CARIBBEAN EXAMINATIONS COUNCIL

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

JANUARY 2013

PHYSICS
GENERAL PROFICIENCY EXAMINATION

GENERAL COMMENTS

This year 1730 candidates registered for the examination. This represented a one per cent decrease in candidates registered compared with 1770 in January 2012. The percentage of candidates achieving Grades I–III was 57 per cent compared with 53 per cent in 2012. 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 solving equations and finding angles using trigonometric functions. More emphasis must be placed on the development of basic mathematical skills in studying Physics.

DETAILED COMMENTS

Paper 01 – Multiple Choice

Performance on the multiple-choice paper was comparable with that of January 2012. This year, the mean score was 32.81 with a standard deviation of 9.68 compared with a mean score of 31.74 and a standard deviation of 9.83 in 2012.

Paper 02 – Structured Essay Questions

This paper consisted of one data analysis, two structured and three essay-type questions. All questions were compulsory. Performance on Paper 02 showed improvement compared with January 2012. This year, the mean score was 40.92 with a standard deviation of 18.23 compared with a mean score of 38.95 and a standard deviation of 21.38 in January 2012.

Question 1

This question tested graphical and analytical skills. Candidates were required to use data given to draw a graph, use the gradient to determine the number of turns in the primary, N_p, the current in the secondary, N_s, and the efficiency of a transformer.

Areas of Good Performance

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

In Part (b), many candidates used a large triangle to calculate the gradient. Many knew the formula and were able to substitute and calculate the answer but candidates were penalized if they used points from the table provided. This does not show the skills of reading off points from the graph.

The response to Part (d) was good. Many candidates responded by determining correctly the number of primary turns and the secondary current.

Areas of Weak Performance

In Part (c), the calculation of the efficiency of the transformer was challenging for most candidates. The efficiency is the ratio of the secondary power to the primary power represented as a percentage:

Efficiency = IsVs / IpVp x 100 but candidates should use the slope of the graph for Vs/Vp.

In Part (e), some of the features of the transformer that enables it to operate efficiently are:

- Low resistance wires/thick copper wire
- Lamination of the core
- Core design/closed loop
- Material (with small hysterisis loss).

Recommendation

Candidates should get more practice in the drawing of graphs and using the graph to calculate physical quantities.

Candidates should

- use the graph page to its maximum
- use a Θ or x when plotting points
- be encouraged to always include the 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 physical quantities and their associated instruments of measurement. It also tested the concept of the force of gravity and vectors. Performance on this question was satisfactory with more than 50 per cent of the candidates scoring 7 or more out of a total of 15 marks.

Areas of Good Performance

Parts (a) and (b) were particularly well done as most candidates were able to identify the physical quantities and their instruments and correctly apply the concept of the force of gravity.

Area of Weak Performance

In Part (c), candidates had difficulty using scale diagrams to determine a resultant vector and in the conversion of the length of the vector to its actual value.

Recommendation

Candidates should get more exposure to problems based on graphical representation of vectors at an angle. The parallelogram of forces is a useful representation of doing a problem involving vectors.

Question 3

This question was based on the thermal Physics and kinetic theory section of the syllabus. It specifically explored thermometers, the pressure law and the gas equation.

Areas of Good Performance

The performance of candidates on Parts (a) (i) and (ii) relating to thermometers and their operating temperatures was good.

Areas of Weak Performance

In Part (a) (i), the actual labelling of the fixed points gave some candidates difficulty. For Part (b), many candidates ignored the fact that atmospheric pressure was also acting and therefore used the basic formula, $P = \rho gh$. The formula should be $P = P_{atm} + \rho gh$.

Question 4

This question was based on an understanding of reflection and refraction.

Areas of Good Performance

The description of terms associated with reflection such as *normal, angle of incidence, reflection* and features of the image formed in a plane mirror were well done.

Area of Weak Performance

The calculations in Part (d) proved difficult for candidates. The important formula here was
$n = \text{Sin } i / \text{Sin } r$

Recommendation

More emphasis should be placed on problem solving using the appropriate formulas and concepts.

Question 5

This question was based on electricity concepts. The diode, truth table, resistors in series and parallel, and an application to Christmas tree lights was given. This question was satisfactorily done.

Areas of Good Performance

Parts (a) (iii), (b) (i) and (c) were all well known as most candidates were able to secure full marks.

Areas of Weak Performance

In Part (a) (i), candidates had difficulty in describing a test for a defective semi-conductor. A possible solution is that *it conducts in neither direction when a forward and reverse voltage/potential difference is applied in the current*.

Part (a) (ii) which involved sketching the graph of a functioning diode presented difficulties for candidates.

Recommendations

Students should be given adequate practical experiences to facilitate learning. The *defective diode* is one such opportunity for hands-on learning. Learning should also be facilitated by visual representations. Some students are visual learners, therefore teachers are encouraged to incorporate more visuals/graphs in their teaching.

Question 6

This question explored alternative energy sources and their uses. It also covered mechanical energy in the forms of kinetic and potential.

Areas of Good Performance

Part (a) on alternative energy was well done. The importance of alternative energy to the Caribbean includes *pollution reduction*; *less reliance on foreign importation of energy*; *less cost in the long term* and *energy conservation*. Some sources of energy expected were *solar*, *hydro-electric*, *geothermal* and *wind*.

Areas of Weak Performance

In Part (b) (i), some candidates confused the energy changes. A model response is:

Ball rises losing KE and gaining PE until a maximum height reached where KE is minimum and PE maximum

Ball loses PE and gains KE until ball drops behind the goalkeeper, PE=0 and KE is maximum

For Part (b) (ii), many candidates forgot the negative sign which should be interpreted as *difference*.

Recommendations

Teachers can explore the topic of alternative energy via a project and presentations or a poster competition. The use of the World Wide Web for information on alternative energy is also a good option.

Students can be taken on the actual football field to demonstrate and experience the football problem.

Paper 032 – Alternative to School Based Assessment (SBA)

Question 1

This question was well done by the majority of candidates. It explored candidates' use of motion. The experimental and use of knowledge skills tested were:

- Plotting of a graph of velocity versus time.
- Identification of an incorrectly recorded reading
- Calculation of the gradient of the graph.
- The interpretation of the graph to interpret the gradient

Areas of Good Performance

Most candidates were able to plot the graph correctly. Identification of the incorrect reading and calculation of the gradient were well done.

Areas of Weak Performance

Most candidates did not state that the formula of gradient = (change in y)/(change in x) , but used it correctly in calculating the gradient.

Some candidates did not know that the gradient of a velocity versus time graph is acceleration.

Recommendation

Teachers should be clear about the requirements in data analysis questions and ensure that students get adequate practice in acquiring the skills.

Question 2

This question was based on Boyle's Law and candidates performed satisfactorily. This question engaged candidates in labelling apparatus, writing a procedure, interpreting a graph and sketching a graph.

The experimental skills tested were:

- Correct labelling of the apparatus — Dry air, glass tube, bourdon pressure gauge and oil reservoir

- Describing the procedure of the investigation — The pressure of the air in the space above the reservoir is altered by the foot pump and measured on the pressure gauge. The pressure is transmitted through the oil to the air in a glass tube whose volume is measured by the measuring cylinder

- Including one precaution

The Use of Knowledge skills tested included confirmation that a particular graph represents Boyle's Law and sketching a graph of V against P.

Area of Good Performance

Candidates were able to identify the apparatus via labelling.

Area of Weak Performance

Candidates could not adequately describe the experiment.

Recommendation

Candidates should familiarize themselves with the meaning of the terms *inversely proportional* and *directly proportional*.

Question 3

In this question, candidates had to use Planning and Design skills to distinguish between the north pole and the south pole of a magnet. The diagram for the set-up of the activity accounted for experimental skills. The use of knowledge skills were tested by a situation in which candidates had to identify which of two steel bars was a magnet.

Area of Good Performance

Candidates identified which steel bar was the magnet.

Area of Weak Performance

The explanation of how the choice of magnet was decided upon was poor. It was expected that candidates would have stated that repulsion is the test for a magnet.

Recommendation

Teachers should spend more time doing Planning and Design type activities with students.