FORM TP 2012103

TEST CODE **01238020**

MAY/JUNE 2012

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of **SIX** questions.
2. Section A consists of **THREE** questions. Candidates must answer **ALL** questions in this section. Answers for this section must be written in this answer booklet.
3. Section B consists of **THREE** questions. Candidates must answer **ALL** questions in this section. Answers for this section must be written in the space provided after EACH question in this answer booklet.
4. All working **MUST** be **CLEARLY** shown.
5. The use of non-programmable calculators is permitted, but candidates should note that the use of an inappropriate number of figures in answers will be penalized.
6. Mathematical tables may be used.

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SECTION A

Answer ALL questions.
You MUST write your answers in the spaces provided in this booklet.

1. A student investigated the relationship between the electrical potential difference across a device and the current flowing through that device. The results were recorded in Table 1.

TABLE 1

Potential difference (V)	1.5	4.0	10.0	18.0	30.0	45.0
Current (I)	0.02	0.05	0.15	0.24	0.40	0.60

(a) Plot on page 3, a graph of potential difference (V) versus current (I). **(8 marks)**

(b) Calculate the gradient of the line obtained in (a). (Do not use any point that coincides with a point from the table.)

(4 marks)

(c) State the physical property of the device with which the gradient is associated.

(1 mark)

(d) Using the information from the graph, comment on the relationship between the potential difference, (V), and the current (I).

_____

_____

(1 mark)

(e) Draw a labelled circuit diagram to show how the student should have connected his/her apparatus to conduct the investigation. **(4 marks)**

(f) With reference to 1 (e), describe the procedure used to conduct the investigation.

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(4 marks)

(g) Three devices with resistances 8 Ω, 12 Ω and 15 Ω are connected in a circuit. Find the combined resistance of these devices when they are arranged in parallel.

(3 marks)

Total 25 marks

2. (a) Complete Table 2 which relates the physical quantities and their derived SI units.

TABLE 2

(i)

Physical Quantity	**Derived SI Units**
Area	_____
Volume	_____
_____	Kg m^{-3}

(3 marks)

(ii) State TWO fundamental quantities and their corresponding SI units.

Fundamental Quantity	SI Units
1.	
2.	

(4 marks)

(b) (i) Calculate the density of gasoline which occupies 150 cm^3 of space and has a mass of 102 g.

(3 marks)

(ii) If 325 g of mercury of density 13.6 gcm^{-3} occupies a certain space, determine the volume of the space.

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(3 marks)

(iii) Calculate the relative density of gasoline using the density of mercury as the base quantity for the comparison.

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(2 marks)

Total 15 marks

3. The yacht shown in Figure 1 has a mass of 8300 kg.

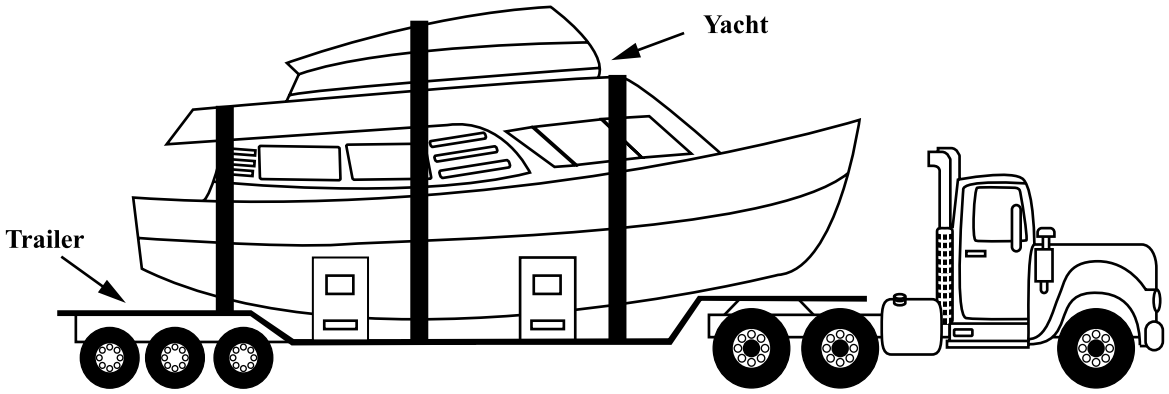


Figure 1. Diagram showing a yacht on a trailer

(a) Determine its weight in air.

[Acceleration due to gravity, g = 10 N Kg^{-1}]

(2 marks)

(b) For land transport, the yacht is secured on a trailer. Each tyre on the trailer can support up to a maximum of 7000 Newtons. What is the LEAST number of tyres the trailer should have to support the yacht adequately?

(2 marks)

(c) (i) Many forces act on the yacht yet it is in equilibrium. State TWO conditions that must be satisfied for an object to be in equilibrium.

1. _____

_____

2. _____

_____

(2 marks)

(ii) State the effect that the position of the centre of gravity of an object has on its stability.

_____

_____

(1 mark)

(d) (i) State Archimedes' Principle.

_____

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(2 marks)

(ii) The yacht's hull is made of steel with density, ρ_s, equal 7850 kg m^{-3}. Explain how the yacht is able to float in sea water of density, ρ_w,1025 kg m^{-3}.

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(2 marks)

(iii) Calculate the volume of sea water displaced by the yacht as it floats.

(4 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

SECTION B

Answer ALL questions.

You MUST write your answers in the space provided after each question.

4. (a) Experiments into the fundamental nature of matter are being carried out at particle accelerator facilities. A hundred years ago, Geiger and Marsden performed the now famous gold – foil experiment at the suggestion of Rutherford.

Describe this experiment and explain how it established the nuclear structure of the atom.

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(6 marks)

(b) One type of reaction in a nuclear reactor involves the bombarding of an Uranium atom ($^{235}_{92}U$) with a neutron. In the process, Krypton (Kr) and Barium (Ba) are created along with the release of 2 neutrons and energy. The incomplete equation for this reaction is:

$$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}_{36}Kr + {}^{144}Ba + 2\ {}^{1}_{0}n + \text{energy}$$

(i) Rewrite and complete the nuclear equation for this process.

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(2 marks)

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(ii) Table 3 below gives atomic mass data for nuclides.

TABLE 3

Nuclide	Atomic Mass / u
$^{235}_{92}U$	235.118
$^{}_{36}Kr$	89.947
^{114}Ba	143.881
$^{1}_{0}n$	1.009

where u = 1.66×10^{-27} kg

Calculate the energy released in the nuclear reaction in 4 (b)(i). State your answer in Joules.

[c = 3.0 x 10^{8} m s^{-1}]

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(7 marks)

Total 15 marks

5. (a) (i) State the equation for the General Gas Law.

_____

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(1 mark)

(ii) A little girl blew up a balloon during a Christmas celebration.
Explain, in terms of the kinetic theory, how pressure is exerted by the air in the balloon.

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(5 marks)

(b) (i) A block of ice of mass 2000 g was heated from 0 °C to steam at 100 °C. Calculate the energy used in Joules.

(6 marks)

(ii) If the activity at (b) (i) took place in 6000 s, how much power was utilized?

(3 marks)

[Specific latent heat of vaporization of steam = 2 250 000 J Kg^{-1}
Specific latent heat of fusion of ice = 330 000 J Kg^{-1}
Specific heat capacity of water = 4 200 J Kg^{-1} K^{-1}]

Total 15 marks

6. (a) (i) Outline THREE differences between 'light waves' and 'sound waves'.

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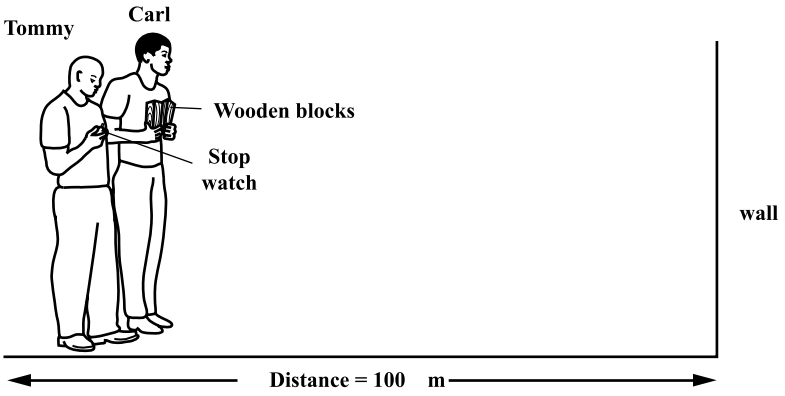
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(3 marks)

(ii) Electromagnetic waves have many properties. Write a paragraph describing at least THREE properties not referred to in Part (a) (i). **(3 marks)**

(b) Carl and his friend Tommy were doing a School-Based Assessment on estimating the speed of sound in air using an echo method.



Carl stands 100 m from a wall. Carl claps two wooden blocks to produce a series of echoes and Tommy who was standing beside him starts his stop watch. After 1 echo Tommy stops the watch. This process is repeated and the time for 50 echoes was calculated to be 30.3 s.

Calculate the speed of the sound generated.

(5 marks)

(c) A popular radio station broadcasts with a frequency of 100×10^6 Hz.

Calculate, in centimetres, the wavelength of the sound waves generated. **(4 marks)**

[Speed of radio waves = 3.0×10^8 m s^{-1}].

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

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