of the Geology of Bermuda. Hamilton: Bermuda Government, 1998.

Vacher, H.L. Ground Water Hydrology of Bermuda. Hamilton: Bermuda Government, 1974.

Course Outline

Module Title	# Double Periods	Module Title	# Double Periods
A. Astronomy	10	**B. Geology**	30
- tools and instruments		- rock	
- objects in the universe		- minerals	
- stars and galaxies		- plate tectonics and continental drift	
		- earth's history	
C. Meteorology	15	**D. Oceanography**	10
- the atmosphere		- oceans and global ecosystem	
- winds		- the ocean floor	
- weather and climate		- humans and the ocean	
		- composition and characteristics of seawater	
E. Resources	10		
- energy resources			
- earth's non living resources			
- resource extraction			

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check: S1 ☐ S2 ☐ S3 ☒ S4 ☐

Earth Science

GOALS		SUBGOALS		MODULE & CURRICULUM CORRELATION MATRIX				
1	Conceptualizing the History and Nature of Science	1.1	Contributions/Diversity	x	x	x	x	x
		1.2	Connections	x	x	x	x	x
		1.3	Health					
		1.4	Interrelationship/ Mathematics Science Technology	x	x	x	x	x
		1.5	Problem Solving	x	x	x	x	x
2	Demonstrating the Nature of Scientific Inquiry	2.1	Hypothesis	x	x	x	x	x
		2.2	Design	x	x	x	x	x
		2.3	Data Collection	x	x	x	x	x
		2.4	Technology Use	x	x	x	x	x
		2.5	Explanations/limitation	x	x	x	x	x
		2.6	Explanations/alternatives	x	x		x	x
		2.7	Communications/Results	x	x		x	x
		2.8	Research	x	x		x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present Use of Science		x			
		3.2	Value, Environment	x	x	x	x	x
		3.3	Ethical, Applications	x	x	x	x	x
		3.4	Career Options	x	x	x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship	x	x	x	x	x
		4.2	Environmental Applications	x	x	x	x	x
CONTENT STRUCTURE		Change		x	x	x		
		Cause and Effect		x	x	x		
		System		x	x	x		
		Life Science						
		Physical Science						
		Earth and Space Science		x	x	x	x	x
		MODULES		**A**	**B**	**C**	**D**	**E**

MODULE KEY

A - Astronomy
B - Geology
C - Meteorology
D - Oceanography
E - Resources

SCIENCE

Course Title: EARTH SCIENCE	**Sequence Reference:** SC3120EAR-A
Module Title: Astronomy	
Number of Periods: 10 double periods	

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.4, 1.5 Nature and History of Science
- 2.1-2.8 Scientific Inquiry
- 3.2-3.4 Positive Attitudes
- 4.1, 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- compare tools and instruments used in astronomy
- describe methods used to determine characteristics and motion of objects in the universe
- identify and compare components of the universe
- compare life cycles of our sun and other stars
- evaluate a theory of the origin of the universe
- describe uses of and advances in space technologies

Content Detail:

- telescopes, spectroscopes, etc.
- spectra, Doppler effect
- galaxies, quasars
- physical and compositional changes of high and low mass stars
- Big Bang theory etc.
- satellites (GPS etc.), space probes, space stations

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports, portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- school information center: newspapers, magazines, books, the Internet
- Department of Education Resource Center: videos, laser discs
- cross curricular connections: geography, physics, design and technology, information technology, chemistry, social studies and language arts
- site visits/speakers: Marine and Ports (ships), pilots (aircraft, boat), international sailors, Bermuda Astronomical Society members
- websites: www.science-explorer.phschool.com

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

WEB SITES:

http://tommy.jsc.nasa.gov/~woodfill/SPACEED/SEHHTML/she.html
http://seds.lpl.arizona.edu/billa/tnp/nineplanets.html
http://bang.lanl.gov/solarsys
hyttp://web.cnam.fr/astro.english.html
http://spacelink.msfc.nasa.gov

REFERENCES - TEACHER:

Feather R. and Synder S. Earth Science. Ohio: Glencoe McGraw Hill, 1999. (teacher annotated)

Mahon et al. Exploring Earth Science (teacher annotated) New York: Prentice Hall, 1995.

Padilla M.J., Miaoulis I., and Cyr M. Science Explorer Series. Astronomy, Weather and Climate. California: Prentice Hall, 1999. (teacher annotated)

Rowe, Mark, An Explanation of the Geology of Bermuda. Hamilton: Bermuda Government, 1998.

Vacher, H.L. Ground Water Hydrology of Bermuda. Hamilton: Bermuda Government, 1974.

REFERENCES - STUDENT:

Feather R. and Synder S. Earth Science. Ohio: Glencoe McGraw Hill, 1999.

Mahon et al. Exploring Earth Science . New York: Prentice Hall, 1995.

Padilla M.J., Miaoulis I., and Cyr M. Science Explorer Series. Astronomy, Weather and Climate. California: Prentice Hall, 1999.

SCIENCE

Course Title: EARTH SCIENCE	**Sequence Reference:** SC3120EAR-B
Module Title: Geology	**Senior School Level**
Number of Periods: 30 double periods	S1 ☐ S2 ☐ S3 ☒ S4 ☐

Subgoal Emphasis:

- 1.1, 1.2, 1.4, 1.5 Nature and History of Science
- 2.1-2.8 Scientific Inquiry
- 3.1-3.4 Positive Attitudes
- 4.1, 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- describe the composition and internal structure of the earth
- classify minerals based on structure, formation and chemical function
- explain uses of minerals
- classify rocks based on structure, formation and chemical composition
- relate weathering of rocks to soil formation
- distinguish between erosional and depositional features formed by different methods
- examine evidence for continental draft and plate tectonic theories
- use plate tectonic theory to explain earthquakes, volcanic eruptions and mountain formation
- outline how geologic evidence is used to explain the progression of earth's history

Content Detail:

- earth's internal structure: seismic evidence, theories of internal structure, earth's core, mantle (location, temperature and pressure changes), crust (continental crust and oceanic crust)
- minerals: 5 characteristics, methods of formation, physical properties, identification methods (color luster, hardness, streak, cleavage and fracture, etc.)
- mineral uses: ores and gems
- rocks: igneous, sedentary, metamorphic, the rock cycle
- weathering and soil formation: mechanical and chemical weathering, factors that affect weathering, soil formation and structure
- methods: glaciers, running water, wave and wind action
- theories: continental drift and plate tectonics
- geophysical processes
- earth's history: relative and absolute time, radiometric dating, fossil formation, geologic time scale, explanations about origin and age of the Earth

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, posters/collages, reports, portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas (if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources (materials, equipment & community involvement):

- school information center: newspapers, magazines, books, the Internet
- Department of Education Resource Center: videos, laser discs
- cross curricular connections: geography
- site visits/speakers: Bermuda Aquarium, Maritime Museum, BUEI, Dept of Environment Geologists
- websites: www.science-explorer.phschool.com

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Feather R. and Synder S. Earth Science. Ohio: Glencoe McGraw Hill, 1999. (teacher annotated)

Mahon et al. Exploring Earth Science (teacher annotated) New York: Prentice Hall, 1995.

Padilla M.J., Miaoulis I., and Cyr M. Science Explorer Series. Astronomy, Weather and Climate. California: Prentice Hall, 1999. (teacher annotated)

Rowe, Mark, An Explanation of the Geology of Bermuda. Hamilton: Bermuda Government, 1998.

Vacher, H.L. Ground Water Hydrology of Bermuda. Hamilton: Bermuda Government, 1974.

REFERENCES - STUDENT:

Feather R. and Synder S. Earth Science. Ohio: Glencoe McGraw Hill, 1999.

Mahon et al. Exploring Earth Science . New York: Prentice Hall, 1995.

Padilla M.J., Miaoulis I., and Cyr M. Science Explorer Series. Astronomy, Weather and Climate. California: Prentice Hall, 1999.

SCIENCE

Course Title: EARTH SCIENCE

Module Title: Meteorology

Number of Periods: 15 double periods

Sequence Reference: SC3120EAR-C

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1-1.5 Nature and History of Science
- 2.1-2.5 Scientific Inquiry
- 3.2 -3.4 Positive Attitudes
- 4.1, 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- describe the composition and structure of the atmosphere
- analyze the effect of the sun's radiation on the atmosphere
- describe the impact of changes in the atmosphere
- describe global wind circulation patterns
- explain the impact of local conditions on wind patterns
- explain how transfer of energy affects weather and climate
- use atmospheric data to predict weather conditions

Content Detail:

- the atmosphere: layers, gases, atmospheric pressure, temperature in the atmospheric layers
- effect of sun on the atmosphere: conduction, convection and radiation, greenhouse effect, the water cycle
- changes in the atmosphere: ozone, water, greenhouse gases, pollutants, changes in composition over time
- winds: circulation patterns, Coriolis Effect, impact of local conditions, measurement
- energy transfer: evaporation, condensation, types of precipitation, cloud types, hurricanes, thunderstorms and tornadoes
- climate: contributing factors, climatic zones, climate change: seasons: El Nino, change theories, global warning vs. greenhouse effect
- weather: weather patterns, weather predictions, weather maps

Module Evaluation:

- **Performance Assessments:**
  - checklists/inventories, laboratory activities, teacher observation, interviews, debates

- **Product Assessments:**
  - data handling (statistics), surveys and reports, posters, models, poems and essays, portfolio assessment: journal, sample works

- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- school information center: newspapers, magazines, books, the Internet
- Department of Education Resource Center: videos, laser discs
- cross curricular connections: geography, chemistry, physics, information technology
- site visits/speakers: weather forecast, Bermuda Weather Service
- website : www.science-explorer.phschool.com

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

WEB SITES:
- http://www.intellicast.com/weather/usa
- www.globe.org
- http://www.intellicast.com/weather/intl/
- http://www.mobot.org/MBGnet/fresh/cycle/index.htm
- http://www.igsnet.com/
- http://cirrus.sprl.umich.edu/wxnet/
- http://www.accuweather.com
- http://www.webcrawler.com/select/wea.05.html

REFERENCES - TEACHER:
Feather R. and Synder S. Earth Science. Ohio: Glencoe McGraw Hill, 1999. (teacher annotated)

Mahon et al. Exploring Earth Science New York: Prentice Hall, 1995.

Padilla M.J., Miaoulis I., and Cyr M. Science Explorer Series. Astronomy, Weather and Climate. California: Prentice Hall, 1999. (teacher annotated)

Rowe, Mark, An Explanation of the Geology of Bermuda. Hamilton: Bermuda Government, 1998.

Vacher, H.L. Ground Water Hydrology of Bermuda. Hamilton: Bermuda Government, 1974.

REFERENCES - STUDENT:
Feather R. and Synder S. Earth Science. Ohio: Glencoe McGraw Hill, 1999.

Mahon et al. Exploring Earth Science New York: Prentice Hall, 1995.

Padilla M.J., Miaoulis I., and Cyr M. Science Explorer Series. Astronomy, Weather and Climate. California: Prentice Hall, 1999.

SCIENCE

Course Title: EARTH SCIENCE

Module Title: Oceanography

Number of Periods: 10 double periods

Sequence Reference: EAR3120SC-D

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.4, 1.5 Nature and History of Science
- 2.1-.8 Scientific Inquiry
- 3.2, 3.3 Positive Attitudes
- 4.1, 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- explain the role of oceans in the global ecosystem
- compare sizes and depths of the earth's major oceans
- describe the major features of the ocean floors of the Atlantic and Pacific Oceans
- describe the composition and characteristics of seawater
- identify the motions of the oceans and their effects
- analyze the impact of human activities on oceans

Content Detail:

- oceans in the global ecosystem: water cycle and weather systems; food and resources; pollution
- earth's major oceans: Atlantic, Pacific, Indian
- typical ocean floor: rift, seamounts, midocean ridge, abyssal, continental margins: technologies used for studying ocean floor
- seawater: origin, dissolved salts and temperature zones
- ocean motion: waves, currents and tides
- humans and the ocean: exploration, migration, transportation, desalination and mining, tidal energy

Module Evaluation:

- **Performance Assessments:**
  - checklists/inventories, laboratory activities, teacher observation, interviews, debates
- **Product Assessments:**
  - data handling (statistics), surveys and reports, posters, models, poems and essays, portfolio assessment: personal journal, sample works
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- school information center: newspapers, magazines, books, the Internet
- Department of Education Resource Center: videos, laser discs
- cross curricular connections: geography, biology, physics, chemistry
- site visits/speakers: Bermuda Biological Station, Bermuda Underwater Exploration Institute, Bermuda Aquarium, Museum and Zoo, Bermuda Weather Bureau, local and international pilots
- Internet: www.science-explorer.phschool.com

GLOSSARY:

- refer to text
- laboratory investigations/other performance rated activities

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Feather R. and Synder S. Earth Science. Ohio: Glencoe McGraw Hill, 1999. (teacher annotated)

Mahon et al. Exploring Earth Science New York: Prentice Hall, 1995. (teacher annotated)

Padilla M.J., Miaoulis I., and Cyr M. Science Explorer Series. Astronomy, Weather and Climate. California: Prentice Hall, 1999. (teacher annotated)

Rowe, Mark, An Explanation o the Geology of Bermuda. Hamilton: Bermuda Government, 1998.

Vacher, H.L. Ground Water Hydrology of Bermuda. Hamilton: Bermuda Government, 1974.

REFERENCES - STUDENT:

Feather R. and Synder S. Earth Science. Ohio: Glencoe McGraw Hill, 1999.

Mahon et al. Exploring Earth Science New York: Prentice Hall, 1995.

Padilla M.J., Miaoulis I., and Cyr M. Science Explorer Series. Astronomy, Weather and Climate. California: Prentice Hall, 1999.

SCIENCE

Course Title: EARTH SCIENCE	**Sequence Reference:** SC3120EAR-E
Module Title: Resources	
Number of Periods: 10 double periods	

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.4, 1.5 Nature and History of Science
- 2.1-2. Scientific Inquiry
- 3.2 -3.4 Positive Attitudes
- 4.1, 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- analyze the importance of the energy resources on the earth
- analyze the importance of the earth's non living resources
- describe the extraction and refining of a resource
- analyze the impact of man's decisions on local and global resources

Content Detail:

- resources - renewable and non renewable: fossil fuels, solar energy, wind and water, nuclear energy
- non living resources: land and soil, minerals
- resource extraction: metal, non metal or fossil fuel
- environmental protection and resource management: local: Bermuda as an oceanic island, isolation, space, recycling

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written etc.)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- school information center: newspapers, magazines, books, the Internet
- Department of Education Resource Center: videos, laser discs
- cross curricular connections: geography, biology, chemistry
- site visits/speakers: Bermuda National Trust, Works and Engineering, Recycling Centre, Tynes Bay, Composing Centre
- website: www.science-explorer.phschool.com

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Feather R. and Synder S. Earth Science. Ohio: Glencoe McGraw Hill, 1999. (teacher annotated)

Mahon et al. Exploring Earth Science . New York: Prentice Hall, 1995.

Padilla M.J., Miaoulis I., and Cyr M. Science Explorer Series. Astronomy, Weather and Climate. California: Prentice Hall, 1999. (teacher annotated)

Rowe, Mark, An Explanation of the Geology of Bermuda. Hamilton: Bermuda Government, 1998.

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REFERENCES - STUDENT:

Feather R. and Synder S. Earth Science. Ohio: Glencoe McGraw Hill, 1999.

Mahon et al. Exploring Earth Science New York: Prentice Hall, 1995.

Padilla M.J., Miaoulis I., and Cyr M. Science Explorer Series. Astronomy, Weather and Climate. California: Prentice Hall, 1999.

Environmental Science I

Course Code: SC3131ENV

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Environmental Science I — **4 credit (s)**, **120 hour (s)**

Prerequisite (s): Science II — **S3 level (s)**

Course Code: SC3131ENV — ☐ **required or** ☒ **elective**

Course Description

Environmental science is the study of the interrelationships of organisms and their environment. This course extends student understandings about the environment that were studied during senior school foundation science courses. Some of the areas covered include methods of environmental science, how ecosystems work, various biomes and the impact of people on the environment. Particular reference will be made to issues of importance to Bermuda. Fieldwork and laboratory are essential components of this course.

Course Requirements

The requirements for this course are as follows:

Performance Assessments: - laboratory investigations/activities - laboratory skills tests, teacher observations, debates, discussions, interviews - rubrics are provided for scoring	**30%**
Product Assessments: **Project/Field Study** **10%** - chapter assignments, short quizzes, reports, data analysis, posters/collages, models, games, portfolios, etc. **10%** - rubrics are provided for scoring	**20%**
Written Assessments: Written tests should be based on content cited in modules. The weighting for each module test is shown in the course outline. Written tests should consist of a variety of assessment components including: • multiple choice questions (not greater than 20 % of the test total) • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions	**20%**
Final Assessment:	**30%**
Total:	**100%**

Course Resources

Bernstein L., Winkler A. and Zierdt-Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Weslley, 1996.

Environmental Science. New York: Holt, Rinehard and Winston 1997.

Cord Applications in Biology/Chemistry. Natural Resources. Texas: Cord Communications, 1997.

Cord Applications in Biology/Chemistry. Waste and Waste Management. Texas: Cord Communications, 1997.

Course Outline

Module Title	# Double Periods
A. Introduction to Environmental Science	10
- methods of environmental science	
- earth and the solar system	
- layers of the atmosphere	
- climate (greenhouse effect and ozone layer depletion)	
- biosphere	
B. Ecosystems	25
- changes	
- needs of organisms	
- matter and energy in ecosystems	
- how ecosystems work	
C. Biomes	25
- desert and tundra	
- marine	
- forests	
- grasslands	
- freshwater	
D. Impact of People	15
- human societies	
- population growth	
- food supply	

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check one: S1 ☐ S2 ☐ S3 ☒ S4 ☐

Environmental Science I

	GOALS		SUBGOALS	MODULE & CURRICULUM CORRELATION MATRIX			
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity	x	x	x	x
		1.2	Connections	x	x	x	x
		1.3	Health	x			x
		1.4	Inter-relationship/Mathematics Science Technology	x	x		
		1.5	Problem Solving	x	x		x
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis	x	x	x	x
		2.2	Design	x	x	x	x
		2.3	Data Collection	x	x	x	x
		2.4	Technology Use	x	x	x	x
		2.5	Explanations/limitation	x	x	x	x
		2.6	Explanations/alternatives	x	x	x	x
		2.7	Communications/Results	x	x	x	x
		2.8	Research	x	x	x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science	x	x	x	x
		3.2	Value, Environment	x	x		x
		3.3	Ethical, Applications	x	x		x
		3.4	Career options	x	x		x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship	x	x	x	x
		4.2	Environmental Applications	x	x	x	x
CONTENT STRUCTURE		Change		x	x	x	x
		Cause & Effect		x	x	x	x
		Systems		x	x	x	x
		Life Science			x	x	x
		Physical Science		x			
		Earth and Space Science			x	x	x
		MODULE		**A**	**B**	**C**	**D**

MODULE KEY

A - Introduction to Environmental Science

B - Ecosystems

C - Biomes

D - Impact of People

SCIENCE

Course Title: ENVIRONMENTAL SCIENCE I	**Sequence Reference:** SC3131EN-A
Module Title: Introduction to Environmental Science	**Senior School Level**
Number of Periods: 10 double periods	S1 ☐ S2 ☐ S3 ☒ S4 ☐

Subgoal Emphasis:		**Content Focus**
• 1.1,1.2, 1.4, 1.5	Nature and History of Science	• Change
• 2.4 - 2.8	Science Inquiry	• Cause and Effect
• 3.1 - 3.4	Positive Attitudes	• Systems
• 4.1	Advocate for the Environment	• Physical Science

Curriculum Objectives:

At the end of this module, students will:

- describe the steps involved in conducting a scientific experiment by using the scientific method in order to solve environmental problems
- describe how parts of the environment interact
- locate earth in a diagram of the solar system
- diagram the layers of the atmosphere and explain the characteristics of each layer
- identify and describe four components of geosphere
- explain why the earth and its atmosphere are like a greenhouse
- explain why carbon dioxide levels in the atmosphere are rising
- explain how the ozone layer shields the earth from much of the sun's harmful radiation
- describe the damaging effects of excessive ultraviolet light
- illustrate how organisms interact with the biosphere

Content Detail:

- earth in the solar system
  - layers of the atmosphere
  - lithosphere
  - hydrosphere
  - atmosphere
  - troposphere
  - stratosphere
- ozone layer
- mesosphere
- thermosphere
- organisms and the biosphere

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- libraries: school, DOE resource centre (print materials, laser discs, videos, software, etc.), BBSR, BAMZ
- site visits/guests speakers: meteorologist, Bermuda Weather Service, Bermuda Shorelines (for lithosphere, hydrosphere, atmosphere interface)
- websites:
  www.mo.org – World Meteorologist organization
  www.scrilib.usod.edu/sio/Scripps Institution of oceanography library
  http://www.digmark.net/iatech/unesco/biofaw.htm

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Bernstein L., Winkler A. and Zierdt-Warshaw, L. Environmental Science: Ecology and Human Impact. (annotated teachers edition) New York. Addison-Wesley, 1998.

Environmental Science. New York: Holt, Rinehard and Winston, 1998.

Cord Applications in Biology/Chemistry. Community of Life. Texas: Cord Communications, 1997.

REFERENCES - STUDENT:

Bernstein L., Winkler A. and Zierdt-Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Wesley, 1998.

Environmental Science. New York: Holt, Rinehard and Winston, 1998.

Cord Applications in Biology/Chemistry. Community of Life. Texas: Cord Communications, 1997.

SCIENCE

Course Title: ENVIRONMENTAL SCIENCE I

Sequence Reference: SC3131EN-B

Module Title: Ecosystems

Number of Periods: 25 double periods

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2 - 1.3 - 1.5 History and Nature of Science
- 2.1 - 2.8 Scientific Enquiry
- 3.1 - 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- describe ways in which the three layers of the biosphere have changed over time
- predict how changes in the environment might affect organisms
- describe the structure of an ecosystem
- relate the concept of habitat destruction to the loss of biodiversity
- identify the roles of producers, consumers and decomposers
- describe the concept of the tropic level
- describe food chains and food webs
- examine the effects of ecosystem structure on population size and pollution
- investigate the movement of energy through an ecosystem
- explain the relationship of a ecological pyramid to energy in an ecosystem
- explain the water, nitrogen and carbon cycles
- examine how interactions between a species and its environment define the species' niche
- explain the relationship between the population sizes of predator and prey
- evaluate the effects of symbiotic relationships on populations
- explain the process of primary and secondary succession

Content Detail:

- roles of herbivores, carnivores, omnivores, decomposers
- energy transfer through food chains and food webs
- water, carbon, nitrogen circles
- abiotic and biotic factors
- terms
  - adaptation, commensalism, community, ecosystem, habitat, host, mutualism, niche, parasitism. population, predation, predator, prey species.
- natural selection
- co-evolution (text p.46) example

Module Evaluation:

- **Performance Assessments:** models of water cycle; investigation (text p.74), concept mapping
  - laboratory investigations, activities, laboratory skills, debates, discussions, interviews
- **Product Assessments:**
  - create a wildlife garden (text p.42); field activity (text p.60); chapter assignments, reports, data - analysis, posters/ collages, models, games, portfolios etc.
- **Written Assessments:**
  - quizzes/tests/assignments

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- school and other libraries
- site visits: pond, marsh, shoreline, Walsingham
- CORD Video: Community of Life: forest ecosystems, salt water ecosystems, changes in ecosystem
- Websites : see module A

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Bernstein L., Winkler A. and Zierdt-Warshaw, L. Environmental Science: Ecology and Human Impact. (annotated teachers edition) New York. Addison-Wesley, 1998.

Environmental Science. New York: Holt, Rinehard and Winston, 1998.

Cord Applications in Biology/Chemistry. Community of Life. Texas: Cord Communications, 1997.

REFERENCES - STUDENT:

Bernstein L., Winkler A. and Zierdt-Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Wesley, 1998.

Environmental Science. New York: Holt, Rinehard and Winston, 1998.

Cord Applications in Biology/Chemistry. Community of Life. Texas: Cord Communications, 1997.

SCIENCE

Course Title: ENVIRONMENTAL SCIENCE I

Sequence Reference: SC3131ENV-C

Module Title: Biomes

Number of Periods: 25 double periods

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2 History and Nature of Science
- 2.1 - 2.5 Nature of Science Inquiry
- 3.1 Positive Attitude
- 4.1, 4.2 Advocate for Environment

Content Focus:

- Change
- Cause and Effect
- Systems
- Earth Science
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- identify the earth's major biomes
- describe the physical, climate and biological features of the major biomes
- explain how the adaptation of plants and animals in each ecosystem help them to survive

Content Detail:

- biomes
  - definition, locations
- desert and tundra (climate & organisms)
  - grasslands, steppes, prairies, savannas
- forest biomes
  - coniferous forest, deciduous, rainforest (including structure and biodiversity)
- fresh water biomes
  - aquatic, standing and flowing water
- marine biomes
  - oceans, nerilic zone (coral reef etc.), intertidal zone (marshes and swamps)

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations(p. 116), activities, laboratory skills tests, observations, debates, discussions, interviews
  - field activity (p. 95)
- **Product Assessments:**
  - chapter assignments reports, data analysis, posters/collages, models, games, portfolios (p.115)
- **Written Assessments:**
  - quizzes/tests/assignments

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- libraries: school, BBSR, BAMZ, DOE resource centre (print materials, laser discs, videos, software, etc.)
- site visits/guests speakers: meteorologists, Bermuda Weather Service, Bermuda Shorelines for lithosphere, hydrosphere, atmosphere interface
- Internet: www.rainforest.org Tropical Rainforest Coalition, www.wri.org/wri/cat-frst.html , World Resources Institute, www.forests.org/ric/, Rainforest Information Center, www.cciw.ca/mab/ (Canada/MAB Programme bisophere reserve sites)
  www.usmab.org/ (US MAB (Man & Biosphere) home page, www.ice.ucdavis.edu/MAB Flora & Fauna databases, www.thc.org The Nature Conservancy
  www.glerl.noaa.gov/ NoAA's Great Lakes Research Lab, www.cciw.ca/glimr/intro.html Canada's Great Lakes Information Management Resource

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Bernstein L., Winkler A. and Zierdt-Warshaw, L. Environmental Science: Ecology and Human Impact. (annotated teachers edition) New York. Addison-Wesley, 1998.

Environmental Science. New York: Holt, Rinehard and Winston, 1998.

Cord Applications in Biology/Chemistry. Community of Life. Texas: Cord Communications, 1997.

REFERENCES - STUDENT:

Bernstein L., Winkler A. and Zierdt-Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Wesley, 1998.

Holt, Rinehard and Winston, Environmental Science. New York: 1998.

Cord Applications in Biology/Chemistry. Community of Life. Texas: Cord Communications, 1997.

SCIENCE

Course Title: ENVIRONMENTAL SCIENCE I

Sequence Reference: SC3131EN-D

Module Title: Impact of People

Number of Periods: 15 double periods

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.3, 1.5 History and Nature of Science
- 2.1 - 2.8 Nature of Science Inquiry
- 3.1 - 3.4 Positive Attitude
- 4.1, 4.2 Environmental Responsibility

Content Focus:

- Change
- Cause and Effect
- Systems
- Life Science
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- describe characteristics of different human societies
- relate the terms population, community, ecosystem and biome
- analyze factors that affect the size of human populations
- assess the impact of population changes
- discuss the advantages and disadvantages of the green revolution
- evaluate the impact of major disasters on a human population

Content Detail:

- human societies (hunter gatherer, agricultural, industrial)
  - characteristics
  - impact on the environment
- human populations
- - ecological vs. demographic definitions
- - growth (factors, rate)
- impact of population changes (local and global)
  - carrying capacity
  - over population
  - zero growth
  - limiting resources
- impact of disaster/crisis on human population
  -AIDS
  -famine
  -hurricane, tornadoes, floods
  -industrial disaster (Chernobyl, etc.)
  -war (Nigeria, Bosnia)
- the green revolution

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations(text p.350), field activity (pp.339 & 343), debates, discussions and interviews
- **Product Assessments:**
  - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios etc.
- **Written Assessments:**
  - quizzes/tests

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- libraries: school, BBSR, BAMZ, DOE resource centre (print materials, laser discs, videos, software, etc.)
- site visits/guests speakers: red cross, dept. of statistics (statistician) farmers, Dept of Health (health Promotion Officer and environmental health officer
- websites: www.censuss.gov.cgi-bin/pop clock vs. census population check
  www.unep.org UN environment Programme

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Bernstein L., Winkler A. and Zierdt-Warshaw, L. Environmental Science: Ecology and Human Impact. (annotated teachers edition) New York. Addison-Wesley, 1998.

Environmental Science. New York: Holt, Rinehard and Winston, 1998.

Cord Applications in Biology/Chemistry. Community of Life. Texas: Cord Communications, 1997.

REFERENCES - STUDENT:

Bernstein L., Winkler A. and Zierdt-Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Wesley, 1998.

Environmental Science. New York: Holt, Rinehard and Winston, 1998.

Cord Applications in Biology/Chemistry. Community of Life. Texas: Cord Communications, 1997.

Environmental Science II

Course Code: SC4112ENV

MINISTRY OF EDUCATION

Bermuda

2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Environmental Science II | **4 credit (s)**
120 hour (s)

Prerequisite (s): Environmental Science I | **S4 level (s)**

Course Code: SC4112ENV | ☐ **required or** ☒ **elective**

Course Description

Concepts from Environmental Science I are expanded in this course. Topics studied include energy resources and uses; earth's physical resources such as water, minerals and soils; and biotic resources including food production. Students will examine issues of local and international importance such as land conservation, environmental health hazards, fisheries, eco-tourism and local and global strategies used to protect the environment. An individual project is a required part of the assessment in this senior course.

Course Requirements

The requirements for this course are as follows:

Performance Assessments: - laboratory investigations/activities - laboratory skills tests, teacher observations, debates, discussions, interviews - rubrics are provided for scoring.	**30%**
Product Assessments: **Project/Field Study** **10%** - chapter assignments, short quizzes, reports, data analysis, posters/collages, models, games, portfolios, **10%** This assessment can be class-work or homework. Rubrics are provided for scoring.	**20%**
Written Assessments: Written tests should be based on content cited in modules. The weighting for each module test is shown in the course outline. Written tests should consist of a variety of assessment components including: • multiple choice questions (not greater than 20 % of the test total) • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions	**20%**
Final Examination: Paper I compulsory (multiple choice and/or short answer) Paper II choice (structured questions, diagram or situation set questions, data analysis, essay etc.)	**30%**
Total:	**100%**

Course Resources

Bernstein L., Winkler A. and Zierdt-Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Wesley, 1996.

Environmental Science. New York: Holt, Rinehart and Winston 1997.

Cord Applications in Biology/Chemistry, Natural Resources. Texas: Cord Communications, 1997.

Cord Applications in Biology/Chemistry, Waste and Waste Management. Texas: Cord Communications, 1997.

Course Outline

Module Title	# Double Periods
A. Energy	10
- organic fuels - nuclear energy - sustainable energy	
B. Physical Resources	25
- water - minerals - soil	
C. Biotic Resources	15
- food production - forestry - ecological balance and pollution - wildlife conservation and Bermuda Fisheries - human population	
D. Society and The Environment	15
- land and landscaping conservation - environmental health hazards - ecotourism (low impact use of the environment)	
E. Strategies	10
- local and global strategies - public involvement (pressure groups, public enquiries)	

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check one: S1 ☐ S2 ☐ S3 ☐ S4 ☒

Environmental Science II

GOALS		SUBGOALS		MODULE & CURRICULUM CORRELATION MATRIX				
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity	x	x	x	x	x
		1.2	Connections	x	x	x	x	x
		1.3	Health	x	x	x	x	x
		1.4	Inter-relationship/Mathematics Science Technology	x	x	x	x	x
		1.5	Problem Solving	x	x	x	x	x
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis		x	x	x	x
		2.2	Design		x	x	x	x
		2.3	Data Collection		x	x	x	x
		2.4	Technology Use	x	x	x	x	x
		2.5	Explanations/limitation	x	x	x	x	x
		2.6	Explanations/alternatives	x		x	x	x
		2.7	Communications/Results	x		x	x	x
		2.8	Research	x	x	x	x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science	x	x	x	x	x
		3.2	Value, Environment	x	x	x	x	x
		3.3	Ethical, Applications	x	x	x	x	x
		3.4	Career options	x	x	x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship	x	x	x	x	x
		4.2	Environmental Applications	x	x	x	x	x
CONTENT STRUCTURE		Change		x				
		Cause & Effect		x				
		Systems		x				
		Life Science			x	x	x	x
		Physical Science		x				
		Earth and Space Science		x	x			x
		MODULE		**A**	**B**	**C**	**D**	**E**

MODULE KEY

A - Energy
B - Physical Resources
C - Biotic Resources
D - Society and the Environment
E - Strategies

SCIENCE

Course Title: ENVIRONMENTAL SCIENCE II	**Sequence Reference:** SC4112ENV-A
Module Title: Energy	
Number of Periods: 10 double periods	**Senior School Level** S1 ☐ S2 ☐ S3 ☐ S4 ☒

Subgoal Emphasis:	**Content Focus**
• 1.1 - 1.5 Nature and History of Science • 2.4.- 2.8 Scientific Inquiry • 3.1- 3.4 Positive Attitudes • 4.1, 4.2 Advocate for the Environment	• Change • Cause and Effect • Systems • Earth Science • Physical Science

Curriculum Objectives:

At the end of this module, students will:

- describe the structure of organic fuels
- compare and contrast the processes of formation and extraction of coal and petroleum
- explain how fossil fuels are used to produce electricity
- compare the use of biomass fuels with fossil fuels
- explain atomic fission
- analyse risks of radioactive waste
- evaluate alternative sources of energy

Content Detail:

- organic fuels (formation and extraction)
  - coal (types)
  - petroleum
  - uses
- biomass fuels
  - bio conversion
- the atom
  - structure
  - atomic fission
- nuclear power plant
  - operation
  - waste (dangers and disposal)
- alternate sources of energy
  - solar energy
  - hydroelectric energy
  - geothermal energy
  - nuclear fission
  - wind energy

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews
- **Product Assessments:**
  - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios etc
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- school library information center and DOE resource center (print materials, video, laser disks)
- newspaper, magazine articles
- guest speakers/ visits: Belco, Waste Management Tynes Bay, Sewage Treatment (Cruise Ships/Hospital/Hotels Recycling Centre
- issues: Asbestos/Belco Emissions
- CORD video: natural Resources
- Websites : refer to next page and Environmental Science I

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

WEBSITES

www.mo.org – World Meteorologist organization
www.scrilib.usod.edu/sio/Scripps Institution of oceanography library
http://www.digmark.net/iatech/unesco/biofaw.htm
www.globe.org
http://me-www.jrc/./

REFERENCES - TEACHER:

Bernstein L., Winkler A. and Zierdt -Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Wesley, 1996.

Environmental Science. New York: Holt, Rinehart and Winston 1997.

Cord Applications in Biology/Chemistry, Natural Resources. Texas: Cord Communications, 1997.

Cord Applications in Biology/Chemistry, Waste and Waste Management. Texas: Cord Communications, 1997.

REFERENCES - STUDENT:

Bernstein L., Winkler A. and Zierdt-Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Wesley, 1996.

Environmental Science. New York. Holt, Rinehart and Winston 1997.

Cord Applications in Biology/Chemistry, Natural Resources. Texas: Cord Communications, 1997.

Cord Applications in Biology/Chemistry, Waste and Waste Management. Texas: Cord Communications, 1997.

SCIENCE

Course Title: ENVIRONMENTAL SCIENCE II	**Sequence Reference:** SC4112ENV-B				
Module Title: Physical Resources		**Senior School Level**			
		S1	**S2**	**S3**	**S4**
Number of Days: 25 double periods		☐	☐	☐	☒

Subgoal Emphasis:

- 1.1, - 1.5 Nature and History of Science
- 2.1. – 2.8 Scientific Inquiry
- 3.1- 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- describe the characteristics of mineral
- recognize the importance of minerals
- analyze issues arising from extracting and using minerals
- explain the formulation, compositions and characteristics of soil
- assess impact of soil mismanagement
- assess the impact of land pollutants
- recognize the importance of water to all organisms
- analyze the problems of obtaining and using water as a resource locally and globally
- identify ways to control water pollution, including ocean pollution
- distinguish between inorganic and organic toxic wastes
- describe the process of eutrophication and its effect on lake ecosystems
- explain the problems of radioactive and thermal water pollution

Content Detail:

- minerals
  - characteristics: solid, naturally occurring, inorganic
  - importance
  - extraction and use
- soil
  - formation, composition and characteristics
  - soil mismanagement
- land pollution
- toxic and inorganic wastes : sources, ,effects, responsibility, clean up, prevention, reduction
- water (including ocean water)
  - importance
  - extraction and use in Bermuda
  - pollution
  - eutrophication

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews
- **Product Assessments:**
  - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios etc.
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- library information center and resource center (print materials, video, laser disks)
- newspaper, magazine articles
- guest speakers/ visits: BBSR, Watlington Water Works desalination plant, reverse osmosis plants, Department of Agriculture and Fisheries
- issues: Asbestos, BELCO Emissions
- CORD video: Natural Resources
- websites: see module A and Enviromental Science I

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Bernstein L., Winkler A. and Zierdt -Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Wesley, 1996.

Environmental Science. New York: Holt, Rinehart and Winston 1997.

Cord Applications in Biology/Chemistry, Natural Resources. Texas: Cord Communications, 1997.

Cord Applications in Biology/Chemistry, Waste and Waste Management. Texas: Cord Communications, 1997.

REFERENCES - STUDENT:

Bernstein L., Winkler A. and Zierdt -Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Wesley, 1996.

Environmental Science. New York: Holt, Rinehart and Winston 1997.

Cord Applications in Biology/Chemistry, Natural Resources. Texas: Cord Communications, 1997.

Cord Applications in Biology/Chemistry, Waste and Waste Management. Texas: Cord Communications, 1997.

SCIENCE

Course Title: ENVIRONMENTAL SCIENCE II	**Sequence Reference:** SC4112ENV-C
Module Title: Biotic Resources	**Senior School Level**
Number of Periods: 15 double periods	

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1, - 1.5 Nature and History of Science
- 2.4. – 2.8 Scientific Inquiry
- 3.1- 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- explain why providing adequate food for all of the world's people is so difficult
- describe fertile soil and describe methods to prevent soil erosion
- list the major groups of nutrients and the amount of energy provided by each type
- explain the effects of economics on the production of food
- explain why pest control is necessary
- explain how insects can become resistant to pesticides
- describe the usefulness of non-urban lands to humans
- explain how logging and ranching affect the land
- explain how humans are causing extinction's of other species
- describe the main provisions of the Endangered Species Act
- define endangered species and threatened species
- identify some species of plants and animals that are at risk in the United States and Bermuda
- identify and describe causes of the decline of six endangered species in Bermuda (cahow, turtles, swordfish, cicada, whistling frog, toad, snail, centipede)
- describe worldwide efforts to prevent extinction

Content Detail:

- malnutrition
- droughts
- famine
- types of foods
- green revolution
- aquaculture
- pest
- pesticides
- deforestation
- reforestation
- overgrazing
- biodiversity
- endangered species
- threatened species

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews
- **Product Assessments:**
  - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios etc
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- library information center and DOE resource center (print materials, video, laser discs)
- newspaper, magazine articles
- guest speakers/ visits: Department of Agriculture and Fisheries (laboratory, plant propagation, plant pests) Vegetable Growers Society, Botanical Society, Farmers Association
- issues: building on cave sites, endangered species in Bermuda
- CORD video: Natural Resources
- websites: see module A and Environmental Science I

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Bernstein L., Winkler A. and Zierdt -Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Wesley, 1996.

Environmental Science. New York: Holt, Rinehart and Winston 1997.

Cord Applications in Biology/Chemistry, Natural Resources. Texas: Cord Communications, 1997.

Cord Applications in Biology/Chemistry, Waste and Waste Management. Texas: Cord Communications, 1997.

REFERENCES - STUDENT:

Bernstein L., Winkler A. and Zierdt -Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Wesley, 1996.

Environmental Science. New York: Holt, Rinehart and Winston 1997.

Cord Applications in Biology/Chemistry, Natural Resources. Texas: Cord Communications, 1997.

Cord Applications in Biology/Chemistry, Waste and Waste Management. Texas: Cord Communications, 1997.

SCIENCE

Course Title: ENVIRONMENTAL SCIENCE II	**Sequence Reference:** SC4112ENV-D
Module Title: Society and the Environment	
Number of Periods: 15 double periods	**Senior School Level**

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1, - 1.5 Nature and History of Science
- 2.1. – 2.8 Scientific Inquiry
- 3.1- 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- list examples of solid wastes, and identify their sources
- identify past and present methods used to dispose of solid wastes
- identify problems associated with hazardous wastes
- classify hazardous wastes
- discuss the benefits and drawbacks of various forms of waste disposal
- evaluate the use of pesticides
- examine the growth of ecotourism

Content Detail:

- landfill
- hazardous wastes
- hazardous materials
- bioegradable
- disposal of hazardous wastes
- resistance
- pesticides: advantages and disadvantages
- ecotourism
  - factors that caused its growth
  - ecotourism sites Costa Rica etc.
  - Daniel's Head project

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations/activities, laboratory skills tests, observations, debates, discussions, interviews
- **Product Assessments:**
  - chapter assignments, reports, data analysis, posters/collages, models, games, portfolios etc.
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols, formulas, etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- library information center and DOE resource center (print materials, video, laser discs)
- newspaper, magazine articles
- guest speakers/ visits: Department of the Environment Waste Management, Tynes Bay, Sewage Treatment (Cruise Ships/Hospital/Hotels Recycling Centre, Pest Control Department, Tourism Department
- issues: Asbestos, Daniel's Head ecotourism initiative
- websites: see module A and Environmental Science I

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Bernstein L., Winkler A. and Zierdt -Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Wesley, 1996.

Environmental Science. New York: Holt, Rinehart and Winston 1997.

Cord Applications in Biology/Chemistry, Natural Resources. Texas: Cord Communications, 1997.

Cord Applications in Biology/Chemistry, Waste and Waste Management. Texas: Cord Communications, 1997.

REFERENCES - STUDENT:

Bernstein L., Winkler A. and Zierdt -Warshaw, L. Environmental Science: Ecology and Human Impact. New York. Addison-Wesley, 1996.

Environmental Science. New York: Holt, Rinehart and Winston 1997.

Cord Applications in Biology/Chemistry, Natural Resources. Texas: Cord Communications, 1997.

Cord Applications in Biology/Chemistry, Waste and Waste Management. Texas: Cord Communications, 1997.

Human Biology

Course Code: SC3140HUM

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Human Biology | **4 credit (s)** | **120 hour (s)**

Prerequisite (s): Science II | **S3 level (s)**

Course Code: SC3140HUM | ☐ **required or** ☒ **elective**

Course Description

This biology course provides insight into the functioning of the human body. Students will revisit cell structure and processes as they study the nutritional, digestive, excretory, respiratory cardiovascular, reproductive and sensory systems. The impact of disease, the environment, licit and illicit drugs on the human body will be examined.

Course Requirements

The requirements for this course are as follows:

Performance Assessments: - laboratory investigations/activities - laboratory skills tests, observations, debates, discussion, interviews - rubrics are provided for scoring	**30%**
Product Assessments: - chapter assignments, reports, data analysis, posters, models, games, portfolios - rubrics are provided for scoring	**20%**
Written Assessments: Written tests should be based on content cited in modules. The weighting for each module test is shown in the course outline. Written tests should consist of a variety of assessment components including: • multiple choice questions (not greater than 20 % of the test total) • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions	**20%**
Final Assessment:	**30%**
Total:	**100%**

Course Resources

Maton, A. et al. Exploring Life Science. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology (7th edition) New York: McGraw-Hill, 2000.

Course Outline

Module Title	# Double Periods
A. The Human Body – an Overview	3
- levels of organization - types of tissue - homeostasis - biological molecules	
B. Protection Support and Motion	10
- skeleton and joints - muscles - skin	
C. Respiration and Excretion	10
- respiration - ventilation - kidneys	
D. The Circulatory System	10
- role of the circulatory system - heart and blood vessels - diseases and disorders - blood - lymph system	
E. Digestion and Nutrition	10
- importance of digestion - digestive system - importance of food - role of nutrients	
F. Coordination	10
- nervous system - hormones and homeostasis - endocrine glands	
G. Reproduction and Heredity	10
- reproduction in humans - sex determination - inheritance	
H. Disease	7
- pathogens - modes of transmission - methods of control	
I. Drugs and The Human Body	5
- impact of drugs - beneficial effort - dependence	

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check one: S1 ☐ S2 ☐ S3 ☒ S4 ☐

Human Biology

GOALS		SUBGOALS		MODULE & CURRICULUM CORRELATION MATRIX								
			MODULE	A	B	C	D	E	F	G	H	I
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity									
		1.2	Connections	x	x	x	x	x	x	x	x	x
		1.3	Health	x	x	x	x	x	x	x	x	x
		1.4	Inter-relationship/Mathematics Science Technology	x	x	x	x	x	x	x	x	x
		1.5	Problem Solving	x	x	x	x	x	x	x	x	x
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis	x	x	x	x	x	x	x	x	x
		2.2	Design	x	x	x	x	x	x	x	x	x
		2.3	Data Collection	x	x	x	x	x	x	x	x	x
		2.4	Technology Use	x	x	x	x	x	x	x	x	x
		2.5	Explanations/limitation	x	x	x	x	x	x	x	x	x
		2.6	Explanations/alternatives									
		2.7	Communications/Results									
		2.8	Research	x	x	x	x	x	x	x	x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science	x	x	x	x	x	x	x	x	x
		3.2	Value, Environment									
		3.3	Ethical, Applications									
		3.4	Career options	x	x	x	x	x	x	x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship									
		4.2	Environmental Applications									
CONTENT STRUCTURE		Change								x	x	x
		Cause & Effect									x	x
		Systems		x	x	x	x	x	x	x	x	x
		Life Science		x	x	x	x	x	x	x	x	x
		Physical Science										
		Earth and Space Science										

MODULE KEY

A - The Human Body – The Overview
B - Protection Support and Motion
C - Respiration and Excretion
D - The Circulatory System
E - Digestion and Nutrition
F - Coordination
G - Reproduction and Heredity
H - Disease
I - Drugs and The Human Body

SCIENCE

Course Title: HUMAN BIOLOGY

Module Title: The Human Body - An Overview

Number of Periods: 3 double periods

Sequence Reference: SC3140HUM-A

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1-1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1,3.2,3.4 Positive Attitudes
- 4.1,4.2 Advocate for Environment

Content Focus:

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- illustrate the levels of organization of living things
- distinguish among the four types of human body tissue
- illustrate how the body maintains a stable internal environment
- describe the functions of biological molecules

Content Detail:

- levels of organization : cells, tissues, organs, organ systems
- types of tissue: muscle, connective, nerve, epithelial
- homeostasis
  - definition
  - importance
  - main systems that maintain constant internal environment (re: blood glucose (pancreas & liver); water content (kidneys) temperature (skin), carbon dioxide and water (lungs) etc.
- biological molecules:
  - organic: carbohydrates, fats and oils, amino acids and proteins
  - inorganic: water, minerals

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs etc.
- cross curricular connections: health education
- site visits: KEMH, dialysis unit, Victoria Street Clinic, gym, laboratories
- guest speakers :medical staff at KEMH and Dept of Health; occupational and physical therapists, medical laboratory technicians, imaging department (X ray, ultra sound, CAT scan) ECG EEG technicians, trainers and coaches
- web site: apha.org

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:
Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology. (7th edition) New York: McGraw Hill, 2000

REFERENCES – STUDENT:
Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology. (7th edition) New York: McGraw-Hill, 2000.

SCIENCE

Course Title: HUMAN BIOLOGY

Module Title: Protection Support and Motion

Number of Periods: 10 double periods

Sequence Reference: SC3140HUM-B

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1 - 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1 - 3.4 Positive Attitudes
- 4.1,4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- explain the structure and function of cartilage and bone
- locate and illustrate the functions of the main parts of the skeleton
- demonstrate the function of the types of joints
- differentiate among types of muscle
- illustrate how the relationship between muscle and bone causes movement
- describe the structure and function of skin

Content Detail:

- cartilage and bone
  - structure
  - factors contributing to healthy development function
- skeleton: axial skeleton, appendicular skeleton
- joints
  - types (ball & socket, hinge, pivot etc.)
  - location and function
  - immovable joints
- muscles: smooth, cardiac, striate
- movement: voluntary muscles and bones (using biceps, triceps muscles and associated bones)
- skin functions: layers; protection, regulation of temperature, detection of environmental change

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs etc.
- cross curricular connections: health education
- site visits: KEMH, dialysis unit, Victoria Street Clinic, gym, laboratories
- guest speakers: medical staff at KEMH and Dept. of Health; occupational and physical therapists, imaging department (X-ray, ultra sound, CAT scan) trainers and coaches
- web site: apha.org
  htttp://anatomy.uams.edu/HTMLpages/anatomyhtml/me dcharts.html

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology. (7th edition) New York: McGraw-Hill, 2000.

REFERENCES – STUDENT:

Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology. (7th edition) New York: McGraw-Hill, 2000.

SCIENCE

Course Title: HUMAN BIOLOGY	**Sequence Reference:** SC3140HUM-C
Module Title: Respiration and Excretion	
Number of Periods: 10 double periods	

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☒

Subgoal Emphasis:

- 1.1 - 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1 - 3.4 Positive Attitudes
- 4.1,4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- distinguish among the processes of respiration
- illustrate the structure and function of components of the ventilation system
- describe the structure of the kidneys
- explain the role of kidneys in maintaining homeostasis

Content Detail:

- respiration: ventilation, internal respiration, cellular respiration
- ventilation:
  -nasal cavities, trachea, lungs, diaphragm, bronchi, bronchioles, alveoli
  - gas exchange
  - mechanism of breathing, lung capacity
  - effect of smoking on lung structure and gas exchange
  - oxygen debt
  - disorder: asthma
- kidneys: location, structure, nephron (structure and function)
  - removal of urea, excess water, salt
  - kidney stones & kidney failure
- kidneys and homeostasis

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessment:**
  - tests and quizzes (multiple choice/ written)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs etc.
- cross curricular connections: health education
- site visits: Imaging Dept KEMH, Victoria Street Clinic, gym, laboratories, Nurses Practice - Open Airways, emergency department
- guest speakers: urologist, respiratory therapist, nurse asthma specialist
- Internet: apha.org

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology. (7th edition) New York: McGraw-Hill, 2000.

REFERENCES – STUDENT:

Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology. (7th edition) New York: McGraw-Hill, 2000.

SCIENCE

Course Title: HUMAN BIOLOGY

Module Title: Circulatory System

Number of Periods: 10 double periods

Sequence Reference: SC3140HUM-D

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1,1.2,1.3,1.4,1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1,3.2,3.3.4 Positive Attitudes
- 4.1,4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- recognize the primary role of the circulatory system as one of transport
- relate the structures of the heart and blood vessels to their functions
- describe the disease/disorders of the heart and blood vessels
- relate the structure and function of the components of the blood
- describe the role of the blood as a defense system
- describe the structure and function of the lymph systems

Content Detail:

- circulatory system as a transport system working with digestive, respiratory and excretory system
- anatomical features of the heart; control of rate of heart beat; the path of blood through the circulatory system; three kinds of blood vessels; blood pressure
- atherosclerosis, hypertension, heart attack
- components of the blood: plasma (antibodies, proteins, salts etc), platelets (clotting), red blood cells (blood typing) , white blood cells, disorders (anemia and leukemia)
- defense system: white blood cells (killing invaders); antibodies (assisting in fighting invaders); clotting
- fluid lymph, lymph vessels, valves, lymphocytes

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs etc.
- cross curricular connections: health education
- guest speakers/site visits: medical staff Health department and KEMH, medical laboratory technicians, imaging technicians, pathologist , oncologist
- web sites: apha.org
- http://sln2.fi.edu/biosci/preview/heart.html

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David et al. Essentials of Human Anatomy and Physiology. (7th edition) New York: McGraw Hill, 2000

REFERENCES – STUDENT:

Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David et al. Essentials of Human Anatomy and Physiology (7th edition) New York: McGraw-Hill, 2000.

SCIENCE

Course Title:	HUMAN BIOLOGY	**Sequence Reference:**	SC3140HUM-E
Module Title:	Digestion and Nutrition		
Number of Periods:	10 double periods		

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1,1.2,1.3,1.4,1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1,3.2,3.3.4 Positive Attitudes
- 4.1,4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- illustrate the importance of digestion as a life process
- explain the structure and function of main parts of the digestive system
- compare mechanical and chemical digestion
- explain the importance of food to the human body
- relate need for a balanced diet to the role of nutrients in the body

Content Detail:

- digestion: movement of food by peristalsis, storage, absorption and egestion of food
- mouth, oesophagus, stomach, intestines, liver and pancreas
- mechanical and chemical digestion
- food: source of energy, materials for growth
- balanced diet
  - importance
  - nutrient functions: energy supplying: carbohydrates fats and proteins; other : vitamins, minerals, water
  - impact of dieting including fad diets

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs etc.
- cross curricular connections: health education
- site visits: KEMH including kitchen
- guest speakers :medical staff at KEMH and Dept of Health; trainers and coaches , nutritionists
- Internet: apha.org

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology. (7th edition) New York: McGraw-Hill, 2000.

REFERENCES – STUDENT:

Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw-Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology (7th edition) New York: McGraw-Hill, 2000.

SCIENCE

Course Title: HUMAN BIOLOGY

Sequence Reference: SC3140HUM-F

Module Title: Coordination

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Number of Periods: 10 double periods

Subgoal Emphasis:

- 1.1,1.2,1.3,1.4,1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1,3.2,3.3.4 Positive Attitudes
- 4.1,4.2 Advocate for Environment

Content Focus:

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- distinguish between different types of neurons
- illustrate how the nervous system links sense organs and effectors
- explain how hormones contribute to maintaining homeostasis
- locate the endocrine glands in the body
- compare the nervous and hormonal systems

Content Detail:

- neurons and their structure: sensory, motor and relay
- nervous system: central nervous system and peripheral nerves
- transmission of nerve impulse: receptor to muscle
- spinal cord: anatomy and functions
- spinal reflex: knee jerk, withdrawal
- brain: main areas and functions
- response of receptors to heat, chemical and light energy
- the eye: structure and function in response to light
- the ear: function in balance and hearing
- chemical coordination: action of hormones from pituitary, adrenal and thyroid glands; insulin and the control of blood sugar levels; role of hormones in growth and development
- endocrine glands: testes, ovaries, adrenal, thyroid, pituitary etc.
- comparison: nervous vs. chemical controls

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written)

Prerequisite Skill Areas (if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources (materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs etc.
- cross curricular connections: health education
- guest speakers/ site visits: KEMH, doctor's office, clinic, opthamalogist , audiologist , endocrinologist
- Internet: apha.org

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:
Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology. (7th edition) New York: McGraw-Hill, 2000.

REFERENCES – STUDENT:
Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology (7th edition) New York: McGraw-Hill, 2000.

SCIENCE

Course Title: HUMAN BIOLOGY

Module Title: Reproduction and Heredity

Number of Periods: 10 double periods

Sequence Reference: SC3140HUM-G

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1-1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1,3.2,3.4 Positive Attitudes
- 4.1,4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- outline the function and importance of reproduction in humans
- illustrate how characteristics are passed from one generation to another

Content Detail:

- human reproduction including fertilization: male and female reproductive organs; the menstrual cycle, copulation, fertilization and implantation; placenta and fetal membranes; birth & breast feeding; birth control
- meosis; sex determination in humans; mechanism of inheritance; genetically inherited conditions (sickle cell anaemia, haemophilia etc) inheritance of ABO blood groups; chromosomes and DNA; mutations

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessment:**
  - tests and quizzes (multiple choice/ written)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs etc.
- cross curricular connections: health education
- site visits: Imaging Dept KEMH, Victoria Street Women's Clinic, medical laboratories, Nurses Practice, maternity ward
- guest speakers: obstetrician & gynaecologist, geneticist
- websites: www.apha.org

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology. (7^{th} edition) New York: McGraw-Hill, 2000.0

REFERENCES – STUDENT:

Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology. (7^{th} edition) New York: McGraw-Hill, 2000.

SCIENCE

Course Title: HUMAN BIOLOGY

Module Title: Disease

Number of Periods: 7 double periods

Sequence Reference: SC3140HUM-H

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1,1.2,1.3,1.4,1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1,3.2,3.3.4 Positive Attitudes
- 4.1,4.2 Advocate for Environment

Content Focus:

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- differentiate among endemic, epidemic and pandemic
- identify and describe disease causing organisms (pathogens) of particular communicable diseases including sexually transmitted infections (STI's)
- explain modes of transmission of communicable diseases
- compare and contrast various communicable diseases (using specific criteria listed in content detail)
- describe methods of control of communicable diseases

Content Detail:

- definition: endemic, pandemic, epidemic, epidemiology
- pathogens:
- viruses (HIV, colds, ebola, herpes etc.); bacteria (strep throat, tuberculosis, chlamydia); fungi (athlete's foot, yeast infections etc.); protozoa (malaria, trichomonas); parasitic worms (tapeworms etc)
- modes of transmission: contact (colds, influenza); food (salmonella); water (chlolera); airborne (from pests or soil); insect vectors (mosquitoes - dengue fever etc.) animal vector(animal saliva – rabies
- criteria for comparison (symptoms, infectious agent, occurrence, reservoir, mode of transmission, incubation, period of communicability, susceptibility and resistance)
- methods of control: Public Health Efforts (see activities next page), immunity (natural and artificial, healthy life style, treatment issues (bacterial vs. viral, drug resistance etc.)

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs etc.
- cross curricular connections: health education
- site visits: KEMH, Victoria Street Clinic, medical laboratories
- guest speakers: careers: nurse, physician, epidemiologist, medical statistician, medical laboratory technician, medical researcher
- website: www.apha.org
  www.cdc.org

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- analyze the impact of **public health efforts on diseases** in Bermuda and design a multi media public relations effort for each of the following efforts: health education, safe water supply, proper sewage disposal, food safety in restaurants, dairy inspection and milk testing, rodent and pest control, immunisation and STD clinics

REFERENCES - TEACHER:

Maton, A. et al. Exploring Life Science: New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw-Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology (7th edition) New York: McGraw-Hill, 2000.

REFERENCES – STUDENT:

Maton, A. et al. Exploring Life Science. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw-Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology (7th edition) New York: McGraw-Hill, 2000.

SCIENCE

Course Title: HUMAN BIOLOGY

Module Title: Drugs and the Human Body

Number of Periods: 5 double periods

Sequence Reference: SC3140HUM-I

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1 - 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1 - 3.4 Positive Attitudes
- 4.1,4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- recognize the impact of drugs on the chemical reactions of the human body
- explain the beneficial effect of drugs
- distinguish between psychological and physical dependence
- illustrate the effects of drugs on the human body
- relate the function of endomorphins to the action of narcotics

Content Detail:

- impact of drugs : changes or affects on body chemistry; harmful and habit forming effects
- beneficial effect: drugs used under medical supervision (e.g. penicillin for bacterial infections) over the counter drugs; abuse of prescribed drugs
- terms: psychological dependence, physical dependence, withdrawal, addiction
- effect of tobacco chemicals : inhibition of the action of the cilia, contributes to heart disease, lung cancer and other lung diseases, reduced birth weight of babies
- effects of alcohol: immediate effects: metabolism by the liver; action on CNS; hangovers; long term effects: alcoholism, cirrhosis of the liver
- marijuana as a depressant: THC, carcinogens in smoke
- heroin, cocaine, steroids
- endomorphins as natural opiates

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- school library & DOE Resource Centre: print material, videos, laser discs etc.
- cross curricular connections: health education
- guest speakers/site visits: addictions counsellors, CADA prevention resource centre, laboratory testing, police liaison officer. pathologist
- Internet: apha.org

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw-Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology (7th edition) New York: McGraw-Hill, 2000.

REFERENCES- STUDENT:

Maton, A. et al. Exploring Life Science: Human Biology and Health. New Jersey: Prentice Hall, 1994.
Biology Holt
Benjamin, C. et al. Human Biology. New York: McGraw Hill Companies, 1997.
Shier, David, et al. Essentials of Human Anatomy and Physiology (7th edition) New York: McGraw-Hill, 2000.

Introduction to Horticulture

Course Code: SC3150HOR

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Introduction to Horticulture — **4 credit (s)**, **120 hour (s)**

Prerequisite (s): Science I — **S3 level (s)**

Course Code: SC3150HOR — ☐ **required or** ☒ **elective**

Course Description

Horticulture is a special branch of agriculture, which includes the study of fruits, vegetables, flowers, shrubs and trees. This introductory course will build upon basic biological concepts met in earlier senior school courses. Students will use the school garden and modern greenhouse to study plant pathology; methods of propagation vegetables and flowers; Bermuda lawns and golf courses. Field trips will be used to extend learning beyond the school facilities.

Course Requirements

The requirements for this course are as follows:

Performance Assessments: - laboratory investigations/activities - laboratory skills tests, observations - rubrics are provided for scoring	**30%**
Product Assessments: - chapter assignments, reports, data analysis, posters/collages, models, portfolios, etc. - rubrics are provided for scoring	**20%**
Written Assessments: - written tests should be based on content cited in modules. The weighting for each module test is shown in the course outline. Tests should include a variety of assessment components: multiple choice questions, short answers (including situation or diagram set questions, data analysis, interpreting science skill, critical thinking (contextual issues) & open ended questions.	**20%**
Project Such as: • report on horticulture in Bermuda • model garden or planter • report on impact of introduced species • extended slat house based investigation	**30%**
Total	**100%**

Course Resources

Reiley, H Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.
CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.
Acquaah, George, Horticulture: Principles and Practices. New Jersey: Prentice-Hall, 1999.
Collett, Jill, Bermuda Her Plants and Gardens. 1609 – 1850 London: MacMillan Publishers Ltd. and Bermuda National Trust , 1987.
Phillips-Watlington, Christine, Bermuda's Botanical Wonderland: A Field Guide London: MacMillan Ltd. 1996.
Smith, Louisa, Hutchings, Bermuda's Oldest Inhabitants: Tales of Plant Life. London: J Salmon Ltd. 1982.
Lennox, G.W. and Seddon S.A. Trees of the Caribbean, the Bahamas and Bermuda . London: MacMillan Education Ltd, 1980.
Whitney, Christine ed, The Bermuda Garden. Bristol: Mardon and Son and Hall Ltd, 1955.

Course Outline

Module Title	# Double Periods
A. Introduction to Horticulture -plant parts and functions -environmental conditions for growth	5
B. Plant Pathology - plant parts and functions - environmental conditions for growth	10
C. Plant Propagation - seeds - cuttings - grafting	10
D. Growing Vegetables - site planning and preparation - choosing and planting -caring for vegetables -economic crops in Bermuda -square foot gardening	10
E. Local Lawns and Grasses - establishing a lawn -maintaining a lawn -the golf course	10
F. Annual and Perennial Flowers - annual bedding plants - perennials - designing with flowers - arrangements and displays	10
G. The Small Fruit Garden - choice of fruit - maintenance of garden -economic importance	10
H. Endemic Plants - identification - propagation - protection - public awareness	10

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check one: S1 ☐ S2 ☐ S3 ☒ S4 ☐

Introduction to Horticulture

GOALS		SUBGOALS		MODULE & CURRICULUM CORRELATION MATRIX							
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity	x		x	x	x	x	x	x
		1.2	Connections	x		x	x	x	x	x	x
		1.3	Health	x	x						x
		1.4	Inter-relationship/Mathematics Science Technology	x	x						x
		1.5	Problem Solving	x	x	x	x	x	x	x	x
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis	x	x	x	x	x	x	x	x
		2.2	Design	x	x	x	x	x	x	x	x
		2.3	Data Collection	x	x	x	x	x	x	x	x
		2.4	Technology Use	x	x	x	x	x	x	x	x
		2.5	Explanations/limitation	x	x	x	x	x	x	x	x
		2.6	Explanations/alternatives	x	x	x	x	x			x
		2.7	Communications/Results	x	x		x	x			x
		2.8	Research	x	x		x	x	x	x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science	x	x	x	x	x			x
		3.2	Value, Environment	x	x		x	x	x	x	x
		3.3	Ethical, Applications	x	x		x	x			x
		3.4	Career options	x	x	x	x	x	x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship	x	x	x	x	x	x		x
		4.2	Environmental Applications	x	x	x	x	x	x		x
CONTENT STRUCTURE		Change			x	x	x	x	x	x	x
		Cause & Effect		x	x	x	x		x	x	x
		Systems		x						x	x
		Life Science		x	x	x	x	x	x	x	x
		Physical Science									
		Earth and Space Science			x						
		MODULE		**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**

MODULE KEY

A - Introduction to Horticulture
B - Plant Pathology
C - Plant Propagation
D - Growing Vegetables
E - Local Lawns and Grasses
F - Annual and Perennial Flowers
G - The Small Fruit Garden
H - Endemic Plants

SCIENCE

Course Title: HORTICULTURE	**Sequence Reference:** SC3150HOR-A
Module Title: Introduction to Horticulture	
Number of Periods: 10 double periods	

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1- 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1 - 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus

- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- explain the term horticulture
- outline the development of horticulture as a science
- explain the importance of horticulture to society
- research careers related to horticulture

Content Detail:

- definition of horticulture :
  - providing food
  - impacting on the environment
- horticulture as a science:
  - related to other plant sciences
  - using methods of science
  - research implications: genetic engineering etc
- importance of horticulture:
  - as a business; an art; as science
  - in other societies (developed and developing nations)
- careers related to horticulture: landscaper, florist, floriculture, horticultural therapy, research scientist, plant pathology

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  - teacher observation, presentation – project/demonstration, posters/essays/etc., portfolio, data collection/data analysis
- **Written Assessments:**
  - tests, quizzes

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- Dept. of Agriculture & Fisheries library and newsletter
- newspaper articles including " Gardeners World" Lisa Greene in Mid Ocean News (weekly)
- guest speakers/ site visits: florists, landscapers, nurseries, landscape architect, Garden Club, The Botanical Society
- curricular connections: biology, geography, business studies, art, food and nutrition

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:
- search the Internet for categories: plant science, horticulture, greenhouse, turf management etc
- visit a golf course and interview turf manager
- use the telephone book or newspaper to collect data about businesses related to horticulture

REFERENCES - TEACHER:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.

CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.

Acquaah, George, Horticulture: Principles and Practices. New Jersey: Prentice-Hall, 1999.

Collett, Jill, Bermuda Her Plants and Gardens. 1609 – 1850 London: MacMillan Publishers Ltd and Bermuda National Trust , 1987.

Phillips-Watlington, Christine, Bermuda's Botanical Wonderland. A Field Guide London: MacMillan Ltd. 1996.

Smith, Louisa, Hutchings, Bermuda's Oldest Inhabitants: Tales of Plant Life. London: J Salmon Ltd. 1982.

Lennox, G.W. and Seddon S.A. Trees of the Caribbean, the Bahamas and Bermuda. London: MacMillan Education Ltd. 1980.

Whitney, Christine ed. The Bermuda Garden. Bristol: Mardon and Son and Hall Ltd. 1955.

REFERENCES - STUDENT:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.

CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.

SCIENCE

Course Title: HORTICULTURE

Module Title: Plant Pathology

Number of Periods: 10 double periods

Sequence Reference: SC3150HOR-B

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.3 - 1.5 Nature and History of Science
- 2.1 - 2.5, 2.8 Scientific Inquiry
- 3.1 - 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life & Earth Sciences

Curriculum Objectives:

At the end of this module, students will:

- identify and explain the functions of plant parts
- be aware of systems of classification
- describe the structure and function of plant cells
- list factors that affect the roots of plants
- recognize and describe the differences in the types of soils
- identify the factors needed for healthy growth
- explain why chemical retardants are applied to plants
- demonstrate how substances are used to stimulate plant growth
- demonstrate the proper application of rooting hormones to cuttings

Content Detail:

- plants parts: root, stem, leaf, flowers, seeds, fruits; function : growth and reproduction; cellular variation; adaptation to environment (local examples)
- classification: characteristics of kingdom plantae; binomial nomenclature and examples using local plants; seasonal growth cycles – annuals, biennials, perennials; stem types - herbs, shrubs, trees; fruits – fleshy and dry
- soil:
  - origin, formation and variation of soil in Bermuda
  - soil as a resource
- plant growth: soil nutrients, water, light, temperature, disease and pests
- chemicals affecting growth:
  - plant hormones and manmade chemicals
  - effect at cellular level
- correct use of chemicals on plants

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  - teacher observation, presentation – project/demonstration, posters/essays/etc., portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations, graphing, using SI units
- reporting observations accurately
- using technology: calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- Dept. of Agriculture & Fisheries library and newsletter
- newspaper articles including " Gardeners World" Lisa Greene in Mid Ocean News (weekly)
- guest speakers/ site visits: florists, landscapers, nurseries, landscape architect, Garden Club, The Botanical Society
- curricular connections: biology, geography, business studies, art
- Materials list: chrysanthemums, gardenias, azaleas and poinsettias; rooting hormone powder; giberellic acid; 9 (growth retardant); misting system for chemical application

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- visit supermarket or vegetable stand and identify or purchase produce in different classes
- examine under the microscope – plant cell and plant roots
- cut fruits and identify parts
- identify plants around campus by describing bark, leaves, flowers etc
- measure seedling growth using stimulant
- examine reproductive parts of flowers
- CORD Lab # 1 (see reference below)

REFERENCES - TEACHER:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.
CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.
Acquaah, George, Horticulture: Principles and Practices. New Jersey: Prentice-Hall, 1999.
Collett, Jill, Bermuda Her Plants and Gardens. 1609 – 1850 London: MacMillan Publishers Ltd. and Bermuda National Trust , 1987.
Phillips-Watlington, Christine, Bermuda's Botanical Wonderland. A Field Guide London: MacMillan Ltd. 1996.
Smith, Louisa, Hutchings, Bermuda's Oldest Inhabitants: Tales of Plant Life. London: J Salmon Ltd. 1982.
Lennox, G.W. and Seddon S.A. Trees of the Caribbean, the Bahamas and Bermuda . London: MacMillan Education Ltd. 1980.
Whitney, Christine ed. The Bermuda Garden. Bristol: Mardon and Son and Hall Ltd. 1955.

REFERENCES - STUDENT:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.
CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.

SCIENCE

Course Title: HORTICULTURE

Module Title: Plant Propagation

Number of Periods: 10 double periods

Sequence Reference: SC3150HOR-C

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.5 Nature and History of Science
- 2.1 - 2.5 Scientific Inquiry
- 3.1, 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus

- Change
- Cause and Effect
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- distinguish between sexual and asexual propagation
- relate the structure and function of seed parts
- distinguish between direct and indirect seeding methods
- assess conditions for germination
- demonstrate other methods for propagation
- select plants suitable for propagation
- discuss the advantages and disadvantages of grafting
- discuss the role of insects in plant reproduction

Content Detail:

- sexual and asexual propagation
- seeds
  - monocots, dicots
  - food storage
  - protection from environment
- germination
  - climate effect and seasonal variation and how this affects timing of sowing for the garden
- other methods of propagation
  - grafting
  - cutting
  - advantages and disadvantages
- role of insects (bees etc.)

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  - teacher observation, presentation – project/demonstration, posters/essays/etc., portfolio, data collection/data analysis
- **Written Assessments:**

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- Dept. of Agriculture & Fisheries library and newsletter
- newspaper articles including " Gardeners World" Lisa Greene in Mid Ocean News (weekly)
- guest speakers/ site visits: florists, landscapers, nurseries, landscape architect, Garden Club, The Botanical Society
- curricular connections: biology
- CORD video Plant Propagation; Tree- Seed - Plant
- materials :potting compost; selection of seeds; rooting hormone; rooting medium (sphag moss, perlite etc.); propagating flats; softwood and hardwood plants for cuttings; hardwood plants suitable for grafting eg. roses

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:
- determine viability of seeds
- investigate best methods of propagation for a variety of plants
- compare seedling growth in various media
- investigate germination times using data from packages of different seeds
- investigate germination of seeds stored
  - in freezer
  - at room temperature
- CORD lab # 2 (see reference below)

REFERENCES - TEACHER:
Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.
CORD Applications I Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.
Acquaah, George, Horticulture: Principles and Practices. New Jersey: Prentice-Hall, 1999.
Collett, Jill, Bermuda Her Plants and Gardens. 1609 – 1850 London: MacMillan Publishers Ltd. and Bermuda National Trust, 1987.
Phillips-Watlington, Christine, Bermuda's Botanical Wonderland. A Field Guide London: MacMillan Ltd. 1996.
Smith, Louisa, Hutchings, Bermuda's Oldest Inhabitants: Tales of Plant Life. London: J Salmon Ltd. 1982.
Lennox, G.W. and Seddon S.A. Trees of the Caribbean, the Bahamas and Bermuda. London: MacMillan Education Ltd. 1980.
Whitney, Christine ed. The Bermuda Garden. Bristol: Mardon and Son and Hall Ltd. 1955.

REFERENCES - STUDENT:
Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.
CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.

SCIENCE

Course Title: HORTICULTURE

Module Title: Growing Vegetables

Number of Periods: 10 double periods

Sequence Reference: SC3150HOR-D

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.5 Nature and History of Science
- 2.1 - 2.5, 2.8 Scientific Inquiry
- 3.1, 3.2, 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus

- Change
- Cause and Effect
- Life Science
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- describe the benefits and characteristics of a home vegetable garden
- identify factors to consider when choosing the location of a vegetable plot
- plan and draw a plot containing a selection of vegetables
- demonstrate the use of basic gardening tools
- demonstrate methods of soil improvement
- describe methods of pest and disease reduction
- select and grow garden crops suitable for a Bermuda vegetable garden

Content Detail:

- home vegetable garden
  - characteristics: size, more than one crop, use of hand tools, home water supply,
  - benefits: reduces cost of groceries, source of vegetables for family and friends
- plot: microclimate, ergonomics and aesthetics; square foot gardening
- gardening tools
- plot design: effective use of land; slope; runoff; shade; optimization of yield related to season
- soil improvement: soil types, testing kits; organic vs. inorganic fertilizers; composting
- pest reduction: identification and symptoms, chemicals, plants with repellant action
- vegetable crops for Bermuda: selection, soil preparation, planting, care (moisture, disease and pests), harvesting

Module Evaluation:

- **Performance Assessments:**
  -laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  - teacher observation, presentation – project/demonstration, posters/essays/etc., portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- Dept. Agriculture & Fisheries library and Newsletter
- newspaper articles including " Gardeners World" Lisa Greene in Mid Ocean News (weekly)
- guest speakers/ site visits: Vegetable Growers Society, Dept of Agriculture
- CORD video: Farming Decisions
- Materials list: flats, propagating trays; garden tools; selection of seeds for locally grown vegetables and herbs, mulching material, rain gauge, soil test kits, insecticide/fungicides, hoses, sprinkler, respirators, compost bins

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES AND PROJECTS:
- determine which vegetables grow best in soil from different parts of the island
- investigate the application of fertilizers with different NPK values on a variety of vegetables
- compare costs of home grown vegetables with those purchased from the supermarket or vegetable stand
- research vegetable embargos in Bermuda (which vegetables, what time of year etc.)

REFERENCES - TEACHER:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.
CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.
Acquaah, George, Horticulture: Principles and Practices. New Jersey: Prentice-Hall, 1999.
Collett, Jill, Bermuda Her Plants and Gardens. 1609 – 1850 London: MacMillan Publishers Ltd and Bermuda National Trust , 1987.
Phillips-Watlington, Christine, Bermuda's Botanical Wonderland. A Field Guide London: MacMillan Ltd. 1996.
Smith, Louisa, Hutchings, Bermuda's Oldest Inhabitants: Tales of Plant Life. London: J Salmon Ltd. 1982
Lennox, G.W. and Seddon S.A. Trees of the Caribbean, the Bahamas and Bermuda. London: MacMillan Education Ltd. 1980.
Whitney, Christine ed The Bermuda Garden. Bristol: Mardon and Son and Hall Ltd. 1955.

REFERENCES - STUDENT:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.
CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.

SCIENCE

Course Title: HORTICULTURE

Module Title: Local Lawns and Grasses

Number of Periods: 10 double periods

Sequence Reference: SC3150HOR-E

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.1 - 2.5, 2.8 Scientific Inquiry
- 3.2, 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- distinguish between lawn and turf
- outline reasons for establishing a lawn
- explain proper maintenance of a lawn
- describe how turf grasses are started in Bermuda
- identify grasses used on golf courses in Bermuda
- describe the various methods of maintaining a golf course in Bermuda
- be aware careers in turf management

Content Detail:

- definitions: lawn and turf
- establishing a lawn
  - advantages (ground cover against soil erosion; mud and dust reduction; recreational uses)
  - choice of grasses
- maintenance of a lawn: irrigation and drainage; pest control; fertilizers; mowing
- turf grasses: seeding, plugging etc., selection, maintenance of golf courses
- turf management in Bermuda: educational requirements, skills, salary, opportunities (including apprenticeships)

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  - teacher observation, presentation – project/demonstration, posters/essays/etc., portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- Dept. of Agriculture & Fisheries library and newsletter
- newspaper articles including " Gardeners World" Lisa Greene in Mid Ocean News (weekly)
- guest speakers: turf manager, Agriculture and Fisheries landscapers
- visits: golf courses, nurseries, Ministry of the Environment & Agriculture and Fisheries laboratory, landscaping companies, Bermuda homes and hotel properties with exemplary lawns
- materials : rototiller, lawn roller, lawn mower, strimmers, lawn seed and turf, lawn fertilizer, lawn fertilizer, rakes, rotary spreader

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES AND PROJECTS:

- create a mowing schedule for a lawn
- evaluate quality of grassed areas around the school
- interview a turf manager of a local golf course
- investigate methods of establishing turf grasses
- investigate variables of growth of grasses (water, fertilizer, soil type)

REFERENCES - TEACHER:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.

CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.

Acquaah, George, Horticulture: Principles and Practices. New Jersey: Prentice-Hall, 1999.

Collett, Jill, Bermuda Her Plants and Gardens. 1609 – 1850 London: MacMillan Publishers Ltd and Bermuda National Trust , 1987.

Phillips-Watlington, Christine, Bermuda's Botanical Wonderland. A Field Guide London: MacMillan Ltd. 1996.

Smith, Louisa Hutchings, Bermuda's Oldest Inhabitants: Tales of Plant Life. London: J Salmon Ltd. 1982.

Lennox, G.W. and Seddon S.A. Trees of the Caribbean, the Bahamas and Bermuda. London: MacMillan Education Ltd. 1980.

Whitney, Christine, ed. The Bermuda Garden. Bristol: Mardon and Son and Hall Ltd. 1955.

REFERENCES - STUDENT:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.

CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.

SCIENCE

Course Title: HORTICULTURE

Module Title: Annual and Perennial Flowers and Plants

Number of Periods: 10 double periods

Sequence Reference: SC3150HOR-F

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.5 Nature and History of Science
- 2.1 - 2.5, 2.8 Scientific Inquiry
- 3.2, 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus

- Change
- Cause and Effect
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- distinguish between annual and perennial plants
- demonstrate the care of common house plants
- plan and grow an ornamental border of annual plants
- provide ongoing care for specialized ornamental perennials such as bonsai, orchids, roses etc.
- research the flower industry

Content Detail:

- annuals vs. perennials
- common houseplants in Bermuda: identification, selection (preference, growing conditions, size etc.)
- caring for house plants: light, temperature, humidity, watering, fertilizing, repotting, pest control
- planting an ornamental flower bed: height, colour, foliage, caring for bulbs, corms and tubers during dormant season
- care of ornamental perennials : feeding, pruning etc.
- the flower industry in Bermuda: production of cut flowers; florists, careers

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  - teacher observation, presentation – project/demonstration, posters/essays/etc., portfolio, data collection/data analysis
- **Written Assessments:**

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations, graphing, using SI units
- reporting observations accurately
- using technology: calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- Dept. of Agriculture & Fisheries library and newsletter
- newspaper articles including " Gardeners World" Lisa Greene in Mid Ocean News (weekly)
- guest speakers: farmers, landscape architects, nursery managers, government and Cooperation of Hamilton specialists(managers of roundabouts, sidewalk gardens etc)
- visits: parks, roundabouts, hotel gardens etc
- Materials list: orchids; roses; bonsai; selection of ferns and indoor plants; bulbs, corms and tubers of lilies, narcissi, freesias etc

GLOSSARY:

- refer text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

- investigate growth of houseplants under different environmental conditions
- design and execute an environmental border
- research the viability of a small business producing cut flowers in Bermuda

REFERENCES - TEACHER:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.

CORD Applications in Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.

Acquaah, George, Horticulture: Principles and Practices. New Jersey: Prentice-Hall, 1999.

Collett, Jill, Bermuda Her Plants and Gardens. 1609 – 1850 London: MacMillan Publishers Ltd. and Bermuda National Trust , 1987.

Phillips-Watlington, Christine, Bermuda's Botanical Wonderland. A Field Guide London: MacMillan Ltd. 1996.

Smith, Louisa, Hutchings, Bermuda's Oldest Inhabitants: Tales of Plant Life. London: J Salmon Ltd. 1982.

Lennox, G.W. and Seddon, S.A. Trees of the Caribbean, the Bahamas and Bermuda. London: MacMillan Education Ltd. 1980.

Whitney, Christine, ed. The Bermuda Garden. Bristol: Mardon and Son and Hall Ltd. 1955.

REFERENCES - STUDENT:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.

CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.

SCIENCE

Course Title: HORTICULTURE

Module Title: The Small Fruit Garden

Number of Periods: 10 double periods

Sequence Reference: SC3150HOR-G

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.5 Nature and History of Science
- 2.1 - 2.5, 2.8 Scientific Inquiry
- 3.2, 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus

- Change
- Cause and Effect
- System
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- be aware of the biological importance of fruit in plant reproduction
- select appropriate fruits for Bermuda's climate
- explore cultural practices as they relate to the fruit garden
- practice grafting and other methods of citrus propagation
- research alternative fruits for the commercial fruit growers
- devise a quarantine system for new plants introduced to Bermuda
- research the history of fruit growing in Bermuda

Content Detail:

- review of biology of sexual plant reproduction
- Bermuda fruit crops: citrus, strawberries, loquats, surinam cherries
- location of fruit garden: temperature, light, water, drainage, soil
- propagation: grafting, budding and by seed
- alternative fruits suitable for Bermuda
- history of fruit growing in Bermuda: Fruit Growers Society

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  - teacher observation, presentation – project/demonstration, posters/essays/etc., portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations, graphing, using SI units
- reporting observations accurately
- using technology: calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- Dept. of Agriculture & Fisheries library and newsletter
- newspaper articles including " Gardeners World" Lisa Greene in Mid Ocean News (weekly)
- guest speakers: farmers, nursery managers, Department of Agriculture and Fisheries Experimental Fruit Garden, botanists (Dept of Agriculture)

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS

- investigate growth of common fruits (loquat and cherry) under different environmental conditions
- investigate the viability of other fruit crops in Bermuda (use data from experimental fruit garden)
- research the viability of a small business producing fruit in Bermuda

REFERENCES - TEACHER:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.
CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.
Acquaah, George, Horticulture: Principles and Practices. New Jersey: Prentice-Hall, 1999.
Collett, Jill, Bermuda Her Plants and Gardens. 1609 – 1850 London: MacMillan Publishers Ltd. and Bermuda National Trust , 1987.
Phillips-Watlington, Christine, Bermuda's Botanical Wonderland. A Field Guide London: MacMillan Ltd. 1996.
Smith, Louisa, Hutchings, Bermuda's Oldest Inhabitants: Tales of Plant Life. London: J Salmon Ltd. 1982.
Lennox, G.W. and Seddon, S.A. Trees of the Caribbean, the Bahamas and Bermuda. London: MacMillan Education Ltd, 1980.
Whitney, Christine, ed. The Bermuda Garden. Bristol: Mardon and Son and Hall Ltd. 1955.

REFERENCES - STUDENT:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.
CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.

SCIENCE

Course Title: HORTICULTURE

Module Title: Endemic Plants

Number of Periods: 10 double periods

Sequence Reference: SC3150HOR-H

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1- 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1 - 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus

- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- differentiate between native and introduced flora
- identify the endemic plants and the need to preserve them
- describe the development of endemic and native flora of Bermuda as a result of being an oceanic island
- explore and devise strategies to prevent introduced plants form escaping and affecting the endemic plants
- understand the historical and environmental significance of cedar blight and how resistant strains were found
- be aware of medicinal uses of plants in Bermuda

Content Detail:

- endemic plants: vs. native and introduced
- identification; on an oceanic island
- Bermuda cedar, palmetto, olivewood, snowberry, Darrell's fleabane, sedge, Bermuda bean, Bermuda spike rush, Bermuda maidenhair fern, Bermuda shield fern, Bermudiana
- propagate and plant endemic trees
- raise awareness and publicize "How to Plant Endemic Species"
- medicinal use of plants

Module Evaluation:

- **Performance Assessments:**
  - laboratory investigations, activities, skills tests, observations
- **Product Assessments:**
  -teacher observation, presentation – project/demonstration, posters/essays/etc., portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations, graphing, using SI units
- reporting observations accurately
- using technology: calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- Dept. of Agriculture & Fisheries library and newsletter
- newspaper articles including " Gardeners World" Lisa Greene in MidOcean News (weekly)
- guest speakers/ site visits: Department of Agricultural and Fisheries, Botanical Society
- site visits: Tulo Valley Nursery, Nonsuch Island, Paget Marsh, Bermuda National Trust

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:
- present a report on the reforestation of Nonsuch Island
- prepare seedlings and propagate cedar and olivewood bark

REFERENCES - TEACHER:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.
CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.
Acquaah, George, Horticulture: Principles and Practices. New Jersey: Prentice-Hall, 1999.
Collett, Jill, Bermuda Her Plants and Gardens. 1609 – 1850 London: MacMillan Publishers Ltd and Bermuda National Trust, 1987.
Phillips-Watlington, Christine, Bermuda's Botanical Wonderland. A Field Guide London: MacMillan Ltd. 1996.
Smith, Louisa, Hutchings, Bermuda's Oldest Inhabitants: Tales of Plant Life. London: J Salmon Ltd. 1982.
Lennox, G.W. and Seddon, S.A. Trees of the Caribbean, the Bahamas and Bermuda. London: MacMillan Education Ltd. 1980.
Whitney, Christine, ed. The Bermuda Garden. Bristol: Mardon and Son and Hall Ltd. 1955.

REFERENCES - STUDENT:

Reiley, H. Edward and Shry, Carrol, Introductory Horticulture. New York: Delmar Publishers, 1991.
CORD Applications In Biology/Chemistry, Plant Growth and Reproduction. Texas: CORD, 1997.

Marine Science

Course Code: SC3160MAR

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Marine Science | **4 credit (s)** **120 hour (s)**

Prerequisite (s): Science II | **S3 level (s)**

Course Code: SC3160MAR | ☐ **required or** ☒ **elective**

Course Description

This course is intended to be an integrated study of marine habitats. An integrated approach to science will be used using the ocean around us. Topics covered included the geology of the ocean, the ecology and biology of the reef, waves and ocean chemistry. Application will be made of these topics to current issues.

Course Requirements

The requirements for this course are as follows:

Product Assessments: - laboratory investigations/activities - laboratory skills tests, observations, debates, discussions, interviews - rubrics are provided for scoring	**20%**
Product Assessments: - chapter assignments, short quizzes, reports, data analysis, posters/collages, models, games, portfolios, etc. - rubrics are provided for scoring	**20%**
Written Assessments: Written tests should be based on content cited in modules. The weighting for each module test is shown in the course outline. Written tests should consist of a variety of assessment components including: • multiple choice questions (not greater than 20 % of the test total) • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions	**20%**
Field Study	**10%**
Final Assessment	**30%**
Total	**100%**

Course Resources

The Bermuda Zoological Society. The Sandy Shore – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society The Rocky Coast - Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society. The Mangroves – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society. The Eco File – Project Nature Information Documents. The Bermuda Zoological Society, 1991.

Thomas, Martin L.H. and Logan, Alan. A Guide to the Ecology of Shoreline and Shallow Water Marine Communities of Bermuda. St. Georges, Bermuda: Bermuda Biological Station, 1999.

Sterrer, Wolfgang eds. Marine Fauna and Flora of Bermuda Life Bermuda London: John Wiley & Sons, 1986.

Sumich, James: An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael: Marine Biology. New York: McGraw- Hill Companies, 2000.

Maton, Anthea et al. Exploring Earth Science New Jersey: Prentice Hall, 1997.

Course Outline

Module Title	Double Periods	Module Title	Double Periods
A. The Ocean Floor - geographical features - abiotic factors - habitats	5	**B. Waves and Tides** - tidal movements - wave dynamics - major ocean currents - depositions, erosions and abrasions - importance of currents	10
C. Origin and Composition of Oceans - formation - composition of sea water - water cycle - pollution	10	**D. Reefs** - types of reefs - biology of coral - conservation	10
E. Harrington Sound - Marine Habits - Seagrass Beds	10	**F. Fisheries and Plankton** - lobsters - conchs - scallops - groupers - plankton	10
G. Mangroves - location - biology of mangrove tree - importance	10	**H. Bermuda Ponds** - marine - freshwater - brackish	10

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check one: S1 ☐ S2 ☐ S3 ☒ S4 ☐

Marine Science

	GOALS		SUBGOALS	MODULE & CURRICULUM CORRELATION MATRIX							
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity	x	x	x	x	x	x	x	x
		1.2	Connections	x	x	x	x	x		x	x
		1.3	Health				x		x		
		1.4	Inter-relationship/Mathematics Science Technology	x	x	x	x	x		x	x
		1.5	Problem Solving	x	x	x	x				
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis		x	x	x	x	x	x	x
		2.2	Design		x	x	x	x	x	x	x
		2.3	Data Collection		x	x	x	x	x	x	x
		2.4	Technology Use	x	x	x	x	x	x	x	x
		2.5	Explanations/limitation	x	x	x	x	x	x	x	x
		2.6	Explanations/alternatives	x		x	x	x	x	x	x
		2.7	Communications/Results	x		x	x	x	x	x	x
		2.8	Research	x		x	x	x	x	x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science	x	x		x				
		3.2	Value, Environment	x	x		x	x	x	x	x
		3.3	Ethical, Applications	x	x	x					
		3.4	Career options	x	x			x	x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship		x	x					
		4.2	Environmental Applications			x		x	x	x	x
	CONTENT STRUCTURE		Change	x	x	x	x	x	x	x	x
			Cause & Effect	x	x	x	x	x	x	x	x
			Systems	x	x	x	x	x	x	x	x
			Life Science	x				x		x	x
			Physical Science	x		x	x	x			
			Earth and Space Science	x	x	x	x				
			MODULE	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**

MODULE KEY

A - The Ocean Floor
B - Waves and Tides
C - Origin and Composition of Oceans
D - Reefs
E - Harrington Sound
F - Fisheries and Plankton
G - Mangroves
H - Bermuda Ponds

SCIENCE

Course Title: MARINE SCIENCE

Module Title: The Ocean Floor

Number of Periods: 5 double periods

Sequence Reference: SC3160MAR-A

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.4 ,1.5 Nature and History of Science
- 2.4-2.8 Scientific Inquiry
- 3.1-3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science
- Physical Science
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- identify the oceanic zones
- describe the major features of the ocean floor

Content Detail:

- intertidal, neritic, open-sea, bathyal,
- abyssal zones
- topography of ocean floor
- mapping the ocean floor
- geographical features
- abiotic factors
- habitats

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- libraries: DOE Resource Centre, BBSR, BAMZ
- Resource Centre (laser discs, videos, software, etc.)
- newspaper, magazine articles
- site visits: BUEI, BAMZ, BBSR, Bermuda Maritime Museum
- cross curricular connections: mathematics problem-solving, language arts
- websites: refer to next page

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

WEBSITES for Marine Biology

BUEI	www.buei.bm
BAMZ	www.bamz.org
BBSR	www.bbsr.edu
Dolphin Quest	www.dolphinquest.org
JASON	www.jason.org

REFERENCES - TEACHER:

The Bermuda Zoological Society, The Sandy Shore – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Rocky Coast - Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Mangroves – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Eco File – Project Nature Information Documents. The Bermuda Zoological Society, 1991.

Thomas, Martin L.H. and Logan, Alan, A Guide to the Ecology of Shoreline and Shallow Water Marine Communities of Bermuda. St. Georges, Bermuda: Bermuda Biological Station, 1999.

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw-Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science. New Jersey: Prentice Hall, 1997.

REFERENCES - STUDENT:

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw- Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science New Jersey: Prentice Hall, 1997.

SCIENCE

Course Title: MARINE SCIENCE

Sequence Reference: SC3160MAR-B

Module Title: Waves and Tides

Number of Periods: 10 double periods

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1,1.2, 1.4, 1.5 Nature and History of Science
- 2.1 - 2.5 Scientific Inquiry
- 3.1 - 3.5 Positive Attitudes
- 4.1 - 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- describe the characteristics and causes of waves
- describe the characteristics and causes of tides
- describe the effects of wave action on the land
- investigate the effects of erosion.
- distinguish between surface currents and deep currents
- identify the major ocean currents
- explain the importance of currents

Content Detail:

- tidal movements
- wave dynamics
- depositions
- erosions, abrasions
- surface currents e.g. the Gulf Stream
- deep currents and upwellings
- El Nino
- the water cycle
- productivity levels of ocean zones

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- libraries: refer to module A
- Department of Education Resource Centre (laser discs, videos, software)
- newspaper, magazine articles
- site visits: BAMZ classes
- guest speakers: laboratory technicians – medical, agriculture & fisheries; bio-diversity project team
- cross curricular connections: mathematics
- websites: refer to module A

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

The Bermuda Zoological Society, The Sandy Shore – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Rocky Coast - Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Mangroves – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Eco File – Project Nature Information Documents. The Bermuda Zoological Society, 1991.

Thomas, Martin L.H. and Logan, Alan, A Guide to the Ecology of Shoreline and Shallow Water Marine Communities of Bermuda. St. Georges, Bermuda: Bermuda Biological Station, 1999.

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw-Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science. New Jersey: Prentice Hall, 1997.

REFERENCES - STUDENT:

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw- Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science New Jersey: Prentice Hall, 1997.

SCIENCE

Course Title: MARINE SCIENCE

Module Title: Origin and Composition of Oceans

Number of Periods: 10 double periods

Sequence Reference: SC3160MAR-C

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.3,1.4, 1.5 Nature and History of Science
- 2.1 – 2.8 Scientific Inquiry
- 3.3 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus

- Change
- Cause and Effect
- Earth Science

Curriculum Objectives:

At the end of this module, students will:

- describe the composition and characteristics
- of ocean water
- explain what is meant by salinity
- describe the water cycle
- discuss the effects of pollution in the oceans

Content Detail:

- major elements in ocean water
- causes of salt deposition in ocean water
- variations in salinity
- illustrated account of the water cycle
- pollutants in the ocean, cause and effects
- ocean resources

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- libraries: see module A
- Department of Education Resource Centre (laser discs, videos, software)
- newspaper, magazine articles,
- site visits: BBSR, BAMZ, BUEI
- cross curricular connections: mathematics, design and technology and food and nutrition
- websites: refer to module A

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

The Bermuda Zoological Society, The Sandy Shore – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Rocky Coast - Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Mangroves – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Eco File – Project Nature Information Documents. The Bermuda Zoological Society, 1991.

Thomas, Martin L.H. and Logan, Alan, A Guide to the Ecology of Shoreline and Shallow Water Marine Communities of Bermuda. St. Georges, Bermuda: Bermuda Biological Station, 1999.

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw-Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science. New Jersey: Prentice Hall, 1997.

REFERENCES - STUDENT:

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw- Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science New Jersey: Prentice Hall, 1997.

SCIENCE

Course Title: MARINE SCIENCE	**Sequence Reference:** SC3160MAR-D
Module Title: Reefs	
Number of Periods: 10 double periods	

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1 - 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1 - 3.5 Positive Attitudes
- 4.1, 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Earth Science
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- identify different reefs based on their structure
- evaluate the protection each reef provides to the island
- distinguish the organisms of each reef
- describe the different types of coral on Bermuda's reefs

Content Detail:

- platform margin reef
- lagoon reefs
- inshore reefs
- coral

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- libraries: refer to module A
- Department of Education resource centre (laser discs, videos, software)
- newspaper, magazine articles
- site visits: BBSR, BAMZ, BUEI
- cross curricular connections: design and technology and mathematics

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

The Bermuda Zoological Society, The Sandy Shore – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Rocky Coast - Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Mangroves – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Eco File – Project Nature Information Documents. The Bermuda Zoological Society, 1991.

Thomas, Martin L.H. and Logan, Alan, A Guide to the Ecology of Shoreline and Shallow Water Marine Communities of Bermuda. St. Georges, Bermuda: Bermuda Biological Station, 1999.

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw-Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science. New Jersey: Prentice Hall, 1997.

REFERENCES - STUDENT:

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw- Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science New Jersey: Prentice Hall, 1997.

SCIENCE

Course Title: MARINE SCIENCE	**Sequence Reference:** SC3160MAR-E
Module Title: Harrington Sound	**Senior School Level**
Number of Periods: 10 double periods	

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.4 Nature and History of Science
- 2.1 - 2.7 Scientific Inquiry
- 3.2, 3.4 Positive Attitudes
- 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- discuss how water moves in Harrington Sound
- classify the adaptations of organisms in Harrington Sound

Content Detail:

- water movement of Harrington Sound
- marine habitats
- seagrass beds

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- newspaper, magazine articles
- libraries: refer to module A
- resource centre (laser discs, videos, software, etc.)
- site visits: island Reefs, BBSR., BAMZ North Rock Tank
- cross curricular connections: geography, mathematics

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS ACTIVITIES & PROJECTS:

REFERENCES – TEACHER:

The Bermuda Zoological Society, The Sandy Shore – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Rocky Coast - Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Mangroves – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Eco File – Project Nature Information Documents. The Bermuda Zoological Society, 1991.

Thomas, Martin L.H. and Logan, Alan, A Guide to the Ecology of Shoreline and Shallow Water Marine Communities of Bermuda. St. Georges, Bermuda: Bermuda Biological Station, 1999.

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw-Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science. New Jersey: Prentice Hall, 1997.

REFERENCES – STUDENT:

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw- Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science New Jersey: Prentice Hall, 1997.

SCIENCE

Course Title: MARINE SCIENCE

Module Title: Fisheries and Plankton

Number of Periods: 10 double periods

Sequence Reference: SC3160MAR-F

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.4 Nature and History of Science
- 2.1 – 2.8 Scientific Inquiry
- 3.2, 3.4 Positive Attitudes
- 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- contrast the life cycles, anatomy and habits of lobsters, conchs, scallops and groupers
- evaluate the role of the lobsters, conchs, scallops and groupers to the Bermuda fisheries industry
- describe the type of plankton found in Bermuda

Content Detail:

- lobsters
- conchs
- scallops
- groupers
- plankton

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessment:**
  - tests and quizzes (multiple choice/written)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc.
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- newspaper, magazine articles
- library information centre
- resource centre (laser discs, videos, software, etc.)
- site visits Coney Island Agriculture and Fisheries
- guest speakers: fisheries officers, fishermen
- cross curricular connections: geography, mathematics
- web sites: refer to module A

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

The Bermuda Zoological Society, The Sandy Shore – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Rocky Coast - Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Mangroves – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Eco File – Project Nature Information Documents. The Bermuda Zoological Society, 1991.

Thomas, Martin L.H. and Logan, Alan, A Guide to the Ecology of Shoreline and Shallow Water Marine Communities of Bermuda. St. Georges, Bermuda: Bermuda Biological Station, 1999.

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Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw-Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science. New Jersey: Prentice Hall, 1997.

REFERENCES - STUDENT:

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw- Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science New Jersey: Prentice Hall, 1997.

SCIENCE

Course Title: MARINE SCIENCE

Module Title: Mangroves

Number of Periods: 10 double periods

Sequence Reference: SC3160MAR-G

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.4 Nature and History of Science
- 2.1 - 2.7 Scientific Inquiry
- 3.2, 3.4 Positive Attitudes
- 4.2 Advocate for Environment

Content Focus

- Change
- Cause and Effect
- Systems
- Life Science

Curriculum Objectives:

At the end of this module, students will:

- illustrate the mangrove environment
- devise a proposal for the protection of Bermuda's mangrove population
- describe uses of the mangrove and its adaptations

Content Detail:

- location
- types in Bermuda
- importance

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written)

Prerequisite Skill Areas (if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources (materials, equipment & community involvement):

- newspaper, magazine articles
- libraries: see module A
- resource centre (laser discs, videos, software, etc.)
- guest speakers: Park Rangers and Agricultural and Fisheries
- cross curricular connections: geography, mathematics

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

The Bermuda Zoological Society, The Sandy Shore – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Rocky Coast - Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Mangroves – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Eco File – Project Nature Information Documents. The Bermuda Zoological Society, 1991.

Thomas, Martin L.H. and Logan, Alan, A Guide to the Ecology of Shoreline and Shallow Water Marine Communities of Bermuda. St. Georges, Bermuda: Bermuda Biological Station, 1999.

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw-Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science. New Jersey: Prentice Hall, 1997.

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Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw- Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science New Jersey: Prentice Hall, 1997.

SCIENCE

Course Title: MARINE SCIENCE	**Sequence Reference:** SC3160MAR-H
Module Title: Bermuda Ponds	**Senior School Level**
Number of Periods: 10 double periods	S1 ☐ S2 ☐ S3 ☒ S4 ☐

Subgoal Emphasis:	**Content Focus**
• 1.1, 1.2, 1.4 Nature and History of Science • 2.1 - 2.7 Scientific Inquiry • 3.2, 3.4 Positive Attitudes • 4.2 Advocate for Environment	• Change • Cause and Effect • Systems • Earth Science

Curriculum Objectives:	**Content Detail:**
At the end of this module, students will: • identify the location of the different ponds in Bermuda • contrast the ways these ponds are different and habitats they support • justify the methods of protectionism for ponds by the Department of Planning	• marine • fresh • brackish • planning restrictions

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written)

Prerequisite Skill Areas (if any):	**Special Resources (materials, equipment & community involvement):**
• using scientific nomenclature, symbols, formulas etc • using appropriate apparatus safely and measuring accurately • using simple arithmetic operations and algebraic procedures, graphing, using SI units • reporting observations accurately • using technology: scientific calculator, computer applications, accessing websites	• newspaper, magazine articles • libraries: see module A • resource centre (laser discs, videos, software, etc.) • site visits BBSR and BAMZ • cross curricular connections: geography, mathematics, art, foreign language (cultures) • websites: see module A

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

The Bermuda Zoological Society, The Sandy Shore – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Rocky Coast - Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Mangroves – Project Nature Field Study Guide. The Bermuda Zoological Society, 1991.

The Bermuda Zoological Society, The Eco File – Project Nature Information Documents. The Bermuda Zoological Society, 1991.

Thomas, Martin L.H. and Logan, Alan, A Guide to the Ecology of Shoreline and Shallow Water Marine Communities of Bermuda. St. Georges, Bermuda: Bermuda Biological Station, 1999.

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

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REFERENCES - STUDENT:

Sterrer, Wolfgang, eds. Marine Fauna and Flora of Bermuda Life Bermuda. London: John Wiley & Sons, 1986.

Sumich, James, An Introduction to the Biology of Marine Life. New York: McGraw Hill Companies, 1999.

Castro, Peter and Huber, Michael, Marine Biology. New York: McGraw- Hill Companies, 2000.

Maton, Anthea, et al. Exploring Earth Science New Jersey: Prentice Hall, 1997.

Physics I

Course Code: SC3171PHY

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Physics I — **4 credit (s)**, **120 hour (s)**

Prerequisite (s): Science II — **S3 level (s)**

Course Code: SC3171PHY — ☐ **required or** ☒ **elective**

Course Description

This course is designed to provide students with a sound foundation of principles and techniques of physics. It builds upon concepts developed in physical science modules of Science I and Science II. It is a prerequisite for Physics II and is recommended for students who wish to study sciences, engineering and mathematics at the college level. Opportunities for careers in physics will be presented. An S3 mathematics course is strongly recommended.

Course Requirements

The requirements for this course are as follows:

Performance Assessments: - laboratory investigations/activities - laboratory skills tests, observations - rubrics are provided for scoring.	**30%**
Product Assessments: - project (research, extended investigation, additional physics topic) **10%** - chapter assignments, reports, data analysis, models, portfolios, etc **10 %** - rubrics are provided for scoring.	**20%**
Written Assessments: Written tests should be based on content cited in modules. The weighting for each module test is shown in the course outline. Written tests should consist of a variety of assessment components including: • multiple choice questions (not greater than 20 % of the test total) • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions	**20%**
Final Assessment:	**30%**
Total:	**100%**

Course Resources

Zitzewitz, Paul, Physics Principles and Problems. New York: Glencoe McGraw-Hill, 1999.
Pople, S. Complete Physics. New York: Oxford University Ross, 1999.
Pople, S. and Whitehead, P. Coordinated Science: Physics: New York: Oxford University Press, 1999.
Bethel, George, Coordinated Science Teachers' Guide: Physics. New York: Oxford University Press, 1999.
Kirkpatrick and Wheeler, Physics: A World View. New York: Sanders Publishing, 1995.
Serway, R. and Faughn J. Physics. New York: Holt, Rinehart and Winston, 1999.
Ellse, M. and Honeywell, C. Mechanics and Electricity. London: Thomas Nelson and Sons, 1999.
Ellse, M. and Honeywell, C. Matter and Waves. London: Thomas Nelson and Sons, 1999.
Ellse, M. and Honeywell, C. Thermal Physics. London: Thomas Nelson and Sons, 1999.
Ellse, M. and Honeywell, C. Fields. London: Thomas Nelson and Sons, 1999.

Course Outline

Module Title	# Double Periods	Module Title	# Double Periods
A. Measurement	10	**B. Motion**	15
- SI units - scientific notation - uncertainty in measurement		- velocity and acceleration - vectors - projectile motion - momentum	
C. Forces	15	**D. Pressure**	10
- force and motion - balanced forces - Newton's Laws of motion - Hooke's law		- density - fluid pressure	
E. Energy, Work, Power	10	**F. Thermodynamics and Molecular Motion**	15
- kinetic and potential energy - power - machine		- forms of energy - conservation of energy - thermal energy - gas laws	

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check one: S1 ☐ S2 ☐ S3 ☒ S4 ☐

Physics I

GOALS		SUBGOALS		MODULE & CURRICULUM CORRELATION MATRIX					
1	Conceptualizing the History and Nature of Science	1.1	Contribution/Diversity	x	x	x	x	x	x
		1.2	Connections	x	x	x	x	x	x
		1.3	Health				x		
		1.4	Inter-relationship/Mathematics Science Technology	x	x	x	x	x	x
		1.5	Problem Solving	x	x	x	x	x	x
2	Demonstrating Nature of Scientific Inquiry	2.1	Hypothesis	x	x	x	x	x	x
		2.2	Design	x	x	x	x	x	x
		2.3	Data Collection	x	x	x	x	x	x
		2.4	Technology Use	x	x	x	x	x	x
		2.5	Explanations/limitation	x	x	x	x	x	x
		2.6	Explanations/alternatives	x	x	x	x	x	x
		2.7	Communications/Results	x	x	x	x	x	x
		2.8	Research	x	x	x	x	x	x
3	Demonstrating Positive Attitudes Towards Science	3.1	Present use of Science		x	x	x	x	x
		3.2	Value, Environment		x	x	x	x	
		3.3	Ethical, Applications			x	x	x	x
		3.4	Career options	x	x	x	x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship		x		x	x	
		4.2	Environmental Applications		x		x	x	x
CONTENT STRUCTURE		Change		x	x	x	x	x	x
		Cause & Effect			x	x	x	x	x
		Systems		x	x	x	x	x	x
		Life Science							
		Physical Science		x	x	x	x	x	x
		Earth and Space Science							
		MODULE		**A**	**B**	**C**	**D**	**E**	**F**

MODULE KEY

A - Measurements
B - Motion
C - Forces
D - Pressure
E - Energy
F - Thermo Dynamics and Molecular Motion

SCIENCE

Course Title: PHYSICS I

Module Title: Measurement

Number of Periods: 10 double periods

Sequence Reference: SC3171PHY-A

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1, 1.2, 1.3, 1.5 Nature and History of Science
- 2.4 - 2.8 Scientific Inquiry
- 3.4 Positive Attitudes

Content Focus:

- Change
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- use SI units
- convert measurements into scientific notation
- distinguish between accuracy and precision
- use significant figures in measurements and calculations
- interpret data in tables and graphs
- use dimensional analysis to check the validity of expressions

Content Detail:

- SI units
- length, mass, time and volume
- scientific notation
- prefixes
- accuracy and precision
- significant digits
- graphing data
- dimensional analysis

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc.
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- library information center, resource center (print materials, laser discs, videos, software, etc.)
- site visits: engineering firm, architectural firm, BELCO, Cable and Wireless, Bermuda Weather Service
- cross curricular connections: mathematics, biology, chemistry
- career focus: science teacher, engineer, meteorologist
- websites : see next page

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

WEBSITES

http://www.schoolnet.ca/math/sci
http://www.pacificnet.net/~mandel/
http://www.imsa.edu/edu/
http://www.energy.ca.gov/education/story/story-htm/chapter02.html
http://www.miamisci.org/af/sln/frankenstein/safety.html
http://schoolnet2.carleton.ca/english/math_sci/phys/electric_club/
http://phys.udallas.edu/

REFERENCES - TEACHER:

Zitzewitz, Paul, Physics Principles and Problems. New York: Glencoe McGraw-Hill, 1999.
Pople, S. Complete Physics. New York: Oxford University Ross, 1999.
Pople, S. and Whitehead, P. Coordinated Science: Physics: New York: Oxford University Press, 1999.
Bethel, George, Coordinated Science Teachers' Guide: Physics. New York: Oxford University Press, 1999.
Kirkpatrick and Wheeler, Physics: A World View. New York: Sanders Publishing, 1995.
Serway, R. and Faughn J. Physics. New York: Holt, Rinehart and Winston, 1999.
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Ellse, M. and Honeywell, C. Fields. London: Thomas Nelson and Sons, 1999.

REFERENCES – STUDENT:

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Pople, S. Complete Physics. New York: Oxford University Ross, 1999.
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SCIENCE

Course Title: PHYSICS I	**Sequence Reference:** SC3171PHYS-B
Module Title: Motion	**Senior School Level**
Number of Periods: 15 double periods	S1 ☒ S2 ☐ S3 ☐ S4 ☐

Subgoal Emphasis:

- 1.1, 1.2, 1.4 -1.6 Nature and History of Science
- 2.4 - 2.8 Scientific Inquiry
- 3.1-3.2, 3.4 Positive Attitudes
- 4.1 Advocate for the Environment

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- describe motion in terms of displacement, time, velocity, and changing velocity
- calculate the velocity of an object traveling at a known velocity for a specific time interval
- construct and interpret motion graphs
- apply the kinematic equations of motion to calculate distance, time, or velocity at constant acceleration,
- distinguish between scalars and vectors
- associate weight with the pull of earth on a body
- calculate the acceleration of free fall
- recognize projectile motion (parabolic path)
- use equations of motion to solve projectile motion problems
- define momentum
- use the principle of the conservation of momentum to predict the results of collisions and explosions
- use and represent physical principles involved in the study of motion to situations that may or may not be familiar

Content Detail:

- velocity and acceleration
  - free fall
  - kinematics (equations of motion) including freely falling objects
  - ticker tapes
  - reference frames
- motion graphs
- vectors
  - vs. scalars
  - magnitude
  - direction
  - parallel and perpendicular
  - resolving
- Circular Motion
  - centripetal force
  - centrifugal force
  - reference frames
- Newton's Laws (1^{st}, 2^{nd}, 3^{rd})
- Momentum: law of conservation of momentum, collisions, explosions and impulse

Module Evaluation:

- **Performance Assessments:**
  - checklists/inventories, laboratory activities, teacher observation, interviews, debates
- **Product Assessments:**
  - data handling (statistics), surveys and reports, posters, models, poems and essays, portfolio assessment: journal, sample works
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas (if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing website Skills

Special Resources (materials, equipment & community involvement):

- library information center, resource Centre (print materials, laser discs, videos, software, etc.)
- newspaper, magazine articles
- site visits/guest speakers: auto mechanic, surveyor, engineer, aeroplane pilot
- cross curricular connections: mathematics problem-solving, language arts
- websites: see module A

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Zitzewitz, Paul, Physics Principles and Problems. New York: Glencoe McGraw-Hill, 1999.
Pople, S. Complete Physics. New York: Oxford University Ross, 1999.
Pople, S. and Whitehead, P. Coordinated Science: Physics: New York: Oxford University Press, 1999.
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Kirkpatrick and Wheeler, Physics: A World View. New York: Sanders Publishing, 1995.
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Serway, R. and Faughn J. Physics. New York; Holt, Rinehart and Winston, 1999.

SCIENCE

Course Title: PHYSICS I

Module Title: Force

Number of Periods: 15 double periods

Sequence Reference: SC3171PHY-C

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Subgoal Emphasis:

- 1.1 - 1.5 Nature and History of Science
- 2.4 - 2.8 Scientific Inquiry
- 3.1-3.4 Positive Attitudes

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- use forces measured in newtons
- define a force and identify various forces
- calculate for two or more vectors the magnitude and direction of resultant vector
- resolve vectors into components
- explain how force affects the motion of objects
- interpret and construct free-body diagrams
- demonstrate concepts of force, mass and acceleration using dynamics trolleys
- apply Newton's laws of motion to the movement of vehicles and animals on or above the earth's surface
- calculate the moment of a force
- demonstrate that the weight of an object acts through its center of gravity
- use the principle of moments
- demonstrate that two equal and opposite parallel forces not acting at a point cause rotation of the object
- investigate Hooke's law and draw and interpret force extension graphs
- apply the physical principles involved in the study of force to situations or devices that may or may not be familiar

Content Detail:

- types of forces
- - weight
  - contact forces
  - electromagnetic forces
- measurement of force
  - Newton (1kg m/s^2)
  - resultant
  - parallel
  - perpendicular
  - components (resolving forces)
- turning effect
  - moments
  - couples
  - center of gravity
  - states of equilibrium
- effects of force on motion
  - use of dynamics carts
  - Newton's laws
  - $a \alpha f$
  - $a \alpha 1/m$
- Hooke's Law: elastic limit, force extension graphs

Module Evaluation:

- **Performance Assessments:** checklists/inventories, laboratory activities, teacher observation, interviews, debates
- **Product Assessments:** data handling (statistics), surveys, reports, posters, models, poems and essays
  -portfolio assessment: personal journal, sample works
- **Written Assessments:** quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- library information center, DOE Resource Center pint material, laser discs, videos, software, etc.)
- site visits/ guest speakers: pilot, engineer, police service (detectives, Scenes of Crime officers)
- cross curricular connections: mathematics problem-solving, language arts
- websites : see module A

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Zitzewitz, Paul, Physics Principles and Problems. New York: Glencoe McGraw-Hill, 1999.
Pople, S. Complete Physics. New York: Oxford University Ross, 1999.
Pople, S. and Whitehead, P. Coordinated Science: Physics: New York: Oxford University Press, 1999.
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Kirkpatrick and Wheeler, Physics: A World View. New York Sanders Publishing, 1995.
Serway, R. and Faughn J. Physics. New York; Holt, Rinehart and Winston, 1999.

SCIENCE

Course Title: PHYSICS I	**Sequence Reference:** SC3171PHY-D
Module Title: Pressure	
Number of Periods: 10 double periods	

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Goal and Subgoal Emphasis:

- 1.1 – 1.5 Nature and History of Science
- 2.4 - 2.8 Scientific Inquiry
- 3.1, 3.3, 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- define density
- investigate the relationship between temperature change and the expansion and contraction of substances
- define pressure
- appreciate that the pressure at a point in a liquid or gas acts equally in all directions
- illustrate how the pressure at a point in a liquid or gas depends on depth and density
- demonstrate the relationship between atmospheric pressure and height
- apply physical principles involved in the study of pressure to situations that may or may not be familiar

Content Detail:

- terms and definitions: density, mass, volume, expansion, contraction, pressure, Pascal
- temperature change and expansion; peculiar expansion of water
- pressure = force/area
- density = mass/volume
- weight = m x g
- pressure in fluids
- atmospheric pressure
- application of pressure
  - hydrometer
  - mercury barometer
  - manometer
  - blood pressure
  - hydraulic machines
  - flow rate
- floating and sinking
  - up thrust
  - Archimedes' Principle
  - law of flotation
  - viscosity
- Bernoulli effect

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols, formulas etc.
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- library information center, DOE resource center (print materials, laser discs, videos, software, etc.)
- site visits: engineering firm, BELCO, Cable and Wireless, Bermuda Weather Service
- cross curricular connections: mathematics, biology, chemistry
- websites: see module A

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Zitzewitz, Paul, Physics Principles and Problems. New York: Glencoe McGraw-Hill, 1999.
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Serway, R. and Faughn J. Physics. New York; Holt, Rinehart and Winston, 1999.

SCIENCE

Course Title: PHYSICS I

Module Title: Energy, Work, Power

Number of Periods: 10 double periods

Sequence Reference: SC3171PHY-E

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Goal and Subgoal Emphasis:

- 1.1 – 1.5 Nature and History of Science
- 2.4 – 2.8 Scientific Inquiry
- 3.1 – 3.4 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- identify several forms of energy
- calculate kinetic energy for an object
- distinguish between kinetic and potential energy
- classify different types of potential energy
- calculate the potential energy associated with an object's position
- recognize the forms that conserved energy can take
- solve problems involving the efficiency of energy conversions
- define work
- define power
- relate the concepts of work, energy, time and power
- calculate power
- explain the effect of machines on work and power
- apply the physical principles involved in the study of energy to situations that may or may not be familiar

Content Detail:

- energy
  -elastic and gravitational
  - kinetic energy
  - mechanical energy, thermal energy, chemical energy, electrical energy, nuclear energy
- work and power
  - relationships with energy and time
  - calculations
  - units and measurement
- conservation of energy
- machines
  - simple machines (levers, gears, pulleys)
  - efficiency
  - mechanical advantage
  - velocity ratio
- pollution
- global warming

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/ written)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing website

Special Resources
(materials, equipment & community involvement):

- library information center, resource center print material, laser discs, videos, software, etc.)
- site visits/ guest speakers: engineers, architects, construction workers, BELCO technician, BELCO automechanics
- cross curricular connections: mathematics problem-solving, language arts, design technology
- websites: see module A

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Zitzewitz, Paul, Physics Principles and Problems. New York: Glencoe McGraw-Hill, 1999.
Pople, S. Complete Physics. New York: Oxford University Ross, 1999.
Pople, S. and Whitehead, P. Coordinated Science: Physics: New York: Oxford University Press, 1999.
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Kirkpatrick and Wheeler, Physics: A World View. New York: Sanders Publishing, 1995.
Serway, R. and Faughn J. Physics. New York: Holt, Rinehart and Winston, 1999.
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Serway, R. and Faughn J. Physics. New York; Holt, Rinehart and Winston, 1999.

SCIENCE

Course Title: PHYSICS I

Sequence Reference: SC3171PHY-F

Module Title: Thermodynamics and Molecular Motion

Senior School Level

S1	S2	S3	S4
☐	☐	☒	☐

Number of Periods: 15 double periods

Goal and Subgoal Emphasis:

- 1.1, 1.2, 1.4, 1.5 Nature and History of Science
- 2.4 – 2.8 Scientific Inquiry
- 3.1 – 3.5 Positive Attitudes
- 4.1, 4.2 Advocate for the Environment

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- appreciate that molecules and atoms are very small
- understand that the particles of a substance are constantly in motion
- appreciate and describe the relative spacing of particles in solids, liquids, and gases
- recognize the significance of Brownian motion
- understand the pressure is exerted on a surface because of the constant bombardment of the surface by many particle
- appreciate that particle motion ceases at absolute zero
- appreciate that the hotter a substance is, the more energy its particles will have
- appreciate that change in state is associated with changes in internal energy at constant temperature
- investigate specific heat capacity and latent heat
- investigate gas laws
- apply the physical principles involved in the study of molecular motion to situations that may or may not be familiar

Content Detail:

- kinetic theory
  - particles in solids, liquids and gases
  - Brownian Motion
  - pressure
  - absolute zero
- thermodynamics
  - internal energy
  - specific heat capacity
  - latent heat
  - energy transfer
- Gas Laws
  - Boyles' Law
  - Charles' Law
  - Pressure and Ideal Gas Laws

Module Evaluation:

- **Performance Assessments:**
  - laboratory activities, skills tests, checklists, debates/discussions, interviews
- **Product Assessments:**
  - chapter assignments, projects/demonstrations, posters/collages, reports portfolio, data collection/data analysis
- **Written Assessments:**
  - tests and quizzes (multiple choice/written)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, symbols formulas etc
- using appropriate apparatus safely and measuring accurately
- using simple arithmetic operations and algebraic procedures, graphing, using SI units
- reporting observations accurately
- using technology: scientific calculator, computer applications, accessing website

Special Resources
(materials, equipment & community involvement):

- library information center, resource Center pint material, laser discs, videos, software, etc.)
- site visits/ guest speakers: airconditioning and refrigeration companies, weather forecasters, plumbers, engineers
- cross curricular connections: mathematics problem-solving, language arts, chemistry
- websites: see module A

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

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Pople, S. Complete Physics. New York: Oxford University Ross, 1999.
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Physics II

Course Code: SC4122PHY

MINISTRY OF EDUCATION
Bermuda
2000

SENIOR SCHOOL SCIENCE
COURSE OVERVIEW

Title: Physics II — **4 credit (s)**, **120 hour (s)**

Prerequisite (s): Physics I, Integrated Mathematics II — **S4 level (s)**

Course Code: SC4122PHY — ☐ **required or** ☒ **elective**

Course Description

This is a college preparatory course intended for students who will study physics and related courses upon completion of senior school. Students will meet major concepts of physics and apply them to specific problems. The ability to understand simple algebraic, trigonometric and graphical relationships is essential to successful completion of this course. The laboratory component will stress science processes and skills and career opportunities will be highlighted. An individual project is a required part of the assessment in this senior course.

Course Requirements

The requirements for this course are as follows:

Performance Assessments: - laboratory investigations/activities - laboratory skills tests, teacher observations, debates, discussions, interviews - rubrics are provided for scoring	30%
Product Assessments: - project (research, extended investigation, additional physics topic) **10%** - chapter assignments, reports, data analysis, models, portfolios, etc. **10%** - rubrics are provided for scoring	20%
Written Assessments: Written tests should be based on content stated in modules. The weighting for each module test is shown in the course outline. Written tests should consist of a variety of assessment components including: • multiple choice questions (not greater than 20 % of the test total) • short answers (including situation or diagram set questions) • data analysis • interpreting science skills • critical thinking (contextual issues) & open-ended questions.	20%
Final Examination: Paper I compulsory (multiple choice and/or short answer) Paper II choice (structured questions, diagram or situation set questions, data analysis, essay etc.)	30%
Total	**100%**

Course Resources

Zitzewitz, Paul, Physics Principles and Problems. New York: Glencoe McGraw-Hill, 1999.
Pople, S. Complete Physics. New York: Oxford University Ross, 1999.
Kirkpatrick and Wheeler, Physics: A World View. New York Sanders Publishing, 1995.
Serway, R. and Faughn J. Physics. New York: Holt, Rinehart and Winston, 1999.
Ellse, M. and Honeywell, C. Mechanics and Electricity. London: Thomas Nelson and Sons, 1999.
Ellse, M. and Honeywell, C. Matter and Waves. London: Thomas Nelson and Sons, 1999.
Ellse, M. and Honeywell, C. Thermal Physics. London: Thomas Nelson and Sons, 1999.
Ellse, M. and Honeywell, C. Fields. London: Thomas Nelson and Sons, 1999.

Course Outline

Module Title | **# Double Periods**

A. Waves and Sound 8
- nature of waves
- wave properties
- wave equation
- Doppler effect

B. Light Reflection and Mirrors 6
- laws of reflection
- mirrors

C. Refraction and Lenses 8
- law of refraction
- prisms
- lens systems
- eye, camera, telescopes

D. Colour 3
- dispersion and refraction
- mixing colours and paint pigments

E. Electric Charge, Force and Fields 8
- leaf electroscope
- Coulomb's law
- electric fields

F. Electrical Potential Energy, Electrical Potential and Capacitance 8
- units of charge
- electrical potential formula
- capacitance equation
- production of electrical energy

G. Ohm's Law Series and Parallel Circuits 8
- ohm's law
- Kirchoff's laws

H. Power and Energy in Electric Circuits 5
- electric power
- electrical energy and potential energy

I. Electro magnetism 5
- magnetic field lines
- uses of electro magnets

J. Electric Motors, Meters and Electromagnetic Induction 8
- turning effect
- Faraday's law
- Fleming's right hand rule
- Lenz's law

K. Atomic and Nuclear Physics 8
- Thermionic emission
- quantum theory
- radioactivity

Subtotal	75
Optional double periods	15
Total double periods	90

SENIOR SCHOOL SCIENCE

check one: S1 ☐ S2 ☐ S3 ☐ S4 ☒

Physics II

	GOALS		SUBGOALS	MODULE & CURRICULUM CORRELATION MATRIX										
1	Conceptualizing the history and Nature of Science	1.1	Contributions/Diversity	x	x	x	x	x	x	x	x	x	x	x
		1.2	Connections	x		x								
		1.3	Health			x								
		1.4	Inter-relationship/Mathematics Technology	x	x	x	x	x	x	x	x	x	x	x
		1.5	Problem Solving	x		x	x	x	x	x	x	x	x	x
2	Demonstrating the Nature of Science Inquiry	2.1	Hypothesis		x	x	x	x	x	x	x	x	x	x
		2.2	Design		x	x	x	x	x	x	x	x	x	x
		2.3	Data Collection		x	x	x	x	x	x	x	x	x	x
		2.4	Technology Use	x	x	x	x	x	x	x	x	x	x	x
		2.5	Explanation/limitation	x	x	x	x	x	x	x	x	x	x	x
		2.6	Explanation/alternative	x	x	x	x	x	x	x	x	x	x	x
		2.7	Communications/Results	x	x	x	x	x	x	x	x	x	x	x
		2.8	Research	x	x	x	x	x	x	x	x	x	x	x
3	Demonstrating Positive Attitude Towards Science	3.1	Present use of Science	x	x	x	x	x	x	x	x	x	x	x
		3.2	Value, Environment	x	x	x	x							
		3.3	Ethical, Applications	x	x	x	x				x	x		
		3.4	Career Options	x	x	x	x	x	x	x	x	x	x	x
4	Advocating for Environmental Responsibility	4.1	Environmental Stewardship	x	x	x								
		4.2	Environmental Applications				x					x	x	x
	CONTENT STRUCTURE		Change	x	x	x	x	x	x	x	x	x	x	x
			Cause & Effect	x	x	x	x	x	x	x	x	x	x	x
			Systems	x	x		x	x	x	x	x	x	x	x
			Life Science											
			Physical Science	x	x	x	x	x	x	x	x	x	x	x
			Earth and Space Science											
			MODULES	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**

MODULE KEY

A - Waves, Light and Sound
B - Light, Reflection and Mirrors
C - Refraction and Lenses
D - Colour
E - Electric Charge, Force and Fields
F - Electric Potential Energy, Electric Potential and Capacitance
G - Ohm's Law, Series and Parallel Circuits
H - Power and Energy in Electric Circuits
I - Electromagnetism
J - Electric motors, meters and Electric Magnetic Induction
K - Atomic and Nuclear Physics

PHYSICS

Course Title: PHYSICS II

Module Title: Waves: Light and Sound

Number of Periods: 8 double periods

Sequence Reference: SC4122PHY-A

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1 - 1.5 Nature and History of Science
- 2.4 - 2.8 Scientific Inquiry
- 3.1 - 3.4 Positive Attitudes
- 4.1 Environmental Conservation

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- define the components of waves
- describe types of waves (longitudinal vs. transverse)
- utilize wave equation to solve problems
- describe Young's Double Slit experiment
- describe the relationship between light color and wavelength
- identify the components of the electromagnetic spectrum
- define thermal radiation
- explain how sound travels

Content Detail:

- nature of waves: amplitude, frequency, period, wavelength, phase, speed
- wave properties using properties of a ripple tank:
  - reflection
  - refraction
  - constructive / destructive interference
- universal wave equation to solve for speed, frequency and wavelength
- Doppler effect

Module Evaluation:

- **Performance Assessments:**
  - graphical analysis, laboratory activities, teacher observation, interviews and presentations
- **Product Assessments:**
  -teacher observation, laboratory activities, data collection / analysis, presentation - project/demonstrations, portfolio assessment: personal journal, sample works
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts, using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- library information center and DOE resource centre (print materials laser discs, videos, software, etc.)
- guest speakers/site visits: Bermuda College
- cross curricular connections: mathematics problem-solving, applied technology
- websites: see next page

GLOSSARY

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS

WEBSITES

http://www.schoolnet.ca/math/sci
http://www.pacificnet.net/~mandel/
http://www.imsa.edu/edu/
http://www.freeserve.net/education/examinerevision/gcse/science/sgtopics.html
http://www.energy.ca.gov/education/story/story-htm/chapter02.html
http://www.miamisci.org/af/sln/frankenstein/safety.html
http://schoolnet2.carleton.ca/english/math_sci/phys/electric_club/
http://phys.udallas.edu/
http://slacvm/slac.stanford.edu/find/explist.html

REFERENCES - TEACHER:

Kirkpatrick and Wheeler: Physics: A World View. (2nd edition), Saunders College Publishing, 1995.
Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.
Zitzewitz, Paul , Physics Principles and Problems (teacher edition) New York: Glencoe Mc Graw-Hill, 1999.
Serway, R and Faughn J. Physics (teacher edition). New York: Holt Rinehart and Winston, 1999.
Pople, S. Complete Physics. New York: Oxford University Press 1999.
Ellse, M. and Honeywell, C. Matter and Waves. London: Thomas Nelson and Sons, 1999.

REFERENCES - STUDENT:

Kirkpatrick and Wheeler: Physics: A World View. (2nd edition), Saunders College Publishing, 1995.
Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.
Zitzewitz, Paul , Physics Principles and Problems. New York: Glencoe Mc Graw-Hill, 1999.
Serway, R and Faughn J. Physics (teacher edition). New York: Holt Rinehart and Winston, 1999.
Pople, S. Complete Physics. New York: Oxford University Press 1999.
Ellse, M. and Honeywell, C. Matter and Waves. London: Thomas Nelson and Sons, 1999.

PHYSICS

Course Title: PHYSICS II	**Sequence Reference:** SC4122PHY-B
Module Title: Light, Reflection and Mirrors	
Number of Periods: 6 double periods	**Senior School Level**

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1, 1.4 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1 - 3.4 Positive Attitudes
- 4.1 Environmental Conservation

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- distinguish between light and shade
- define the law of reflection of light
- illustrate the behavior of plane mirrors
- describe the behavior of curved mirrors,
- utilize ray diagrams to find the image location of an object for plane and curved mirrors
- explain the uses of curved mirrors
- investigate image formed by a pinhole camera

Content Detail:

- production of shadows and eclipses
- reflection of light: incident and reflected angles, normal to the plane surface
- formation of images from a plane mirror
- converging (concave) and diverging (convex) mirrors
- system variables for curved mirrors: principle axis, vertex, focal points, focal length, center of curvature, image and object distances
- image size, virtual vs. real image, laterally inverted vs. upright, object to mirror distance, image to mirror distance

Module Evaluation:

- **Performance Assessments:**
  - graphical analysis, laboratory activities, teacher observation, interviews and presentations
- **Product Assessments:**
  -teacher observation, laboratory activities, data collection / analysis, presentation - project/demonstrations, portfolio assessment: personal journal, sample works
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- library information center, DOE resource centre (print materials laser discs, videos, software, etc.)
- site visits/guest speakers: Bermuda College
- cross curricular connections: mathematics problem-solving, applied technology
- websites: refer to previous physics modules

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:
Kirkpatrick and Wheeler: Physics: A World View. (2nd edition), Saunders College Publishing, 1995.
Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.
Zitzewitz, Paul , Physics Principles and Problems (teacher edition) New York: Glencoe Mc Graw-Hill, 1999.
Serway, R and Faughn J. Physics (teacher edition). New York: Holt Rinehart and Winston, 1999.
Pople, S. Complete Physics. New York: Oxford University Press 1999.
Ellse, M. and Honeywell, C. Matter and Waves. London: Thomas Nelson and Sons, 1999.

REFERENCES - STUDENT:
Kirkpatrick and Wheeler: Physics: A World View. (2nd edition), Saunders College Publishing, 1995.
Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.
Zitzewitz, Paul , Physics Principles and Problems. New York: Glencoe Mc Graw-Hill, 1999.
Serway, R and Faughn J. Physics (teacher edition). New York: Holt Rinehart and Winston, 1999.
Pople, S. Complete Physics. New York: Oxford University Press 1999.
Ellse, M. and Honeywell, C. Matter and Waves. London: Thomas Nelson and Sons, 1999.

PHYSICS

Course Title: PHYSICS II	**Sequence Reference:** SC4122PHY-C
Module Title: Refraction and Lenses	
Number of Periods: 8 double periods	

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1 - 1.5 Nature and History of Science
- 2.4 - 2.7 Scientific Inquiry
- 3.1 - 3.4 Positive Attitudes
- 4.1 Environmental Conservation

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- demonstrate the law of refraction
- describe the difference between real and apparent depth
- define total internal reflection and critical angle
- distinguish between types of prisms
- illustrate the components of a lens system
- describe and illustrate the differences between concave and convex lenses
- explain the operation of a camera and the eye
- define and utilize the lensmakers formula
- illustrate and define system components for telescopes

Content Detail:

- Snell's law to solve for incident and refracted angles and index of refraction
- optical density and refractive index
- speed of light in vacuum and air
- critical angle from Snell's law
- dispersion and refraction through prisms
- lenses: pole, principal axis, focal points, image and object distances.
- diverging and converging lenses
- accurate ray diagrams, calculation of image location
- magnification
- eye: pupil, iris, cornea
- astronomical telescope

Module Evaluation:

- **Performance Assessments:**
  - graphical analysis, laboratory activities, teacher observation, interviews and presentations
- **Product Assessments:**
  - teacher observation, laboratory activities, data collection / analysis, presentation - project/demonstrations, portfolio assessment: personal journal, sample works
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- library information center and DOE resource centre (print materials laser discs, videos, software, etc.)
- site visits: guest speakers: Bermuda College, optician
- cross curricular connections: mathematics problem-solving, applied technology
- websites: refer to previous modules

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Kirkpatrick and Wheeler, Physics: A World View. (2nd edition), Saunders College Publishing, 1995.
Pople, Explaining Physics. (5th edition), Oxford University Press.
Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.
Ellse, M. and Honeywell, C. Fields. London: Thomas Nelson and Sons, 1999.

REFERENCES - STUDENT:

Kirkpatrick and Wheeler, Physics: A World View. (2nd edition), Saunders College Publishing, 1995.
Pople, Explaining Physics. (5th edition), Oxford University Press.
Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.
Ellse, M. and Honeywell, C. Fields. London: Thomas Nelson and Sons, 1999.

PHYSICS

Course Title: PHYSICS II	**Sequence Reference:** SC4122PHY-D
Module Title: Colour	
Number of Periods: 3 double periods	

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1 - 3.4 Positive Attitudes
- 4.2 Environmental Conservation

Content Focus

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- define dispersion and refraction of light
- state visible spectrum components
- describe the mixing of primary colours
- demonstrate how filters operate
- predict the results of mixing paint pigments

Content Detail:

- white light
- 7-colour component of visible spectrum
- Newton's colour wheel
- primary colours: red, green, blue
- secondary colours
- complementary colours
- colour of objects: reflection vs. absorption

Module Evaluation:

- **Performance Assessments:**
  - graphical analysis, laboratory activities, teacher observation, interviews and presentations
- **Product Assessments:**
  - teacher observation, laboratory activities, data collection / analysis, presentation - project/demonstrations, portfolio assessment: personal journal, sample works
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- DOE Resource Centre (print materials, laser discs, videos, software, etc.)
- site visits/ guest speakers: Bermuda College
- cross curricular connections: mathematics problem-solving, applied technology
- websites: refer to previous physics modules

GLOSSARY

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Kirkpatrick and Wheeler, Physics: A World View. (2nd edition) Saunders College Publishing, 1995.
Pople: Explaining Physics. (5th edition) Oxford University Press.
Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.
Ellse, M. and Honeywell, C. Matter and Waves. London: Thomas Nelson and Sons, 1999.

REFERENCES - STUDENT:

Kirkpatrick and Wheeler, Physics: A World View. (2nd edition) Saunders College Publishing, 1995.
Pople, Explaining Physics. (5th edition) Oxford University Press.
Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.
Ellse, M. and Honeywell, C. Matter and Waves. London: Thomas Nelson and Sons, 1999.

PHYSICS

Course Title: PHYSICS II

Module Title: Electric Charge, Force and Fields

Number of Periods: 5 double periods

Sequence Reference: SC4122PHY-E

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1, 3.4 Positive Attitudes

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- define types of charges
- describe conductors and insulators
- explain static and dynamic charge
- state Coulomb's Law
- describe electric field

Content Detail:

- negative and positive charges
- apparatus: leaf electroscope, Van der Graaf generator
- Coulomb's law for two point charges to solve for electric force, and explain inverse square law
- electric field diagrams for simple charge distributions

Module Evaluation:

- **Performance Assessments:**
  - graphical analysis, laboratory activities, teacher observation, interviews and presentations
- **Product Assessments:**
  - teacher observation, laboratory activities, data collection / analysis, presentation - project/demonstrations, portfolio assessment: personal journal, sample works
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts, using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- DOE Resource Centre (print materials, laser discs, videos, software, etc.)
- site visits/guest speakers: Bermuda College, BELCO
- cross curricular connections: mathematics problem-solving, applied technology
- websites: refer to previous physics modules

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Kirkpatrick and Wheeler, Physics: A World View. (2nd edition), Saunders College Publishing, 1995.
Pople, Explaining Physics. (5th edition), Oxford University Press.
Bermuda College, Physics Laboratory Manual, Physics 012, (Tara Soares), 1999.
Ellse, M. and Honeywell, C. Mechanics and Electricity. London: Thomas Nelson and Sons, 1999.

REFERENCES - STUDENT:

Kirkpatrick and Wheeler, Physics: A World View. (2nd edition), Saunders College Publishing, 1995.
Pople, Explaining Physics. (5th edition) Oxford University Press.
Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.
Ellse, M. and Honeywell, C. Mechanics and Electricity. London: Thomas Nelson and Sons, 1999.

PHYSICS

Course Title: PHYSICS II

Module Title: Electric Potential Energy, Electric Potential and Capacitance

Number of Periods: 8 double periods

Sequence Reference: SC4122PHY-F

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1, 3.4 Positive Attitudes

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- define: electric potential energy, electric potential and potential difference
- state electric potential formula
- explain difference between positive and negative potential
- describe electron flow due to a potential difference
- describe capacitance
- describe how electrical energy is produced

Content Detail:

- units of charge
- use of electric potential formula to solve for work done, charge moved and electric potential
- use of capacitance equation to solve for charge on a conductor, potential of a conductor and capacitance
- use of capacitors in electrical circuits
- operation of cells, batteries and electric generators

Module Evaluation:

- **Product Assessments:**
  - teacher observation, laboratory activities, data collection / analysis, presentations - projects/demonstration portfolio assessment: personal journal, sample works, debate/discussions
- **Performance Assessments:**
  - graphical analysis, laboratory activities, teacher observation, interviews, presentations
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts, using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- library information center, DOE resource centre (print materials, laser discs, videos, software, etc.)
- site visits/guest speakers: Bermuda College, BELCO
- cross curricular connections: mathematics problem-solving, applied technology

GLOSSARY:
- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:
Kirkpatrick and Wheeler, Physics: A World View. (2nd edition), Saunders College Publishing, 1995.
Pople, Explaining Physics. (5th edition), Oxford University Press
Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.

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Kirkpatrick and Wheeler, Physics: A World View. (2nd edition), Saunders College Publishing, 1995.
Pople, Explaining Physics. (5th edition), Oxford University Press.
Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.

PHYSICS

Course Title: PHYSICS II

Module Title: Ohm's Law, Series and Parallel Circuits

Number of Periods: 8 double periods

Sequence Reference: SC4122PHY-G

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1,1.4, 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1 - 3.4 Positive Attitudes

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- draw circuit symbols used in schematics
- define electric current
- describe potential difference around a simple series circuit and parallel and series circuits
- define resistance in terms of Ohm's law
- solve for equivalent (total) resistance in series and parallel circuits
- state Kirchhoff's Laws (Junction rule and Loop rule)
- construct circuits from simple schematic diagrams
- demonstrate the correct placement and use of ammeters and voltmeters in a circuit
- define electromotive force (emf), terminal voltage, and internal resistance

Content Detail:

- problem solving: involving: current, charge & time
- relate conventional current direction to actual electron flow
- Ohm's law : solving for electric potential difference, resistance and current; experiments
- basic circuit rules to solve for circuit variables such as: current, potential difference and resistance
- Kirchhoff's Laws to circuits containing one source of electric potential difference
- problems solve: terminal voltage, emf, internal resistance, current and electric potential difference

Module Evaluation:

- **Performance Assessments:**
  - graphical analysis, laboratory activities, teacher observation, interviews and presentations
- **Product Assessments:**
  - teacher observation, laboratory activities, data collection / analysis, presentation - project/demonstrations, portfolio assessment: personal journal, sample works
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts, using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- library information center, resource centre (print materials, laser discs, videos, software, etc.)
- site visits/guest speakers: Bermuda College
- cross curricular connections: mathematics problem-solving, applied technology
- websites: refer to previous physics modules

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS

REFERENCES - TEACHER:

Kirkpatrick and Wheeler: Physics: A World View, 2nd edition, Saunders College Publishing, 1995.
Pople: Explaining Physics, 5th edition, Oxford University Press
Bermuda College: Physics Laboratory Manual, Physics 012, (Tara Soares), 1999.
Ellse, M. and Honeywell, C. Mechanics and Electricity London: Thomas Nelson and Sons, 1999.

REFERENCES - STUDENT:

Kirkpatrick and Wheeler: Physics: A World View, 2nd edition, Saunders College Publishing, 1995.
Pople: Explaining Physics, 5th edition, Oxford University Press
Bermuda College: Physics Laboratory Manual, Physics 012, (Tara Soares), 1999.
Ellse, M. and Honeywell, C. Mechanics and Electricity London: Thomas Nelson and Sons, 1999.

PHYSICS

Course Title: PHYSICS II	**Sequence Reference:** SC4122PHY-H
Module Title: Power and Energy in Electric Circuits	**Senior School Level**
Number of Periods: 5 double periods	S1 ☐ S2 ☐ S3 ☐ S4 ☒

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1, 3.3, 3.4 Positive Attitudes
- 4.2 Environmental Conservation

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- define electric power
- define power dissipated in a resistor
- define how to calculate energy using power and time
- define the relationship between electrical energy and thermal energy

Content Detail:

- use of electric power formulas:
  - electric power
  - electric potential difference
  - current
  - resistance
  - efficiency
- comparison of energy consumption of various household electrical appliances
- use of electrical energy formula to solve for thermal energy transfer

Module Evaluation:

- **Performance Assessments:**
  - graphical analysis, laboratory activities, teacher observation, interviews and presentations
- **Product Assessments:**
  - teacher observation, laboratory activities, data collection / analysis, presentation - project/demonstrations, portfolio assessment: personal journal, sample works
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas

(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts, using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources

(materials, equipment & community involvement):

- library information center, DOE resource centre (print materials, laser discs, videos, software, etc.)
- site visits/guest speakers: Bermuda College, BELCO
- cross curricular connections: mathematics problem-solving, applied technology
- websites: refer to previous physics modules

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS

REFERENCES - TEACHER:

Kirkpatrick and Wheeler, Physics: A World View. (2nd edition), Saunders College Publishing, 1995.
Pople, Explaining Physics. (5th edition), Oxford University Press.
Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.
Ellse, M. and Honeywell, C. Fields. London: Thomas Nelson and Sons, 1999.

REFERENCES - STUDENT:

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Pople: Explaining Physics, 5th edition, Oxford University Press
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Ellse, M. and Honeywell, C. Mechanics and Electricity London: Thomas Nelson and Sons, 1999.

PHYSICS

Course Title: PHYSICS II	**Sequence Reference:** SC4122PHY-I
Module Title: Electromagnetism	**Senior School Level** S1 ☐ S2 ☐ S3 ☐ S4 ☒
Number of Periods: 5 double periods	

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1, 3.4 Positive Attitudes
- 4.2 Advocate for the Environment

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- state the rules that explain how magnetic poles interact with each other
- produce magnetic field lines around a permanent magnet
- define operation of the earth's magnetic field
- use the right-hand rule to determine the magnetic field direction for a current-carrying wire or solenoid
- provide examples of practical uses of electromagnets in the home and workplace

Content Detail:

- plotting compass and bar magnet to produce magnetic field lines
  - one bar magnet
  - two bar magnet
- draw magnetic field lines for two bar magnets placed near each other
- operation of electromagnets in telephones and fire alarm bells
  - telephone
  - fire alarm bells

Module Evaluation:

- **Performance Assessments:**
  - graphical analysis, laboratory activities, teacher observation, interviews and presentations
- **Product Assessments:**
  - teacher observation, laboratory activities, data collection / analysis, presentation - project/demonstrations, portfolio assessment: personal journal, sample works
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts, using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- library information center, DOE resource centre (print materials, laser discs, videos, software, etc.)
- site visits/guest speakers: Bermuda College, BELCO
- cross curricular connections: mathematics problem-solving, applied technology
- websites: see previous physics modules

GLOSSARY

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

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Ellse, M. and Honeywell, C. Fields. London: Thomas Nelson and Sons, 1999.

PHYSICS

Course Title: PHYSICS II	**Sequence Reference:** SC4122PHY-J
Module Title: Electric Motors, Meters and Electromagnetic induction	
Number of Periods: 8 double periods	**Senior School Level:** S1 ☐ S2 ☐ S3 ☐ S4 ☒

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.1 - 2.8 Scientific Inquiry
- 3.1, 3.4 Positive Attitudes
- 4.2 Advocate for the Environment

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- describe turning effect of a coil in a magnetic field
- explain the operation of a simple d.c. motor
- explain the operation of a galvanometer
- describe the production of e.m.f. by induction
- describe how current is induced in a coiled wire using Faraday's Law
- demonstrate Fleming's right-hand rule for the direction of an induced current
- apply Lenz's law to determine the direction of the induced current

Content Detail:

- variables that change the turning effect: current, number of turns of coil, magnetic field strength, area of the coil (length and thickness)
- Ohm's Law solving for resistance required in operation of a galvanometer
- problem solving: for a conductor moving perpendicular through a uniform magnetic field, involving: e.m.f., speed of conductor, magnetic field strength, length of conductor
- variables which effect induced current: speed of movement of magnet, strength of magnet, number of turns of coil

Module Evaluation:

- **Performance Assessments:**
  - graphical analysis, laboratory activities, teacher observation, interviews and presentations
- **Product Assessments:**
  - teacher observation, laboratory activities, data collection / analysis, presentation - project/demonstrations, portfolio assessment: personal journal, sample works
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts, using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- DOE resource centre (print materials, laser discs, videos, software, etc.)
- site visits/guest speakers: Bermuda College, BELCO
- cross curricular connections: mathematics problem-solving, applied technology
- websites: refer to previous physics modules

GLOSSARY:

- refer to text

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Pople, Explaining Physics. (5th edition) Oxford University Press.
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Ellse, M. and Honeywell, C. Mechanics and Electricity. London: Thomas Nelson and Sons, 1999.

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Pople, Explaining Physics, 5th edition, Oxford University Press.
Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.
Ellse, M. and Honeywell, C. Mechanics and Electricity. London: Thomas Nelson and Sons, 1999.

PHYSICS

Course Title: PHYSICS II

Sequence Reference: SC4122PHY-K

Module Title: Atomic and Nuclear Physics

Number of Periods: 8 double periods

Senior School Level

S1	S2	S3	S4
☐	☐	☐	☒

Subgoal Emphasis:

- 1.1, 1.4, 1.5 Nature and History of Science
- 2.4 - 2.8 Scientific Inquiry
- 3.1, 3.4 Positive Attitudes
- 4.2 Advocate for the Environment

Content Focus:

- Change
- Cause and Effect
- Systems
- Physical Science

Curriculum Objectives:

At the end of this module, students will:

- describe thermionic emission of electrons
- explain the basic operation of a cathode ray tube
- reproduce the electromagnetic spectrum and define ionizing radiation
- describe quantum theory
- explain Einstein's photoelectric effect
- explain how X-rays are produced
- define the term radioactivity
- explain radioactive decay and half-life of elements (isotopes)
- explain the difference between nuclear fission and nuclear fusion
- highlight the dangers to humans and environment due to the use of radioactive materials

Content Detail:

- temperature and material requirements for thermionic emission
- terms: cathode, anode and electrodes
- deflection of an electron beam
- the basic operation of a television as a cathode ray device
- examples of photoelectric devices solar cells, photoresistors and photodiodes)
- the relationship between an electron beam and the production of X-rays
- use of X-rays in everyday life
- alpha, beta and gamma radiation
- uses of radioactivity: nuclear reaction, carbon dating, medical treatment for cancer

Module Evaluation:

- **Performance Assessments:**
  - graphical analysis, laboratory activities, teacher observation, interviews and presentations
- **Product Assessments:**
  - teacher observation, laboratory activities, data collection / analysis, presentation - project/demonstrations, portfolio assessment: personal journal, sample works
- **Written Assessments:**
  - quizzes/tests/assignments (multiple choice/written, etc.)

Prerequisite Skill Areas
(if any):

- using scientific nomenclature, periodic table, symbols, formulas, chemical equations etc
- designing and carrying out investigations safely and accurately; reporting in appropriate format
- using arithmetic operations and algebraic procedures, plotting and interpreting graphs, determining slopes and intercepts, using SI units
- researching, planning and carrying out an extended investigation or report using appropriate style
- using technology: scientific calculator, computer applications, accessing websites

Special Resources
(materials, equipment & community involvement):

- DOE resource centre (print materials, laser discs, videos, software, etc.)
- newspaper, magazine articles
- site visits: Bermuda College, KEMH-Nuclear Medicine and X-ray department
- guest speakers: T. Soares (Radiation physicist)
- cross curricular connections: mathematics problem-solving, applied technology

GLOSSARY:

- refer to text

LABORATORY INVESTIGATIONS, ACTIVITIES & PROJECTS:

REFERENCES - TEACHER:

Kirkpatrick and Wheeler, Physics: A World View. (2nd edition) Saunders College Publishing, 1995.
Pople, Explaining Physics. (5th edition) Oxford University Press.
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Bermuda College, Physics Laboratory Manual, Physics 012. (Tara Soares), 1999.

EXEMPLAR SCORING GUIDE
(0 - 4 Scale)

Level	Definition	EQUIVALENT Letter	EQUIVALENT % mark
4	**An excellent performance** • focuses on the purpose of the task • meets or exceeds all the requirements of the task • organizes content and ideas in a logical way • presents information clearly • includes appropriate detail to support ideas or conclusions • demonstrates creativity, originality and/or initiative	**A**	**90-100**
3	**A good performance** • focuses on purpose of the task • meets all the requirements of the task • organizes content and ideas in a logical way • presents information clearly • includes some detail to support ideas or conclusions	**B**	**80-89**
2	**A fair performance** • has some awareness of the purpose of the task • meets most of the requirements of the task • organizes content and ideas in a logical way • presents information in an understandable way • may not include significant details to support ideas or conclusions	**C**	**70-79**
1 (R)	**A poor performance** • does not fit the purpose of the task • does not meet the requirements of the task • presents information in an unorganized or confused way • does not include details to support ideas or conclusions • Remediation required.	**D**	**60-69**
0 (R)	**An unscorable performance** • does not demonstrate the required knowledge, skills or capabilities • is not understandable, is incomplete or 'defiant' (e.g. "I won't do this"). • Extensive remediation is required.	**F**	**Below 60**

'R' – Extensive Remediation required: student may need to repeat or restart work, or teaching method may need to be altered.
An '0' student may be one who refuses to work or needs specialist help.

*** Adapted from British Columbia**

SCIENCE 1

TABLE 1: OVERVIEW OF SCIENCE ASSESSMENT STRATEGIES

	% time	written tests 30%	products 30%	performances [lab based] 40%	goals met
Nature of Science	[2]				
Nature & Variety of Living Things	27				
Nature & Structure of Matter	27				
Heat	11				
Sound & Light	20				
Solar System	15				

TABLE 2: TEST SPECIFICATIONS [BLOOM'S TAXONOMY]

Module	% time weighting	knowledge	application & comprehension	higher: analysis & evaluation	affective	goals met
Nature & variety of Living Things	27					
Nature & Structure of Matter	27					
Heat	11					
Sound & Light	20					
Solar System	15					

TABLE 2: ASSESSMENT STRATEGIES

Module	% time weighting	multiple choice	short answer	data analysis	interpreting science	critical thinking/ problem solving	goals met
Nature of Science	[2 not tested]						
Nature & Variety of Living Things	27						
Nature & Structure of Matter	27						
Heat	11						
Sound &Light	20						
Solar	15						

SCIENCE PROCESS SKILLS

The skills and processes listed below are not unique to science. It is expected that all students will develop such critical thinking skills as they extend and refine their knowledge in all subject areas. The science process skills should be integrated throughout the science programme. Bermuda Science Goals 1 and 2 [Nature of Science & Scientific Inquiry] provide a framework for appropriately developing the process skills from Learning Phase A to Learning Phase B.

PROCESS SKILLS	EXPLANATION
OBSERVING	• using as many of the senses as possible to gather information
MEASURING	• using non standard then standard units (metric) and appropriate equipment to quantify observations
CLASSIFYING	• putting objects or events in groups
INFERRING	• suggesting additional ideas based on observations and experiences
PREDICTING	• forecasting a result based on data
HYPOTHESIZING	• making an educated guess that can be tested by an experiment
DESIGNING AN EXPERIMENT	• identifying the question, the problems, planning the method for testing, controlling variables and following the procedure
CONTROLLING VARIABLES	• changing factors that affect the outcome of an investigation whilst systemically holding other factors constant
MAKING MODELS	• using physical or mental models to explain a phenomenon, ideal or object
WORKING IN GROUPS	• interacting appropriately within a group by participating in activities, communicating ideas, listening actively
COMMUNICATING	• giving information in a variety of ways: orally, in writing, using charts, graphs, mathematics & technology

SENIOR 1 SCIENCE CURRICULUM OBJECTIVES AT A GLANCE
PACING GUIDE

Objectives	Time/ Minutes	Date Completed
A. NATURE OF SCIENCE		
❑ identify broad branches of science		
❑ use the scientific method		
❑ select and use laboratory equipment appropriately		
❑ identify sources of error in measurement techniques		
❑ appreciate the importance of safety in the laboratory		
❑ research the accomplishments of one scientist		
B. NATURE AND VARIETY OF LIVING THINGS		
❑ analyze the characteristics of living things		
❑ explain cell theory		
❑ analyze the structure and function of cells		
❑ differentiate between animal and plant cells		
❑ illustrate cell processes		
❑ justify the position that cells are the building blocks of nature		
❑ appreciate classification as a tool of biologists		
❑ apply biological system of classification to organisms		
❑ select an example of an organism from each kingdom to illustrate the system of classification		
C. NATURE AND STRUCTURE OF MATTER		
❑ describe materials in terms of physical properties		
❑ illustrate phase changes in terms of particle model of matter		
❑ distinguish between chemical properties and chemical changes		
❑ differentiate amongst mixtures, elements and compounds		

Objectives	Time/ Minutes	Date Completed
C. NATURE AND STRUCTURE OF MATTER (cont'd)		
❑ identify and write the chemical symbol or molecular formula of common elements and compounds		
❑ outline the historical development of the structure of the atom		
❑ illustrate the structure and components of atoms and molecules		
❑ predict the properties of the elements based on their positions in the periodic table		
❑ investigate changes that occur during common chemical reactions		
❑ describe chemical reactions using word equations		
D. HEAT		
❑ recognize heat as a form of energy		
❑ explain temperature using kinetic energy and particle model of matter		
❑ explain the impact of changes of temperature on states of matter		
❑ distinguish between heat and temperature		
❑ describe how heat energy is used in everyday life		
E. SOUND AND LIGHT		
❑ describe and explain the properties of visible light		
❑ describe the laws of reflection of visible light and explain their application to everyday light		
❑ describe the process of refraction		
❑ describe the types of electromagnetic radiation		
❑ compare the properties of visible light to be properties of other types of electromagnetic radiation		
❑ describe how sound waves are produced and transmitted		
❑ explain applications of sound and waves in everyday life		

SENIOR 1 SCIENCE CURRICULUM OBJECTIVES AT A GLANCE
PACING GUIDE

Objectives	Time/ Minutes	Date Completed	Objectives	Time/ Minutes	Date Completed
F. INTRODUCTION TO ASTRONOMY ❑ describe the organization of the solar system ❑ describe the technologies used to explore our solar system and beyond ❑ appreciate the relative sizes and distances of objects in the universe ❑ explain the classification of groups of stars ❑ describe the life cycle of our sun ❑ describe the current theory of the formation and evolution of our solar system and the universe ❑ illustrate the views of different cultures of the origins of the universe ❑ evaluate the pros and cons of space travel					

Overview of Science Courses from Middle 1 to Senior School 2

	M1	M2	M3	S1	S2
Life	**Oceanic Island** -ecology	**Oceanic Island** - oceanic island development - Bermuda habitats	**Oceanic Island** - coral reefs - oceanic circulation		**Ecology** - cycles - impact of external factors - protection of Bermuda's environment
	Taxonomy and Microorganism - classification - microorganism	**Cells** - structure - function - plant and animal		**Nature and Variety of Living Things** - cell organelles - classification - taxonomy	
	Systems				
	Senses - types of senses - adaptations for survival	**Excretion and Respiration** - respiratory - excretory processes in plants and animals **Nervous and Endocrine system** - skeletal - nervous - endocrine	**Reproduction and Genetics** - human and plant reproduction - DNA **Nutrition/Digestion/Circulation** - food groups and tests - digestive - circulatory		
	Life Cycles - comparison of life cycles				
	Plant Studies - plant structure - plant growth - plants of Bermuda				
Physical	**Energy and Matter** - matter - forms of energy - sound	**Energy and Matter** - particular theory of matter - properties of matter - work and energy	**Matter** - atomic structure - periodic table - kinetic theory **Energy** - electrical energy - magnetism	**Nature and Structure of Matter** - changes - atomic structure - periodic table - chemical reactions **Sound and Light** - waves - visible light - electromagnetic spectrum - applications **Heat** - temperature - transmission - impact of heat	**Chemical Reactions** - ionic and molecular compounds - acids bases and salts - carbon compounds - types of chemical reactions - rate of chemical reactions **Electricity** - static electricity - electric current & circuits - electrical appliances - power production & consumption in Bermuda

Overview of Science Courses from Middle 1 to Senior School 2

	M1	M2	M3	S1	S2
	Force and Motion -types of forces -speed, velocity and acceleration	**Force and Motion** - gravity - circular motion and momentum			**Motion** - time, displacement, velocity - instantaneous and average velocity - velocity, time acceleration
		Consumer Chemistry - product testing	**Pollution Chemistry** - types of population - pollution reduction and control		
	Geophysical Cycles and Planetary System - solar system - earthquakes - volcanoes		**Geophysical Cycles/Geothermal Systems** - earthquakes - volcanoes - continental drift	**Solar System** - stars and galaxies	
		Rocks and Minerals - minerals - types of rocks			
			Weather - weather systems - weather maps		**Weather and Bermuda's Water** - the water cycle - purification techniques - water pollution - weather prediction - storms

SAFETY AT SCHOOLS

The Ministry of Labour and Home Affairs, Health and Safety at Work Act, 1982 provides standards for Safety at School. As developed by the Advisory Council for Health and Safety, these guidelines and similar ones developed in the future are of paramount importance to the well-being of our staff and students. It is expected that all staff members will follow these written guidelines. These are written in the following three documents:

- HSG7 General Advice
- HSG9 Safety in Practical Subjects
- HSG10 Safety in Science Laboratories

These documents suggest safety precautions for all those who work in or attend schools. It is important that teachers, administrators and other users of present school facilities be aware of the dangers which can arise from the incorrect use of materials and equipment. In the senior school, no activity should be undertaken unless it can be made reasonably safe. If the resources are not available to ensure safety, then that activity should not be continued and some other means found to safely provide the necessary educational experience. It is expected that teachers of science, design and technology, family studies, physical education, visual arts and dance pay particular attention to advice for safety in practical subjects and science laboratories.

SAFETY REFERENCES

Advisory Council for Health and Safety. Safety at School: Safety in the Science Laboratories. Bermuda: The Bermuda Press, 1988

Benham, Ann H. (ed.) An Emphasis on Safety Science Laboratory Instruction. Texas: Fischer Scientific

Everett, K. and Jenkins, E. W. A Safety Handbook for Science Teachers. 3rd Edition London: John Murray, 1980

Rakaw, Steve (ed.) "The Safety Supplement" Science Scope Nov./Dec. (1989): S2-S32

SUGGESTIONS FOR INFUSING
LIBRARY INFORMATION, INFORMATION TECHNOLOGY AND CAREER EDUCATION ACROSS

SCIENCE I

LIBRARY INFORMATION	S1 Students will:
Orientation and Organization	• locate science and related sections in library based on Dewey Decimal System • use card catalogue to find information about a scientist
Selection and Utilization	• use print and non print media to research how a selected musical instrument produces sound
Research and Thinking Skills	• retrieve, select and organize information about alternative sources of energy

INFORMATION TECHNOLOGY	S1 Students will:
Word Processing	• describe the contribution of a scientist or a research project that involved Bermuda
Spreadsheet	• collect statistics • record measurements during experiments involving sound/light, produce graphs and compare list • record solar data and produce graphs
Databases	• create a database about scientists found in Bermuda • create a database about types of stars and galaxies • create a database about careers involving applications of sound and light

CAREER EDUCATION	S1 Students will:
Self Assessment	• develop respect for diversity • understand the importance of academic competencies in careers • match interests and personality to science careers met at this level
Career Directions	• examine applications of science in local community • research science careers not evident in Bermuda • research future projections of science related jobs in Bermuda • interview a professional in a career unrelated to science to determine science courses taken
Career Planning	• examine traditional versus non-traditional roles in science • plot the appropriate science courses based on personal career plan

SUGGESTIONS FOR INFUSING
LIBRARY INFORMATION, INFORMATION TECHNOLOGY AND CAREER EDUCATION ACROSS

SCIENCE I

LIBRARY INFORMATION	S1 Students will:
Appreciation of Literature	• read trade books related to modules studied and make a book report
Production, Application and Communication	• make a presentation about the difference between music and noise

INFORMATION TECHNOLOGY	S1 Students will:
Desktop Publishing	• illustrate taxonomy, chemical reactions and waves
Enrichment/ Demonstrative Software	• use software to: explore real time events and the effect of the change of variables • explore heat, chemical reactions and waves
Internet Use	• apply search criteria to locate and send information to a local scientist • apply search criteria to locate and send information on the impact of heat • apply search criteria to locate and send information on electromagnet spectrum

CAREER EDUCATION	S1 Students will:

PLANNING FOR INTEGRATED CURRICULUM
IN THE
SENIOR SCHOOLS

When you walk through the Botanical Gardens, you don't hear kiskadees for ten minutes, then the wind rustling for five minutes, and then smell the flowers for three minutes. All of this impacts on you at once and you make the experience into a meaningful whole.

> *"Young people are interested in the entire world around them - it doesn't make sense to them to say, 'Mathematics', 'Science' or 'Social Studies'. When instruction jumps from one discipline to another every 45 minutes, learning is fragmented unnecessarily."*
>
> *By Susan Krog,*
> *Professor of Education*
> *Western Washington University*

Where Are We Now?

If we consider a continuum from parallel connections across each discipline to a blending of all subject areas, teachers may be at different stages of integrating curriculum.

Simplest Stage: Parallel teachers realign content so that related topics are taught concurrently.

More Ambitious Stage: Teachers begin to link subjects by scrutinizing what they teach, reinforcing overlapping concepts and avoiding needless repetition.

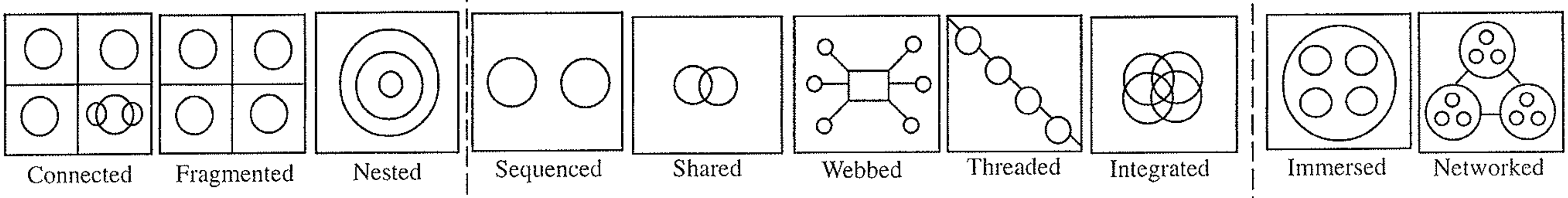
Most Ambitious Stage: Teachers create interdisciplinary modules that focus on a theme or project.

The process of collaboration at the building level will strengthen integrated curriculum and give a vital tool for professional growth of teachers. Appropriate and meaningful staff development, perusal of professional literature, and/or university training on approaches to integrating curriculum is vital to any significant change in education practice. Teachers should find ways to naturally integrate subjects and develop meaningful instruction.

Design Options (see next page)

Techniques for designing an integrated curriculum include mapping the curriculum and planning an integrated module. To design an integrated curriculum, teachers need to know what is taught in other subject areas and at other grade levels - information that is traditionally not shared.

How to Integrate the Curriculum



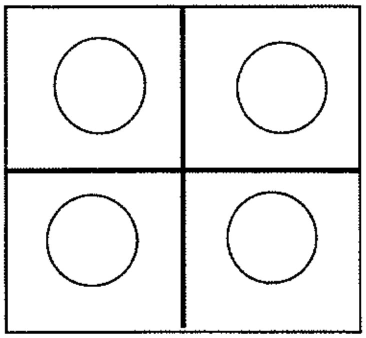
Within single disciplines

Across several disciplines

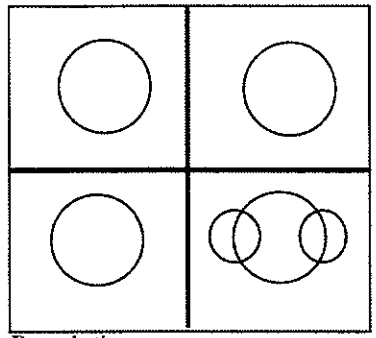
Inside the mind of the learner

Design options for curriculum might include:

Disciplined-based

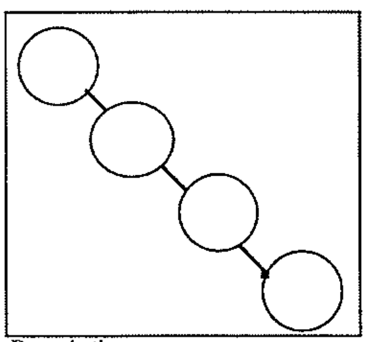


Description
The traditional model of separate and distinct disciplines which fragments the subject areas.
Example
Teacher applies this view in ics, science and social studies.

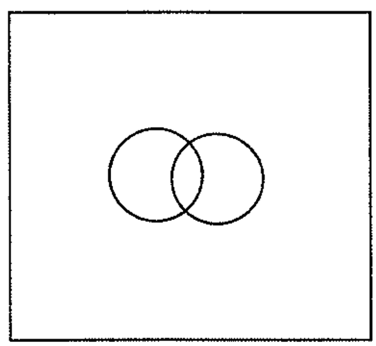


Description
Within each subject area, course content is connected topic to topic, concept to concept, one year's work to next and relates idea(s)
Example
Teacher relates the concept of to decimals, which in turn relates to money, grades.

Parallel Disciplines

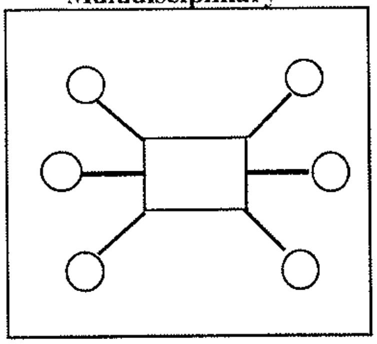


Description
The metacurricular approach threads thinking skills, multiple technology and study skills through various disciplines.
Example
Teaching staff targets prediction in reading, mathematics and science lab experiments while the social studies teacher targets forecasting current events and thus threads the skill (prediction) across all



Description
Shared planning and teaching take place in two disciplines in which lapping concepts or ideas emerge as organizing
Example
Science and mathematics teachers data collection, charting and as shared concepts that can be team-taught.

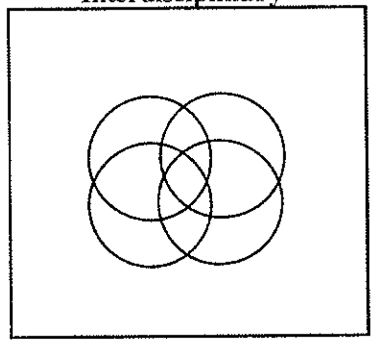
Multidisciplinary



Description
The fertile theme is webbed to lum contents and disciplines; use the theme to sift out appropriate concepts, topics and

Example
Teacher presents a simple topical theme, such as the circus, and webs into the subject areas. A conceptual theme, such as conflict, can be for more depth in the theme

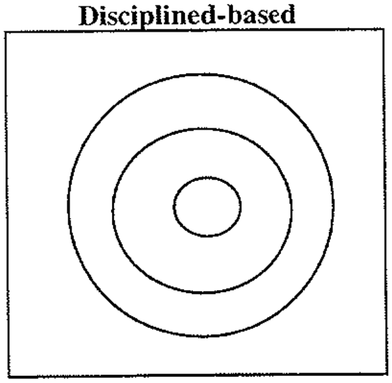
Interdisciplinary



Description
This interdisciplinary approach matches subjects for overlaps in and concepts with some team in an authentic integrated

Example
In science, the arts, health family studies and design and technology, teachers look for patterning models and approach content through these

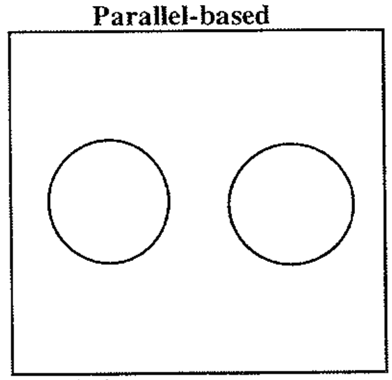
Disciplined-based



Description
Within each subject area, the teacher targets multiple skills: a social skill, a thinking skill and a concept-specific skill.

Example
Teacher designs the unit on photosynthesis to simultaneously target consensus seeking (social skill), sequencing (thinking skill) and plant life cycle (science skill)

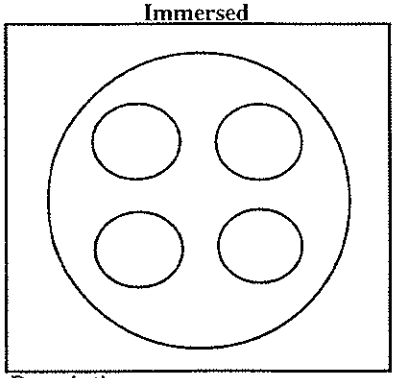
Parallel-based



Description
Topics or units of study are rearranged and sequenced to coincide with one another. Similar ideas are taught in concert while remaining separate subjects.

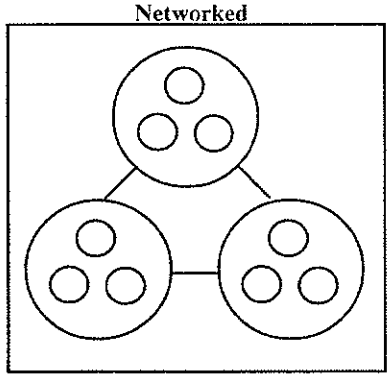
Example
English Language Arts teacher an historical novel depicting a particular period while Social Science teacher teaches covers the same period.

Immersed



Description
The disciplines become part of the learner's lens of expertise: the learner filters all content through this lens and becomes immersed in his or her own experience.

Networked



Description
Learner filters all learning through the expert's eye and makes internal connections that lead to external networks of experts in related fields.

Choosing a Theme

In the initial development of senior schools, four career pathways have been identified:

- Applied Technologies
- Arts and Communications
- Health and Human Services
- International Business and Tourism

Interdisciplinary teachers, along with teachers of other subjects areas should utilize related materials located in their professional library, modifying these as appropriate to their students' needs and interests.

It is important that senior school teachers keep abreast of current research and trends on integrating curriculum and careers associated with the various pathways. Teachers are encouraged to take part in related staff development workshops, read professional literature and/or take university courses.

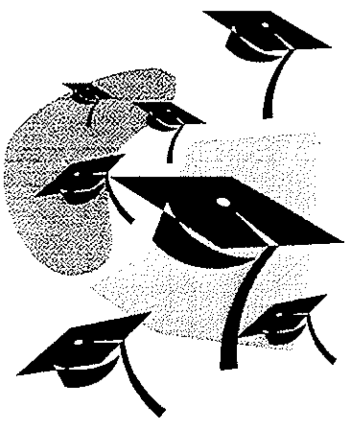
Teachers should:

- take inventory of what is already being done - career awareness initiatives, writing across the curriculum, etc.
- design a curriculum map by listing the content of associated subjects and then identify a theme or umbrella
- design an integrated module and develop related lesson plans
- decide on the length of time for completion and an appropriate title
- discover student interest - ask them what they want to know!
- decide whether the theme has substance and application to the real world
- display student work
- celebrate success!

Department of Education

Career Pathways

SEPTEMBER 2000

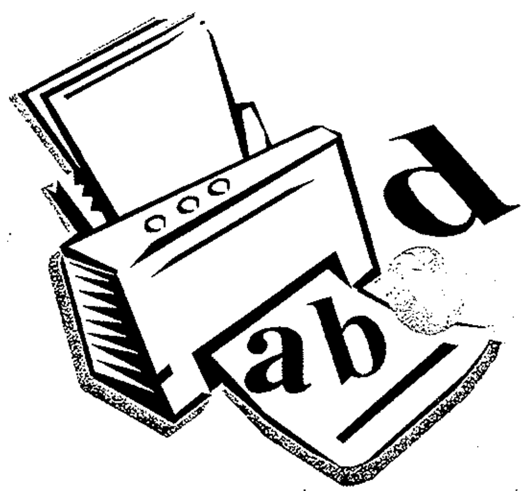


FOR BERMUDA'S SENIOR SCHOOLS

Applied Technologies

Are you practically inclined? Do you enjoy doing puzzles and solving problems? Are you curious about how things work? Are you fascinated by technology? Do you like designing and creating things? Do you love nature? Are you interested in plants and animals? Are you interested in numbers and symbols?

This may be the pathway for you!



APPLIED TECHNOLOGIES

PRODUCTION OCCUPATIONS

Blue-Collar Worker Supervisors

Food Processing Occupations

- Butchers & Meat, Poultry, & Fish Cutters

Inspectors, Testers & Graders

- Boilermakers
- Jewellers
- Machinists
- Metalworking & Plastics-Working Machine Operators
- Tool & Die Makers
- Welders, Cutters & Welding Machine Operators

Plant & Systems Operators

- Electric Power Generating Plant Operators & Power
- Distributors & Dispatchers
- Stationary Engineers
- Water & Wastewater Treatment
- Plant Operators

Printing Occupations

- Prepress Workers
- Printing Press Operators
- Bindery Workers

Textile, Apparel and Furnishings Occupations

- Shoe & Leather Workers & Repairers
- Upholsterers

Woodwork Occupations

Miscellaneous Production Occupations

- Dental Laboratory Technicians
- Painting & Coating Machine Operators
- Photographic Process Workers

Transportation & Material Moving Occupations

- Bus drivers
- Material Moving Equipment Operators
- Truckdrivers
- Water Transportation Occupations

Handlers, Equipment Cleaners, Helpers & Labourers

Job Opportunities in the Armed Forces

ARCHITECTS & SURVEYORS

- Architects
- Landscape Architects
- Surveyors

CONSTRUCTION TRADES & EXTRACTIVE OCCUPATIONS

- Stonemasons
- Bulldozer Operators
- Carpenters
- Carpet Installers
- Concrete Masons and Terazzo Workers
- Drywall Workers and Lathers
- Electricians
- Engineering Technicians
- Forklift Operators
- Glaziers
- Insulation Workers
- Painters & Paperhangers
- Plasterers
- Plumbers & Pipefitters
- Roofers
- Strictiral & Reinforcing Ironworkers
- Tilesetters

COMPUTER, MATHEMATICAL & OPERATIONS RESEARCH OCCUPATIONS

- Actuaries
- Computer Service Technicians
- Computer Systems Analysts
- Mathematicians
- Operations Reseach Analysts
- Statisticians

TECHNOLOGISTS (EXCEPT HEALTH)

- Air Traffic Controllers
- Broadcast Technicians
- Computer Programmers
- Drafters
- Engineering Technicians
- Science Technicians

MECHANICS, INSTALLERS & REPAIRERS

- Aircraft Mechanics and Engine specialists
- Automotive Body Repairers
- Automotive Mechanics
- Biomedical Technicians
- Diesel Mechanics
- Electronic Equipment Repairers
  - Commercial and Indstrial Electronics Equipment Repairs
  - Communications Equipment
- Mechanics
  - Computer & Office Machine Repairers
  - Electronic Home Entertainment Equipment Repairers
  - Telephone Installers & Repairers
  - TV & Radio Repairers
- Elevator Installers & Repairers
- General Maintenance Mechanics
- Heating, Air-Cond. & Refrigeration Technicians
- Home Appliance & Power Tool Repairers
- Industrial Machinery Repairers
- Line Installers & Cable Splicers
- Millwrights
- Mobile Heavy Equipment Mechanics
- Motorcycle, Boat, & Small-Engine Mechanics
- Musical Instrument Repairers & Tuners
- Small Engine Mechanics
- Vending Machine Servicers & Repairers

ENGINEERS

- Chemical Engineers
- Civil Engineers
- Electrical and Electronics Engineers
- Industrial Engineers
- Mechanical Engineers

Career Pathway: Applied Technologies

SENIOR SCHOOL

Subject		100	200	300	400
English Language Arts 16cr		ELA I 4cr	ELA II 4cr	ELA III 4cr	ELA IV 4cr
Math 12cr		Foundations of Mathematics 4cr	Integrated Math I 4cr **or** Applied Math I 4cr	Integrated Math II **or** Business Math I & II **or** Applied Math II, IIIA & IIIB **or** Introductory Calculus **or** Advanced Math	
Science 12cr		Science I 4cr	Science II 4cr	Biology **or** Chemistry **or** Physics **or** Environmental Science **or** Horticulture **or** Marine Science **or** Applied Biology & Chemistry **or** Applied Physics **or** Human Biology **or** Earth Science	
Social Studies 12cr		Overview of Social Studies 4cr	Politics and Law in Action 4cr	Preserving Our Heritage **or** World Geography **or** World History	
D & T <u>or</u> Family Studies 2cr		Design & Technology 2cr **<u>or</u>** Exploring Family Living 2cr			
Bus. Studies <u>and</u> Computer Science 4cr		Business Essentials I 2cr **<u>and</u>** Computer Science I 2cr			
Physical Education 6cr <u>and</u> Health 4cr		Physical Education I 2cr **<u>and</u>** Health & Wellness 2cr	Physical Education II 2cr	Physical Education III 2cr **<u>and</u>** Health Issues 2cr	
The Arts 2cr		Music or Theatre or Dance or Visual Arts (in Society) 2cr		Band/Choir or Theatre or Dance or Visual Arts	Band/Choir or Theatre or Dance or Visual Arts
Electives from the areas of…		Computer Studies, Science	Family Studies, Foreign Language	Design & Technology, Physical Education	Health
Possible Electives for Career Pathway		• All Computer Science Courses, Technical Theatre & Music Technology • Graphic Communications, Design & Realization, Fashion & Textiles, Electronics Technology, Transportation Technology, Textile Design, & Interior Decorating • Business Essentials II, Foreign Languages & American History			

POST SENIOR

Bermuda College

Associate Degree Programmes

- Associate in Science
- Associate in Arts and Science
- Associate in Arts *(Computer Information Systems)*
- Associate in Computer Information Systems
- Associate in Science *(Electronics)*
- Associate in Electronics Technology

Certificate Programmes

- Certificate in Electrical Structure and Maintenance
- Certificate in Engineering Competencies
- Certificate in Tele-communications and Electronics
- Certificate in Motor Vehicle Bodywork
- Certificate in Motor Vehicle Mechanics
- Certificate in Plumbing
- Certificate in Heating, Ventilating and Air Conditioning
- Certificate in Horticulture
- Certificate in Wood Trades
- Developmental Technology

Other Academic Institutions

- Post Graduate Year Programmes
- Associate Degree Programmes
- Bachelor's Degree Programmes

Apprenticeship and Trainee Programmes under the Bermuda National Training Board

Career Pathway: "Student Constructed"

---SENIOR---					
Subject		100 (28 cr)	200 (18 cr)	300 (20 cr)	400 (4 cr)
English Language Arts 16cr		ELA I 4cr	ELA II 4cr	ELA III 4cr	ELA IV 4cr
Math 12cr		Foundations of Mathematics 4cr	Integrated Math I 4cr **or** Applied Math I 4cr	4cr	
Science 12cr		Science I 4cr	Science II 4cr	4cr	
Social Studies 12cr		Overview of Social Studies 4cr	Politics and Law in Action 4cr	4cr	
D&T <u>or</u> Family Studies 2cr		2cr			
Bus. Studies <u>and</u> Comp. Science 4cr		Business Studies I 2cr <u>**and**</u> Computer Science I 2cr			
Physical Education 6cr <u>and</u> Health 4cr		Physical Education I 2cr <u>**and**</u> Health & Wellness 2cr	Physical Education II 2cr	Physical Education III 2cr <u>**and**</u> Health Issues 2cr	
The Arts 2cr		2cr			
Electives from the areas of…		Computer Studies, Science, Family Studies, Business Studies, Physical Education, Foreign Languages, Design & Technology, Health			
Possible Electives for Career Pathway		**(Additional 46 credit hours required for graduation)**			

---POST SENIOR---

Bermuda College

Associate Degree Programmes

Certificate Programmes

Other Academic Institutions

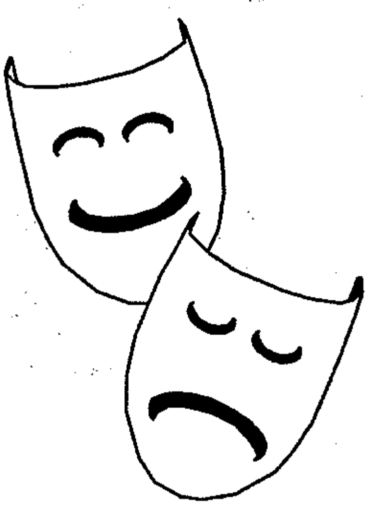
- Post Graduate Year Programmes
- Associate Degree Programmes
- Bachelor's Degree Programmes

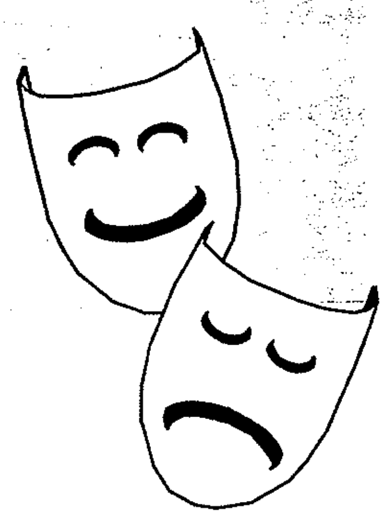
Apprenticeship and Trainee Programmes under the Bermuda National Training Board

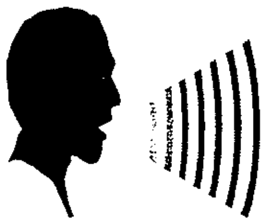
Arts and Communications

Do you like to communicate ideas? Do you like to express yourself creatively? Do you like to travel and learn about other cultures? Do you enjoy going to concerts and performances? Are you imaginative, innovative and original? Do you like to perform in front of an audience?

This may be the pathway for you!

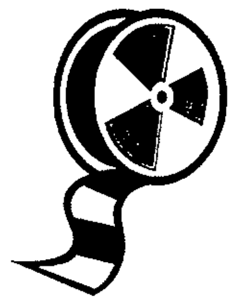






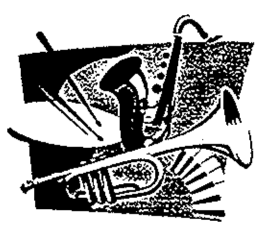
ARTS & COMMUNICATIONS

COMMUNICATION OCCUPATIONS



Announcers & Newscasters
Broadcast Technicians
Composition/Typesetters
Interpreters & Translators
Public Relations Specialists
Radio & Television
Reporters & Correspondents
Technical Writers
Writers & Editors

VISUAL ARTS OCCUPATIONS



Commercial Artists
Fashion Designers
Florists
Graphic Designers
Interior Decorators
Jewelers
Merchandise Display Workers
Photographers & Camera Operators
Visual Artists

PERFORMING ARTS OCCUPATIONS

Actors, Directors. & Producers
Dancers & Choreographers
Models
Musicians

ref: arts & communications/ts disc SS Certification

Career Pathway: Arts & Communications

SENIOR					
Subject		**100**	**200**	**300**	**400**
English Language Arts 16cr		ELA I 4cr	ELA II 4cr	ELA III 4cr	ELA IV 4cr
Math 12cr		Foundations of Mathematics 4cr	Integrated Math I 4cr **or** Applied Math I 4cr	Integrated Math II **or** Business Math I & II **or** Applied Math II, IIIA & IIIB **or** Introductory Calculus **or** Advanced Math	
Science 12cr		Science I 4cr	Science II 4cr	Biology **or** Chemistry **or** Physics **or** Environmental Science **or** Horticulture **or** Marine Science **or** Applied Biology & Chemistry **or** Applied Physics **or** Human Biology **or** Earth Science	
Social Studies 12cr		Overview of Social Studies 4cr	Politics and Law in Action 4cr	Preserving our Heritage **or** World Geography **or** World History **or** Introduction to Africa	
D&T or Family Studies 2cr		Design & Technology 2cr **or** Exploring Family Living 2cr			
Bus. Studies and Computer Science 4cr		Business Studies I 2cr **and** Computer Science I 2cr			
Physical Education 6cr and Health 4cr		Physical Education I 2cr **and** Health & Wellness 2cr	Physical Education II 2cr	Physical Education III 2cr **and** Health Issues 2cr	
The Arts 2cr		Music or Theatre or Dance or Visual Arts (in Society) 2cr		Band/Choir or Theatre or Dance or Visual Arts	Band/Choir or Theatre or Dance or Visual Arts
Electives from the areas of…		Computer Studies; Science; Business Studies; Family Studies; Foreign Languages; Design & Technology; Health			
Possible Electives for Career Pathway		• Business Essentials II, Marketing & Graphic Communication • Journalism & Publications, Speech and Debate, Writer's Workshop, Foreign Languages • Fashion & Textiles Design, Interior Decorating, Textiles Design & Photography			

-----POST SENIOR----

Bermuda College

Associate Degree Programmes

- Associate in Arts
- Associate in Arts & Science
- Associate in Art & Design

Other Academic Institutions

- Post Graduate Year Programmes
- Associate Degree Programmes
- Bachelor's Degree Programmes

Apprenticeship and Trainee Programmes under the Bermuda National Training Board

Career Pathway: "Student Constructed"

SENIOR

Subject		100 (28 cr)	200 (18 cr)	300 (20 cr)	400 (4 cr)
English Language Arts 16cr		ELA I 4cr	ELA II 4cr	ELA III 4cr	ELA IV 4cr
Math 12cr		Foundations of Mathematics 4cr	Integrated Math I 4cr **or** Applied Math I 4cr	4cr	
Science 12cr		Science I 4cr	Science II 4cr	4cr	
Social Studies 12cr		Overview of Social Studies 4cr	Politics and Law in Action 4cr	4cr	
D&T <u>or</u> Family Studies 2cr		2cr			
Bus. Studies <u>and</u> Comp. Science 4cr		Business Studies I 2cr **<u>and</u>** Computer Science I 2cr			
Physical Education 6cr **<u>and</u> Health** 4cr		Physical Education I 2cr **<u>and</u>** Health & Wellness 2cr	Physical Education II 2cr	Physical Education III 2cr **<u>and</u>** Health Issues 2cr	
The Arts 2cr		2cr			
Electives from the areas of…		Computer Studies, Science, Family Studies, Business Studies, Physical Education, Foreign Languages, Design & Technology, Health			
Possible Electives for Career Pathway		**(Additional 46 credit hours required for graduation)**			

POST SENIOR

Bermuda College

Associate Degree Programmes

Certificate Programmes

Other Academic Institutions

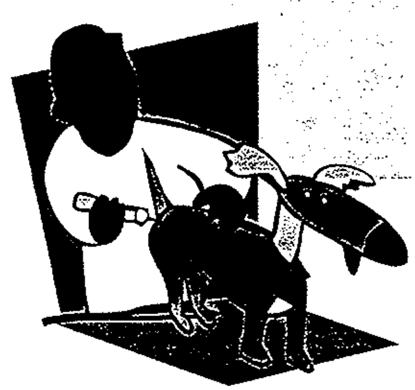
- Post Graduate Year Programmes
- Associate Degree Programmes
- Bachelor's Degree Programmes

Apprenticeship and Trainee Programmes under the Bermuda National Training Board

Health and Human Services

Do you like to care for people or animals who are sick? Are you fitness and wellness oriented? Are you interested in how the body works and how disease or drugs affect us? Are you friendly, outgoing, compassionate and cooperative? Do you like to work with people to solve problems? Is it important for you to provide service to the community by doing something that makes things better for other people?

This may be the pathway for you!



HEALTH & HUMAN SERVICES

Health Services

Health Diagnosing Practitioners

Chiropractors
Dentists
Opticians
Optometrists
Physicians
Podiatrists
Veterinarians

Health Assessment & Treating Occupations

Activity Therapists
Dietitians & Nutritionists
Occupational Therapists
Pharmacists
Physical Therapists
Physician Assistants
Recreational Therapists
Registered Nurses
Respiratory Therapists
Speech-Language Pathologists & Audiologists
Nursing Aides & Psychiatric Aides

Health Technologists & Technicians

Certified Nurses Aides
Clinical Laboratory Technologists & Technicians
Dental Hygienists
Dialysis Technicians
Dispensing Opticians
EEG Technologists
EKG Technicians
Emergency Medical Techni-cians
License Practical Nurses
Medical Record Technicians
Nuclear Medicine Technologists
Radiologic Technologists
Surgical Technicians
Ultrasound Technologists

Health Service Occupations

Dental Assistants
Home Health Aides
Medical Assistants

Human Services

Lawyers & Judges

Social Scientists & Urban Planners

Economists & Marketing Research Analysts
Psychologist
Sociologists
Urban & Regional Planners

Social & Recreation Workers

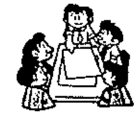
Human Services Workers
Marriage Counsellors
Social Workers
Social Worker Aides
Recreation Workers
Substance Abuse Counsellors
Janitors & Cleaners
Private and Household Workers

Religious Workers

Clergy
Protestant Ministers
Religious Workers
Rabbis
Roman Catholic Priests

Teachers, Librarians, & Counsellors

Adult Education Teachers
Archivists & Curators
College & University Faculty
Counsellors
Teachers
Librarians
Paraprofessional



Technologists, Except Health

Library Technicians
Paralegals

Protective Service Occupations

Correction's Officers
Firefighting Occupations
Security Guard
Police

Food & Beverage Preparation & Service Occupations

Chefs, Cooks, & Other Kitchen Workers
Food & Beverage Service Occupations
Meat Cutter/Butcher

Personal Service & Building & Grounds Service Occupations

Animal Caretakers
Barbers & Cosmetologists
Flight Attendants
Gardeners & Groundkeepers
Homemaker-Home Health Aides

Career Pathway: Health and Human Services

SENIOR					
Subject		**S1**	**S2**	**S3**	**S4**
English Language Arts 16cr		ELA I 4cr	ELA II 4cr	ELA III 4cr	ELA IV 4cr
Math 12cr		Foundations of Mathematics 4cr	Integrated Math I 4cr **or** Applied Math I 4cr	Integrated Math II **or** Business Math I & II **or** Applied Math II, IIIA & IIIB **or** Calculus **or** Advanced Math	
Science 12cr		Science I 4cr	Science II 4cr	Biology **or** Chemistry **or** Physics **or** Environmental Science **or** Horticulture **or** Marine Science **or** Applied Biology & Chemistry **or** Applied Physics **or** Human Biology **or** Earth Science	
Social Studies 12cr		Overview of Social Studies 4cr	Politics and Law in Action 4cr	World Geography **or** World History **or** Introduction to American History	
D & T <u>or</u> Family Studies 2cr		Design Technology 2cr **<u>or</u>** Exploring Family Living 2cr			
Bus. Studies <u>and</u> Computer Science 4cr		Business Essentials I 2cr **<u>and</u>** Computer Science I 2cr			
Physical Education 6cr and Health 4cr		Physical Education I 2cr **<u>and</u>** Health & Wellness 2cr	Physical Education II 2cr	Physical Education III 2cr **<u>and</u>** Health Issues 2cr	
The Arts 2cr		Music or Theatre or Dance or Visual Arts (in Society) 2cr		Band/Choir or Theatre or Dance or Visual Arts	Band/Choir or Theatre or Dance or Visual Arts
Electives from the areas of…		Computer Studies Science	Family Studies Business Studies	Physical Education Foreign Languages	Design & Technology Health
Possible Electives for Career Pathway		• All Health Courses & Business Essentials II • Exploring Family Living, Discovery Food & Nutrition, Meal Management & Hospitality, Exploring Careers in Nutrition & Hospitality, Personal Care, & Child Care • Speech and Debate, Foreign Languages & Preserving Our Heritage			

----POST SENIOR---

Bermuda College

Associate Degree Programmes

- Associate in Arts
- Associate in Science
- Associate in Arts & Science
- Associate in Arts *(Business Administration)*
- Associate in Business Administration
- Associate in Arts *(Hospitality Management)*
- Associate in Hospitality Management
- Associate in Office Administration
- Associate in Arts *(Human Services)*
- Associate in Human Services

Certificate Programmes

- Certificate for General Secretaries
- Certificate for Culinary Arts
- Certificate for Front Office Procedures
- Certificate in Secretarial Skills
- Certificate in Food & Beverage Service
- Certificate for Child Care Assistant
- Certificate for Geriatric Aids
- Certificate in Legal Studies
- Certificate in Hairdressing

Other Academic Institutions

- Post Graduate Year Programmes
- Associate Degree Programmes
- Bachelor's Degree Programmes

Apprenticeship and Trainee Programmes under the Bermuda National Training Board

Career Pathway: "Student Constructed"

SENIOR					
Subject		**100 (28 cr)**	**200 (18 cr)**	**300 (20 cr)**	**400 (4 cr)**
English Language Arts 16cr		ELA I 4cr	ELA II 4cr	ELA III 4cr	ELA IV 4cr
Math 12cr		Foundations of Mathematics 4cr	Integrated Math I 4cr **or** Applied Math I 4cr	4cr	
Science 12cr		Science I 4cr	Science II 4cr	4cr	
Social Studies 12cr		Overview of Social Studies 4cr	Politics and Law in Action 4cr	4cr	
D&T <u>or</u> Family Studies 2cr		2cr			
Bus. Studies <u>and</u> Comp. Science 4cr		Business Studies I 2cr **<u>and</u>** Computer Science I 2cr			
Physical Education 6cr **<u>and</u> Health** 4cr		Physical Education I 2cr **<u>and</u>** Health & Wellness 2cr	Physical Education II 2cr	Physical Education III 2cr **<u>and</u>** Health Issues 2cr	
The Arts 2cr		2cr			
Electives from the areas of…		Computer Studies, Science	Family Studies, Business Studies	Physical Education, Foreign Languages	Design & Technology, Health
Possible Electives for Career Pathway		**(Additional 46 credit hours required for graduation)**			

POST SENIOR

Bermuda College

Associate Degree Programmes

Certificate Programmes

Other Academic Institutions

- Post Graduate Year Programmes
- Associate Degree Programmes
- Bachelor's Degree Programmes

Apprenticeship and Trainee Programmes under the Bermuda National Training Board

International Business and Tourism

Do you enjoy being a leader, organizing people, talking and planning activities? Do you enjoy initiating an idea and seeing it through to the end product? Do you like things neat and orderly? Are you business-minded in organizing your life? Do you value the importance of travel and tourism in Bermuda?

This may be the pathway for you!

International Business & Tourism

EXECUTIVE ADMINISTRATIVE, & MANAGERIAL OCCUPATIONS

Accountants & Auditors
Administrative Services Managers
Budget Analysis
Construction & Building Inspectors
Construction Contractors & Managers
Cost Estimators
Education Administrators
Employment Interviewers
Engineering, Science, & Data Processing
Managers
Financial Managers
General Managers & Top Executives
Government Chief Executives & Legislators
Health Services Managers
Hotel Managers & Assistants
Industrial Production Managers
Inspectors & Compliance Officers,
Except Construction
Management Analysts & Consultants
Marketing, Advertising, & Public
Relations Managers
Personnel, Training, & Labour Relations
Specialists & Managers
Property & Real Estate Managers
Purchasing Agents & Managers
Restaurant & Food Service Managers
Underwriters
Wholesale & Retail Buyers &
Merchandise Managers

MARKETING AND SALES OCCUPATIONS

Advertising Agent
Cashiers
Counter & Rental Clerks
Insurance Agency & Brokers
Manufacturer's & Wholesale Sales Representatives
Real Estate Agents, Brokers & Appraisers
Retail Sales Workers
Securities & Financial Service Sales Representatives
Services Sales Representatives
Stockbrokers
Travel Agents

ADMINISTRATIVE SUPPORT OCCUPATIONS

Adjusters, Investigators, & Collectors
Bank Tellers
Clerical Supervisors & Managers
Computer & Peripheral Equipment Operators
General Office Clerks
Credit Clerks and Authorizers

Information Clerks
Hotel & Motel Clerks
Interviewing & New Accounts Clerks
Receptionists
Reservation & Transportation
Ticket Agents and Travel Clerks
Mail Clerks & Messengers
Material Recording, Scheduling,
Dispatching and Distributing
Occupations
Dispatchers
Stock Clerks
Traffic, Shipping & Receiving Clerks
Postal Clerks & Mail Carriers
Record Clerks
Billing Clerks
Bookkeeping, Accounting & Auditing Clerks
Brokerage Clerks & Statement Clerks
File Clerks
Library Assistants & Bookmobile Driver
Order Clerks
Payroll & Timekeeping Clerks
Personnel Clerks
Receptionists
Secretaries
Stenographers & Court Clerk/Reporters
Telephone, Telegraph & Teletype Operators
Typist, Word Processors and Data Entry Keyers

ref: Int'l Bus/ts disc SS Certification

Career Pathway: International Business & Tourism

-----SENIOR-----

Subject		100	200	300	400
English Language Arts 16cr		ELA I 4cr	ELA II 4cr	ELA III 4cr	ELA IV 4cr
Math 12cr		Foundations of Mathematics 4cr	Integrated Math I **or** Applied Math I 4cr	Integrated Math II **or** Business Math I & II **or** Applied Math II, IIIA & IIIB **or** Introductory Calculus **or** Advanced Math	
Science 12cr		Science I 4cr	Science II 4cr	Biology **or** Chemistry **or** Physics **or** Environmental Science **or** Horticulture **or** Marine Science **or** Applied Biology & Chemistry **or** Applied Physics **or** Human Biology **or** Earth Science	
Social Studies 12cr		Overview of Social Studies 4cr	Politics and Law in Action 4cr	World Geography **or** World History	
D&T or Family Studies 2cr		Design & Technology 2cr **or** Exploring Family Living 2cr			
Bus. Studies and Computer Science 4cr		Business Essentials I 2cr **and** Computer Studies I 2cr			
Physical Education 6cr and Health 4cr		Physical Education I 2cr **and** Health & Wellness 2cr	Physical Education II 2cr	Physical Education III 2cr **and** Health Issues 2cr	
The Arts 2cr		Music or Theatre or Dance or Visual Arts (in Society) 2cr		Band/Choir or Theatre or Dance or Visual Arts	Band/Choir or Theatre or Dance or Visual Arts
Electives from the areas of…		Computer Studies Science	Family Studies Foreign Languages	Design & Technology Health	
Possible Electives for Career Pathway		• All Computer Science Courses, Computer Keyboarding & Business Applications, • Accounting, Business Essentials II, Business & Personal Law, Economics, Insurance, International Business, Marketing, Office Technology, Small Business Management, Office Technology & Business Application, Travel & Tourism • Personal Care, Discovering Food & Nutrition, Meal Management & Hospitality, Exploring Careers in Nutrition & Hospitality, Speech and Debate and Foreign Languages			

-----POST SENIOR---

Bermuda College

Associate Degree Programmes

- Associate in Arts
- Associate in Science
- Associate in Arts & Science
- Associate in Arts *(Business Administration)*
- Associate in Business Administration
- Associate in *Arts* *(Hospitality Management)*
- Associate in Hospitality Management
- Associate in Arts *(Computer Information Systems)*
- Associate in Computer Information Systems

Certificate Programmes

- Certificate for Accounting Systems
- Certificate for General Secretaries
- Certificate in Secretarial Skills
- Certificate in Culinary Arts
- Certificate for Front Office Procedures
- Certificate in Food & Beverage Service
- Certificate in Legal Studies

Other Academic Institutions

- Post Graduate Year Programmes
- Associate Degree Programmes
- Bachelor's Degree Programmes

Apprenticeship and Trainee Programmes under the Bermuda National Training Board

Career Pathway: "Student Constructed"

-----SENIOR-----

Subject		100 (28 cr)	200 (18 cr)	300 (20 cr)	400 (4 cr)
English Language Arts 16cr		ELA I 4cr	ELA II 4cr	ELA III 4cr	ELA IV 4cr
Math 12cr		Foundations of Mathematics 4cr	Integrated Math I 4cr **or** Applied Math I 4cr	4cr	
Science 12cr		Science I 4cr	Science II 4cr	4cr	
Social Studies 12cr		Overview of Social Studies 4cr	Politics and Law in Action 4cr	4cr	
D&T <u>or</u> Family Studies 2cr		2cr			
Bus. Studies <u>and</u> Comp. Science 4cr		Business Studies I 2cr <u>and</u> Computer Science I 2cr			
Physical Education 6cr <u>and</u> Health 4cr		Physical Education I 2cr <u>and</u> Health & Wellness 2cr	Physical Education II 2cr	Physical Education III 2cr <u>and</u> Health Issues 2cr	
The Arts 2cr		2cr			
Electives from the areas of...		Computer Studies, Science, Family Studies, Business Studies, Physical Education, Foreign Languages, Design & Technology, Health			
Possible Electives for Career Pathway		(Additional 46 credit hours required for graduation)			

-----POST SENIOR-----

Bermuda College

Associate Degree Programmes

Certificate Programmes

Other Academic Institutions

- Post Graduate Year Programmes
- Associate Degree Programmes
- Bachelor's Degree Programmes

Apprenticeship and Trainee Programmes under the Bermuda National Training Board

Personal Education Plan

Student's Name:______________________________ **Date:**__________ **Expected Graduation Date:**__________

Career Pathway: (Check One)

_____ Arts and Communication

_____ Health and Human Services

_____ International Business and Tourism

_____ Applied Technologies

S1 (100)		S2 (200)		S3 (300)		S4 (400)	
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
ELA (I)	ELA (I)	ELA (II)	ELA (II)	ELA	ELA	ELA	ELA
Science (I)	Science (I)	Science (II)	Science (II)	Science	Science		
Soc. Stud.	Soc. Stud.	Soc. Stud.	Soc. Stud.	Soc. Stud.	Soc. Stud.		
Math	Math	Math	Math	Math	Math		
PE (I)	Bus. Stud.	PE (II)		PE (III)			
Health	Com. Sc.			Health			
Arts	DT/Fam.						

Summer School: __________ **Summer School:** __________ **Summer School:** __________ **Summer School:** __________

Graduation Requirements:

Course	Credits	Course	Credits
ELA	16	Health Education	4
Math	12	The Arts	2
Science	12	Computer Studies	2
Social Studies	12	Business Studies	2
Physical Education	6	Fam. Stud. <u>or</u> D&T	2
		Electives	46

Annual Review: (Advisor's Signature)

S1 Date:__________ S2 Date: __________

S3 Date: __________ S4 Date: __________

Annual Review: (Parent's Signature)

S1 Date: __________ S2 Date: __________

S3 Date: __________ S4 Date: __________

PROFESSIONAL ASSOCIATIONS
SCIENCE

Name: The Science Teachers Association of Ontario

Address: P.O. Box 771
Toronto, Ontario ON NOP 1 MO

Country: CANADA
(800) 461 2264

Telephone:

Name: The Association for Science Education

Address: College Lane, Hatfield
Hertfordshire AL 109AA

Country: ENGLAND

Telephone: 0707 267411

Fax: 0707 266532

Name: National Science Education Leadership Association

Address: P.O. Box 5556
Reston, Virginia VA 22205-3000

Country: U.S.A.

Telephone: (703) 524 8646

Name: National Science Teachers Association

Address: 1840 Wilson Boulevard
Arlington, Virginia VA 22201-3000

Country: U.S.A.

Telephone: (703) 471 1134

Name: National Association of Biology Teachers

Address: 11250 Roger Bacon Drive #19
Reston, Virginia VA 22090

Country: U.S.A.

Telephone: (703) 471 1134

Name:	Institute for Chemical Education
Address:	University of Wisconsin-Madison 1101 University Avenue Madison, Wisconsin 53706
Country:	U.S.A.

Name:	National Marine Educators Association
Address:	P.O. Box 51215 Pacific Grove, CA 93950
Country:	U.S.A.
Telephone:	(406) 648 4841

Name:	American Association of Physics Teachers
Address:	One Physics Ellipse College Park, MD 20740
Country:	U.S.A.
Telephone:	(301) 209 3300

Name:	American Chemical Society Education Division
Address:	1155 16th St. NW Washington, DC 20036
Country:	U.S.A.
Telephone:	(202) 872 4388

Name:	Bermuda Association for the Advancement of Science and Technology
Address:	Bermuda College P.O. Box PG 297 PG BX
Country:	Bermuda
Telephone:	(414) 236-9000

CURRICULUM ABBREVIATIONS

School Abbreviations

Preschool	PS
Primary School	P1-P6
Middle School	M1-M3
Senior School	S1-S4

Subject Area Abbreviations

Business Studies	BS
Dance	DN
Design & Technology	DT
English Language Arts	EL
Family Studies	FM
Foreign Languages	FL
Health Education	HE
Computer Science	CS
Mathematics	MT
Music	MU
Physical Education	PE
Science	SC
Social Studies	SS
Theatre	TH
Visual Arts	VR

Course Code

e.g. Physical and Human Geography II
SS3192GEO

Subject Area	Course Level	Number Placement	Course Sequence	Course Title
abbreviated subject area	(1-4) representing course level 100-400	(1-99) representing placement of course in each level	(1-4) representing sequence of course with same title	abbreviated course title
SS	**3**	**19**	**2**	**GEO**
(Social Studies)	(300 level course)	(19th course in 300 series)	(2^{nd} in the sequence of 3 courses)	(Physical and Human Geography)

Curriculum Framework & Course Abbreviations

Philosophy	PHL
Goals & Sub Goals	GLS
Performance Indicators	PI
Scope & Sequence	SAS
References	REF
Course Overview	OVW
Correlation Matrix	MTX
Modules	MDL
Teacher Resources	TRS
Student Resources	SRS
Exemplar Scoring Guide	SCO
Rubrics	RUB
Objectives at a Glance	OBJ
Infusing Across the Curriculum	INF
Glossary	GRY
Health and Safety	HAS
Professional Association Directory	PAD
Curriculum Abbreviations	ABR
Appendix	APX

Programme Abbreviations

Advisory Programme	ADV
Career Education Programme	CED
Functional Skills Programme	FUN
Guidance and Counselling Programme	GUI
Library Information Programme	LIB

Ministry of Education
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