

**CARIBBEAN EXAMINATIONS COUNCIL**

**REPORT ON CANDIDATES' WORK IN THE  
CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION**

**MAY/JUNE 2012**

**PHYSICS  
GENERAL PROFICIENCY EXAMINATION**

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## GENERAL COMMENTS

This year 13,860 candidates registered for the examination. This represented a 6.94 per cent increase in candidates registered compared with 12,961 in June 2011. The percentage of candidates achieving Grades I – III was 76 per cent compared with 74 per cent in 2011. This increase 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.

Performance on the multiple-choice paper was similar to that of June 2011. This year, the mean score was 33 with a standard deviation of 10.48 compared with a mean score of 34 and a standard deviation of 10.84 in June 2011.

### 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 concepts of electrical potential difference across a device, current and the resistance which required the plotting of a PD/V vs I/A graph .

#### Areas of Good Performance

For Part (a), the graphs were well plotted with correct orientation, scales well chosen, axes labelled with quantity and unit, fine and best fit line.

The response for Part (d) was good. A significant number of candidates responded correctly by stating that as V increased, I increased and some gave the equation  $V = IR$ .

#### Areas of Weak Performance

In Part (b), many candidates did not use a large triangle to calculate the gradient. Most of the given points fell on the best straight line so it was easy to read off. Most candidates knew the formula and were able to substitute and calculate the answer but failed to give the unit.

For Part (c), most candidates knew that the gradient was associated with resistance but quite a few stated the device ‘resistor’ as the unit. Some also gave the ohm symbol.

In Part (e), candidates should have used accurate symbols; many did not include the variable resistor but used the variable power supply instead which was acceptable.

In Part (f), most candidates lost a mark for not varying the resistance.

Some candidates used the equation  $R_T = 1/R_1 + 1/R_2 + 1/R_3$  or tried to use the formula for two resistors in parallel for three resistors in parallel. The correct formula use is most important.

## Recommendations

Candidates should

- use the graph page to its maximum,
- use a  $\bigcirc$  or  $\times$  when plotting points
- be encouraged to always include unit of gradient where necessary
- be trained to understand the meaning of the gradient
- use formulae in the right context.

### Question 2

This question tested SI units and density. Part (a) (i) and (ii) tested candidates' ability to recall SI units, both base units and derived units. There was some level of open/free response for the candidates as they chose their own fundamental quantities and matching SI units.

In Part (b) (i), candidates were expected to recall the formula for density and its application in a simple case. For Part (b) (iii), candidates learnt that relative density dealt with the density of the substance divided by the density of *water*. This part of the question required candidates to compare the density of gasoline with the density of *mercury*.

### Areas of Good Performance

Part (a) (i) and Part (b) (ii) were well done.

### Areas of Weak Performance

In Part (b) (i), candidates had difficulty in trying to change the units to SI base units; the question simply required candidates to work in the units given and give the answer in grams per  $\text{cm}^3$ . Correct conversion to SI units with the answer in  $\text{kg per m}^3$  was accepted. Candidates also had difficulty converting  $\text{cm}^3$  to  $\text{m}^3$ .

Part (b) (ii) required the use of the following formula:

Density = mass/volume to find volume, and there was no need to change to SI units. The answer given in  $\text{cm}^3$  was accepted. Conversion to SI units was again a problem.

For Part (b) (iii), candidates were expected to know that relative density is a pale comparison of two densities and so will have no units.

### Recommendation:

Candidates should get more exposure to problems based on the formulas.

### Question 3

This question tested candidates' ability to (i) determine the weight of a body, given its mass (ii) recall the conditions necessary for a body to be in equilibrium and (iii) recall Archimedes' principle and apply it to the law of flotation. 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

Parts (a) and (b) were particularly well done as most candidates knew and could use the formula  $W = mg$ .

### **Areas of Weak Performance**

Parts (d) (ii)–(iii) presented difficulties for candidates. They could not conceptualize that the yacht is less dense than sea water as it is made up of materials other than steel and also that air is an integral part of the system.

### **Recommendations**

Once again candidates need to develop their problem solving skills. Teacher can allow students to have a ‘boat’ race with boats made of many materials, for example, paper, card board, plasticine, styrotex. A trip in a ‘water taxi’, boat or cruise liner would surely give students a memorable experience for this topic.

### **Section B**

#### Question 4

This question was based on the Geiger and Marsden experiment with the gold foil. Candidates were required to know the apparatus used and have knowledge of the results and its interpretation. Few candidates appeared to be familiar with the experiment and the content of the topic. A large number of candidates were able to calculate the energy released in the second section.

### **Area of Good Performance**

The performance of candidates in the calculation of the energy released was good. However, the common errors which occurred were not squaring the  $c$  in the equation  $E = mc^2$  and improper use of standard form.

### **Areas of Weak Performance**

For candidates familiar with the experiment, the fluorescent screen/detector was the most frequent omission. Many candidates were able to calculate the atomic number for Barium (Ba) while the mass number for Krypton (Kr) proved more challenging as many of them did not include the mass of the neutron.

### **Recommendations**

Candidates need to be more competent with the use of the standard form and significant figures.

#### Question 5

This question was based on the general gas equation, kinetic theory, specific and latent heat and power. Part (a) (i) was reasonably well done, as most candidates had a general idea about the equation, though quite a few simply stated  $pV/T$ .

### **Area of Weak Performance**

Candidates, in Part (a) (ii), had great difficulty in explaining the pressure in terms of the kinetic theory.

#### Question 6

Part (a) (i) required candidates, to recall three differences between light waves and sound waves. There are many differences, but the common ones at least are expected: *light is transverse and sound is longitudinal, light can travel through a vacuum while sound cannot, light travels much faster than sound, light is electromagnetically produced while sound is mechanically produced, light slows down when going through a medium while sound speeds up when going through a medium.* Some candidates also included that *light can be polarized whilst sound cannot be polarized.*

Part (a) (ii) asked for three properties of electromagnetic radiation not mentioned in Part a(i). The following answers were expected

- Can be reflected, refracted, diffracted
- Travels at a speed of  $3.0 \times 10^8$  m/s in a vacuum
- Takes energy from one point to another

In Part (b), candidates were expected to use the skill from their practical pendulum experiments to work out what one echo would take if 50 echoes took 30.3 seconds. It also required candidates to recognize that the echo had to travel  $2 \times 100$ m in order to be picked up. The formula  $\text{speed} = \text{distance}/\text{time}$  was then required.

The recall of the wave formula  $v = f\lambda$  was required in Part (c) and the subsequent answer would be in metres. One mark was given to convert metres to centimetres.

### **Paper 032 Alternative to School-Based Assessment (SBA)**

#### Question 1

This question explored the candidates' use of the pressure law. Experimental skills tested were:

- (a) Reading off coordinates from a graph of pressure vs temperature.
- (b) Gradient determination — large triangle and correct read offs
- (c) Correct read off of temperature from the graph.
- (d) Extrapolation of a graph — using dotted lines [4]

The use of knowledge skills tested were:

- (a) Calculation of gradient using  $\text{gradient} = \frac{\text{change in } y}{\text{change in } x}$  with correct unit
- (b) The conversion of Degrees Celsius to Kelvin. Use of  $T/^{\circ}\text{C} = T/\text{K} - 273$

#### **Areas of Good Performance**

- Most candidates were able to fill the table correctly.
- The extrapolation of the graph at both ends and the reading off.

#### **Areas of Weak Performance**

- Most candidates did not state the formula of  $\text{gradient} = \frac{\text{change in } y}{\text{change in } x}$ , but used it correctly in calculating the gradient.
- The use of large triangles was another area of weakness. Instead small triangles or no triangles were used.
- Some candidates used the table to take their readings for the gradient. This should not be so.

#### **Recommendation**

Teachers should be clear about the requirements in data analysis questions and ensure that students get adequate practice using the skills. Parts of the scheme are included above.

## Question 2

This question was well done by the majority of candidates. It explored a popular SBA topic, Ohm's Law in Current Electricity. In this question, candidates were given the circuit diagram and asked to identify the components in a table. They also had to plot a V vs I graph and hence find the resistance in the circuit. Another resistor was provided for calculation of new resistance.

The experimental skills tested were:

- (a) Identification of circuit components
- (b) Using values from a table to plot a graph
- (c) Determining gradient

The use of knowledge skills tested included calculating gradient and resistance

### **Areas of Good Performance**

- Identification of the circuit components
- Plotting the points from the table and drawing the graph.

### **Areas of Weak Performance**

- In Part (b), inappropriate scales for the axes. Non-linear scales are not valid. Incorrect orientation of the axes was also evident in some scripts.
- In drawing the best straight line, candidates joined their points one after the other.
- Although candidates were not marked for spelling, few candidates spelt *ammeter* as 'ammameter' or 'ampemeter' and *voltmeter* as 'voltammeter'. Physics teachers should encourage the correct spelling of physics terms.

### **Recommendations**

Teachers should build a 'Wall of Physics' in the classroom and include the terms as fast as they are encountered. Weak spellers should write the terms on the wall or maybe on a free internet site, Edmodo.com, for example.

Another application can be a free collaborative wiki at wikispaces.com. All students and teachers can contribute to it.

## Question 3

In this question, candidates had to use planning and design skills to identify radioactive sources. The apparatus to use, the procedure, safety measures and conclusion were expected. Generally, candidates did not perform as expected. For those who had some idea, it was not sufficient and they had problems expressing themselves logically.

### **Recommendations**

- Teachers should spend more time doing planning and design type activities with students.
- More complete coverage of the topic is needed.

### **Paper 031 - School Based Assessment (SBA)**

This year also showed improvements in the quality of SBA samples. Some centres continue to have challenges in their presentation of students' work.

If a centre has five or more students, then five books are to be submitted. If there are fewer than five students, all books are to be submitted. Some teachers confused the criteria; reference to CXC's SBA module and subject reports would help.

While the Organization, Recording and Reporting skills were generally well displayed, the Planning and Design, and the Analysis and Interpretation skills can be improved.

Teachers are thanked for their continued cooperation with the Council in the presentation of the SBA samples and they are advised to communicate via email [cxcezo@cx.org](mailto:cxcezo@cx.org) or via the website [www.cxc.org](http://www.cxc.org) for Physics documents or any answers they may specifically need. Another relevant site for CSEC Physics information is [notesmaster.com](http://notesmaster.com).