FORM TP 02025107

TEST CODE 01238020

MAY/JUNE 2025

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN 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 in TWO sections. Answer ALL questions.
2. Write your answers in the spaces provided in this booklet.
3. Do NOT write in the margins.
4. All working MUST be shown. Where appropriate, ALL formulas MUST be clearly stated as part of your working.
5. You may use a silent, non-programmable calculator to answer questions, but you should note that the use of an inappropriate number of figures in answers will be penalized.
6. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
7. **If you use the extra page(s), you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

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

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SECTION A

Answer ALL questions.

1. An electric hotplate rated at 240 V and 3.5 A is used to heat 600 g of liquid. The liquid is heated and its temperature is recorded at 20-second intervals. The results obtained are shown in Table 1.

TABLE 1: TEMPERATURE READINGS FOR LIQUID WHEN HEATED

Time t/s	Temperature θ/°C
0	28
20	28
40	30
60	34
80	38
100	43
120	47
140	55
160	59
180	67
200	74

(a) (i) Using the data recorded in Table 1 and the grid provided in Figure 1 **on page 5**, plot a graph of temperature (θ/°C) against time (t/s).

Draw the line of best fit through the last five points (that is, from t = 120 s to t = 200 s). **(8 marks)**

(ii) Hence, calculate the gradient, *G*, of the line drawn in (a) (i).

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(5 marks)

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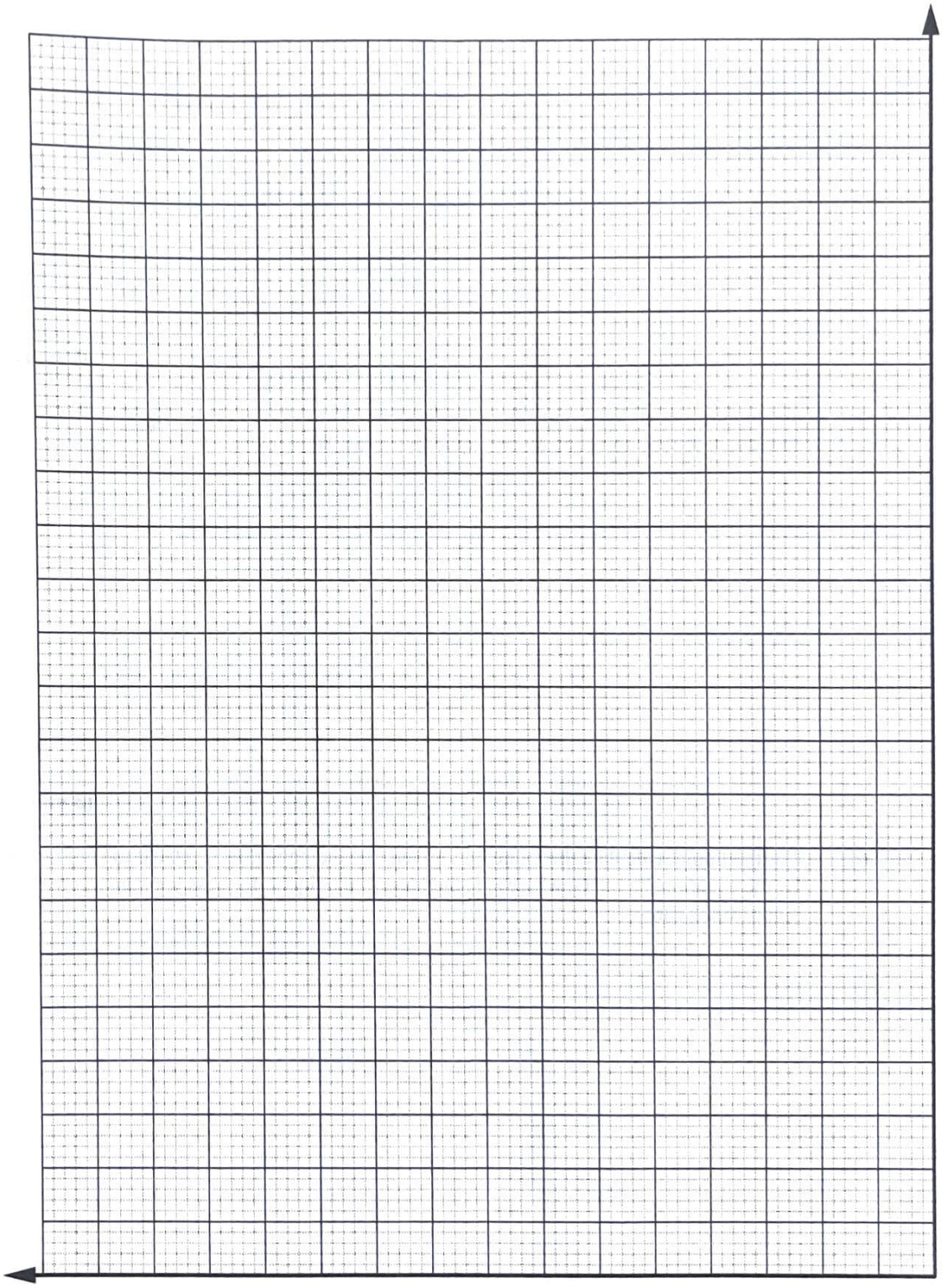


Figure 1. Graph of temperature, θ/°C, against time, t/s, for a liquid that is being heated

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0 1 2 3 8 0 2 0 0 5

(b) Calculate the power, P, of the hotplate, in watts.

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(2 marks)

(c) Assuming that all the energy from the hotplate is transferred to the liquid, calculate the energy, in joules, absorbed by the liquid in the last 80 seconds.

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(3 marks)

(d) For the liquid, calculate the value of c, given that the power, P, is related to the gradient by the equation $P = mcG$, where m is the mass of the liquid. Express your answer to three significant figures.

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(4 marks)

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(e) Complete Table 2 by inserting the symbol and SI unit for the quantities involved in the experiment.

TABLE 2: SYMBOLS AND SI UNITS FOR QUANTITIES INVOLVED IN THE EXPERIMENT

Quantity	Symbol	SI Unit
	c	
Heat capacity		$J\ K^{-1}$

(3 marks)

Total 25 marks

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2. (a) Define the term 'gravitational potential energy'.

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(2 marks)

Figure 2 shows Keroi, a basketball player in the national league in St Vincent, going through his routine.



Figure 2. Keroi dribbling a basketball

(b) As Keroi dribbles the ball with either his right or left hand, energy conversion takes place.

List the energy changes which take place through the following stages as he dribbles the ball.

(i) When the ball leaves his hand and strikes the ground

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(ii) While the ball is in contact with the ground

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(iii) When the ball leaves the ground and rebounds to his hand

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(5 marks)

(c) In a test to determine if a basketball with a mass of 1.1 kg is properly inflated, the basketball is dropped from a height of 1.5 m and rebounds to a height of 0.8 m.

Calculate the energy lost by the basketball.

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(6 marks)

(d) Suggest TWO possible ways in which the energy was lost by the ball.

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(2 marks)

Total 15 marks

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3. (a) (i) Draw and label a diagram of a simple transformer.

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(5 marks)

(ii) With the aid of your diagram, explain the operation of a simple transformer.

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(4 marks)

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(b) A local power station distributes power at 13.2 kV. This power is then converted to 220 V for domestic use.

(i) Based on the scenario above, identify the key assumption made with respect to an ideal transformer.

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(1 mark)

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(ii) State the equation for an ideal transformer.

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(1 mark)

(iii) Assuming the transformer is ideal, calculate its turns ratio.

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(2 marks)

(iv) If the current in the secondary coils is 5 A, calculate the current in the primary coils.

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(2 marks)

Total 15 marks

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SECTION B

Answer ALL questions.

4. (a) Define EACH of the following wave phenomena.

Wavelength

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(2 marks)

Amplitude

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(2 marks)

Diffraction

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(2 marks)

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(b) Two loudspeakers placed about one metre apart are simultaneously playing the same music. Sophia walks along the line from A to B, as shown in Figure 3.

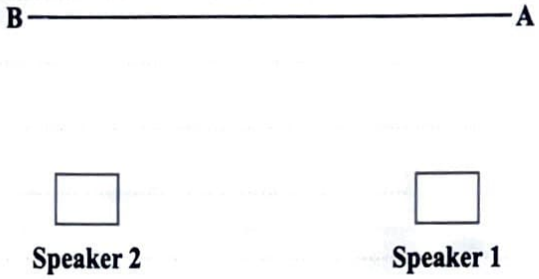


Figure 3. Two loudspeakers and the path taken by Sophia walking by

(i) Describe what Sophia hears while walking along the line from A to B.

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(2 marks)

(ii) Explain your answer in (b) (i).

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(3 marks)

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(c) Explain the concept of 'wave particle duality' of light, making use of the contributions of Newton and Young.

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(4 marks)

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5. (a) Define EACH of the following terms.

Velocity

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(2 marks)

Momentum

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(1 marks)

(b) State the principle of conservation of linear momentum.

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(3 marks)

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(c) In a Twenty20 cricket match, a ball with a mass of 160 g has a velocity of 25 ms^{-1} off the pitch and is hit by a bat with a mass of 1.2 kg moving in the opposite direction at 15 ms^{-1}.

(i) Calculate the momentum of the

a) bat before collision

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(2 marks)

b) ball before collision.

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(2 marks)

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(ii) After contact between the bat and the ball, the ball moves in the opposite direction at 20 ms^{-1}. Assuming the collision is completely elastic, calculate the

a) momentum of the bat after the collision

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(3 marks)

b) velocity of the bat after the collision.

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(2 marks)

Total 15 marks

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6. (a) Table 3 shows the properties of the radiation emitted in radioactive decay.

TABLE 3: PROPERTIES OF THE RADIATION EMITTED IN RADIOACTIVE DECAY

Emission	Mass	Ionizing Power	Composition of Radiation
α	4u		
β		Medium	An electron
γ			

Fill in the missing information in Table 3.

(6 marks)

(b) An equation for radioactive decay is shown below.

$$^{K}_{6}C \longrightarrow {}^{14}_{7}N + {}^{0}_{P}e$$

(i) Determine the values of *K* and *P*. Explain your response.

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(4 marks)

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(ii) Using the equation of radioactive decay given **on page 18**, deduce the type of emission.

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(1 mark)

(iii) If, during the decay process, the energy liberated is 2.50×10^{-14} J, calculate the mass difference. Use Einstein's mass–energy equation.

[Take the velocity of light as $c = 3.00 \times 10^{8}$ ms^{-1}]

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(4 marks)

Total 15 marks

END OF TEST

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

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