C A R I B B E A N E X A M I N A T I O N S C O U N C I L

REPORT ON CANDIDATES' WORK IN THE SECONDARY EDUCATION CERTIFICATE EXAMINATION

MAY/JUNE 2010

PHYSICS
GENERAL PROFICIENCY

GENERAL COMMENTS

This year 12, 417 candidates registered for the examination. This represented a 93 per cent increase in candidates registered compared with 11, 616 in June 2009.

This trend is encouraging as it is important for the region to have sufficient numbers of qualified Physics graduates to cater to the increasing thrust in Science and Technology which is the driver of present and future development in the Caribbean.

Once again, candidates needed to show better mathematical skills in areas such as scientific notation and solving equations. More emphasis must be placed on using mathematical skills in studying Physics. Also, candidates should not be losing marks on simple recall items.

Paper 01 – Multiple Choice

Performance on this year's Multiple Choice Paper was below that of June 2009. This year, the mean score was 31.56 with a standard deviation of 10.60 compared with a mean score of 33.71 and a standard deviation of 10.12 in 2009.

Paper 02 – Structured Essay Questions

This paper consisted of one data analysis, two structured and three essay-type questions.

Section A

Question 1

This question was based on the refraction of light. Candidates were required to use data given to draw a graph, determine its gradient and use this value to determine the refractive index of a lens. The question also called for the recall of the two laws of refraction.

An analysis of overall performance revealed that 60 per cent of the candidates received a score of 13 (52 per cent) out of a possible 25 marks.

Areas of Good Performance

Part (a) which required candidates to complete a table, Part (b) which asked that they plot a graph and Part (c) which required them to determine the slope of the graph were clearly areas in which candidates performed well.

In determining the slope the following were required:

(i) a large triangle

(ii) correct read offs

(iii) calculation to two significant figures

Areas of Weak Performance

In Parts (c) and (e), candidates showed some confusion in relating the refractive index to the gradient of the graph and in determining the angle of refraction when I = 90°.

General Comments and Recommendations

Students should

(a) use the graph page to its maximum.

(b) use a Θ or x when plotting points.

(c) be given adequate practice in drawing and analysing graphs.

Question 2

Section B – Mechanics.

This question was based on the concepts of velocity, acceleration, momentum and kinetic energy. It was also based on the Jamaican/World athletic icon Usain Bolt and his historic record in the 100 metres race. Performance on this question was not good. Only 36 per cent of the candidates scored more than 7 marks out of a total of 15 marks.

Area of Good Performance

The main area of good performance was in Part (b) (i) which required candidates to calculate the average speed.

Area of Weak Performance

Part (b) (iii) which required candidates to calculate the acceleration was poorly done.

General Comments and Recommendations

(a) Teachers should use culturally relevant examples in the teaching of Physics.

(b) More practice in mathematical problems can help candidates in clarifying concepts.

Question 3

Section E – Electricity and Magnetism

This question was based on a fundamental device in electronics — the diode. It involved the concept of rectification and the determination of a defective diode. The question also explored truth tables for logic gates. Performance on this question was satisfactory with 50 per cent of the candidates scoring more than 7 out of a total of 15 marks.

Areas of Good Performance

Part (a) (i), which required candidates to sketch the voltage-time graph when a switch is open and Part (b) which dealt with a logic gate were well done.

Areas of Weak Performance

Parts (a) (iii), (iv) and (v) posed difficulties for candidates. Candidates should have know that both graphs for parts (a) (iii) and (iv), were based on direct current in the circuit and that to determine if a diode was defective a check for rectification needed to be done. If there was no rectification the diode was defective.

General Comments and Recommendations

(a) There is clearly a need for candidates to do more electronics in their preparation. These are basic concepts and will act as a foundation for the CAPE Electronics module and electronics-based careers.

(b) Candidates should get adequate practical experience in preparation for the examination.

Question 4

Sections B – Mechanics, E-Electricity and Magnetism

This question was based on the popular DC motor. It involved how the motor worked and also the use of the commutator. The motor was used in a problem of lifting an appliance in a multi-story car park – a real-life application. A few candidates scored the full 15 marks but the vast majority, 64 per cent, scored less than half of the full marks.

Area of Good Performance

Candidates were able to recall the formulas relating to power.

Areas of Weak Performance

Candidates performed poorly on Part (a) which required them to explain the operation of the d.c. motor and the purpose of the commutator.

Critical points candidates were required to state were:

(i) When the switch is closed, current flows into the coil via carbon brushes.

(ii) The downward force on AB and upward force on CD is due to the magnetic fields produced by the magnet and the coil

(iii) The coil rotates and reaches the vertical position and continues rotating due to the commutator.

The purpose of the commutator is to

- reverse the direction of the current in the loop when it changes contact from one brush to the other or
- ensure the loop always turns in one direction.

General Comments and Recommendations

It is beneficial to cover the topic of the d.c. motor in a more practical way with candidates who should be allowed to actually build one and discuss how it operates. They can also make simple applications for their motor. These motors can be displayed in science fairs.

Question 5

Section C – Thermal Physics and Kinetic Theory

This question explored the idea of Specific Heat Capacity for a solid and a liquid. A diagram of a set up of the apparatus used was given as stimulus. Candidates were required to describe the method used. With the liquid, the specific heat capacity had to be determined and a related question given. This question was poorly done with very few candidates gaining full marks.

Area of Good Performance

Candidates understood the concept of Specific Heat Capacity and its relationship to mass, energy and temperature change.

Area of Weak Performance

Candidates were not too familiar with the experiment. Some candidates thought the heater was inserted in water even though the diagram clearly labelled the block. They also confused the electrical method with the method of mixtures. Many candidates did not realize that it was not necessary to convert to Kelvin in order to get a temperature difference.

General Comments and Recommendations

There is need for more practice in describing 'methods' in experiments. In responding to questions candidates should:

(i) State that the apparatus was set up as shown in the diagram.

(ii) Explain how each variable was measured and then state how the variables were used to calculate the quantity sought. For example: $E = Pt$, $E = mc\Delta\theta$, $c = Pt/m\Delta\theta$

Question 6

Section F – The Physics of the Atom

This question involved a comparison of two types of radioactive radiation. Candidates also had to calculate the amount of energy produced in a nuclear reaction and then make a judgement regarding a preferred method of energy production. Only two per cent of the candidates scored full marks on this question while 27 per cent earned more than half of the full marks.

Area of Good Performance

Part (a) was done relatively well by most candidates.

Areas of Weak Performance

Candidates were again unfamiliar with the topic of core to radioactivity. Candidates showed unfamiliarity with Part (b) which was based on an artificial radioactive decay process to produce energy.

General Comments and Recommendations

(a) Greater practice is needed. Teachers can use worksheets and research-based methods.

(b) Einstein's mass-energy equation should be known by all candidates. Working with the formula is essential.

Paper 03/ 2 – Alternative to School-Based Assessment (SBA)

Question 1

Section A – Physical Measurements and Units, Section E – Electricity and Magnetism

This question concerned the calculation of resistance. It measured Use of Knowledge (6 marks) and Experimental Skills (14 marks). It involved reading an ammeter, drawing and using a graph to calculate resistance. Candidates also had to identify precautions for the experiment based on Ohm's law.
Performance on this question was satisfactory with 47 per cent of candidates earning more than half the total marks.

Areas of Good Performance

Candidates were able to read the ammeter and plot the graph accurately.

Area of Weak Performance

Part (a), the determination of the gradient of the graph, proved a challenge to most candidates.

General Comments and Recommendations

This experiment was a core experiment for preparation for the CSEC exams in current electricity. It was clear that some candidates lacked the experience. Teachers should identify core activities, expose candidates to them and build on these experiences.

Question 2

Section A – Physical Measurements and Units, Section C – Thermal Physics and Kinetic Theory.

This question involved the use of PV/T as a constant. Candidates had to draw a graph from which they were to extract information. They also had to label parts of the apparatus. Investigating the relationship between volume and length proved challenging for many candidates. The question was poorly done with 15 per cent of candidates earning 10 or more marks out of a possible 19 marks.

Areas of Good Performance

Parts (a) and (c) which involved the plotting of the graph and the labelling of apparatus were well done.

Area of Weak Performance

Part (d) was difficult for most candidates as they were weaker in their explanation in relating volume to height. Candidates could have written:

$V = Ah$

$\therefore V \alpha h$ so that the length of the air column can be used to represent the volume.

General Comments and Recommendations

Candidates must be given adequate opportunities in actually performing experiments, drawing and interpreting graphs.

Question 3

Section A – Physical Measurements and Units

This question required candidates to describe an experiment to investigate the effect of the mass of the bob on the period of the pendulum. It was well done by the majority of candidates, with 36 per cent achieving over four marks out of a possible nine marks.

Area of Good Performance

In Part (a), candidates generally knew the apparatus that was required.

Areas of Weak Performance

Parts (b) and (c) were difficult for most candidates as they were weak in describing the procedure and how to use the results to come to a conclusion.

General Comments and Recommendations

This question showed the need for more exposure to these types of experiments in a practical setting.

Paper 03/1 – School-Based Assessment

The overall standard of the SBA improved in June 2010 compared with June 2009. Teachers' marking was very consistent and reflected the standard expected. Random sampling was used in the moderation of the SBA as in 2009. Of the 167 centres involved, 154 submitted mark schemes.

RECOMMENDATIONS

Teachers should pay more attention to

- graphs, diagrams, tables, equations, interpretations from observations, choice of appropriate Planning and Design activities
- the dating of all exercises
- having an index in all laboratory books
- marking and writing comments to assist students and ensuring that students do individual work.