



**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.

**DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.**

**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**

<b>Potential difference (V)</b>	1.5	4.0	10.0	18.0	30.0	45.0
<b>Current (I)</b>	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.

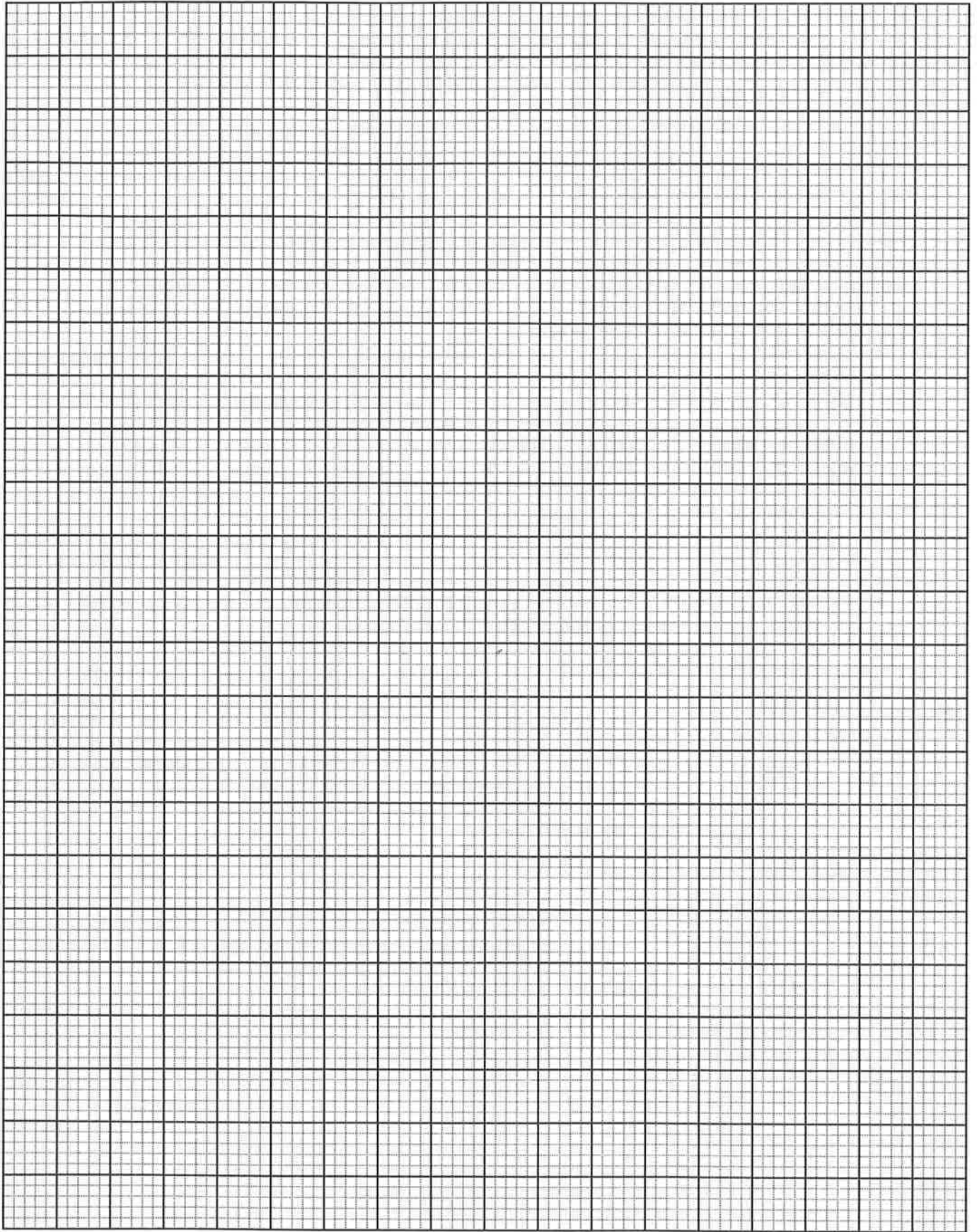
**(1 mark)**

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

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**(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  $8 \Omega$ ,  $12 \Omega$  and  $15 \Omega$  are connected in a circuit. Find the combined resistance of these devices when they are arranged in parallel.

**(3 marks)**

**Total 25 marks**

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

**TABLE 2**

(i)

<b>Physical Quantity</b>	<b>Derived SI Units</b>
Area	_____
Volume	_____
_____	$\text{Kg m}^{-3}$

**(3 marks)**

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

<u>Fundamental Quantity</u>	<u>SI Units</u>
1.	
2.	

**(4 marks)**

- (b) (i) Calculate the density of gasoline which occupies  $150 \text{ cm}^3$  of space and has a mass of 102 g.

**(3 marks)**

- (ii) If 325 g of mercury of density  $13.6 \text{ gcm}^{-3}$  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.

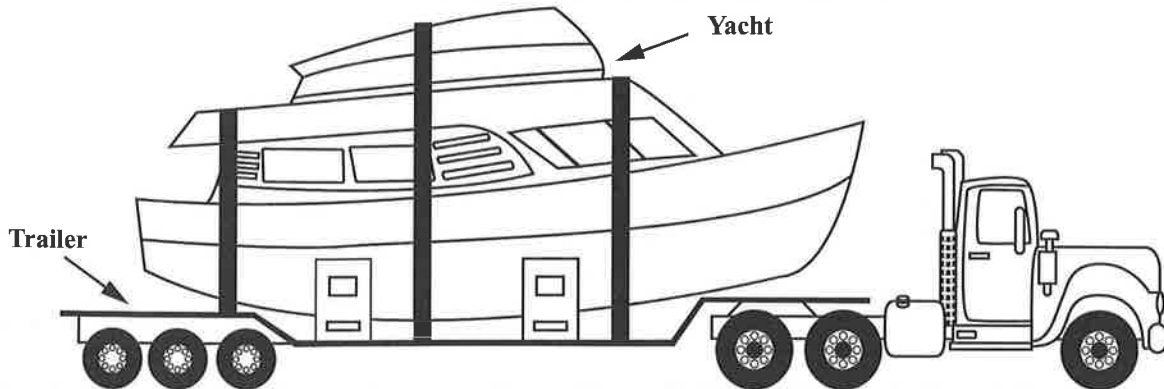


Figure 1. Diagram showing a yacht on a trailer

- (a) Determine its weight in air.

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

(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,  $\rho_s$ , equal  $7850 \text{ kg m}^{-3}$ . Explain how the yacht is able to float in sea water of density,  $\rho_w$ ,  $1025 \text{ kg m}^{-3}$ .

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\_\_\_\_\_  
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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**

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**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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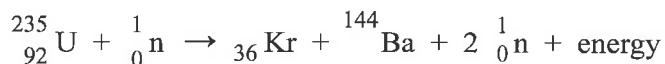
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**(6 marks)**

- (b) One type of reaction in a nuclear reactor involves the bombarding of an Uranium atom ( $^{235}_{92}\text{U}$ ) 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:



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

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**(2 marks)**

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

**TABLE 3**

Nuclide	Atomic Mass / u
${}_{92}^{235}\text{U}$	235.118
${}_{36}^{89}\text{Kr}$	89.947
${}_{56}^{144}\text{Ba}$	143.881
${}_{0}^{1}\text{n}$	1.009

where  $u = 1.66 \times 10^{-27}$  kg

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

$$[c = 3.0 \times 10^8 \text{ m s}^{-1}]$$

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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 <sup>-1</sup>
Specific latent heat of fusion of ice	= 330 000 J Kg <sup>-1</sup>
Specific heat capacity of water	= 4 200 J Kg <sup>-1</sup> K <sup>-1</sup> ]

**Total 15 marks**

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

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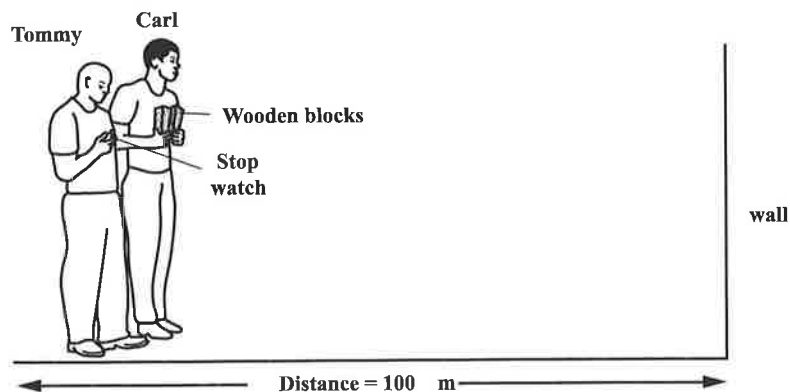
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**(3 marks)**

- (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  $100 \times 10^6$  Hz.

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

[ Speed of radio waves =  $3.0 \times 10^8$  m s<sup>-1</sup> ].

**Total 15 marks**

**END OF TEST**

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