FORM TP 2022103

TEST CODE 01238020

MAY/JUNE 2022

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. Where appropriate, ALL WORKING MUST BE SHOWN in this booklet.
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. The activity of a radioactive substance was measured over a six-minute period. The results are recorded in Table 1.

TABLE 1: ACTIVITY, *A*, AND CORRESPONDING TIME, *t*

Time, (*t*) in minutes	Activity, (*A*) Disintegrations per minute
0	80.0
1	50.0
2	35.0
3	22.0
4	13.0
5	8.0
6	4.0

(a) Using the grid provided in Figure 1 **on page 5**, plot a graph of activity, *A* versus time, *t*, and draw a smooth curve.

(8 marks)

(b) (i) Define the term 'half-life'.

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(2 marks)

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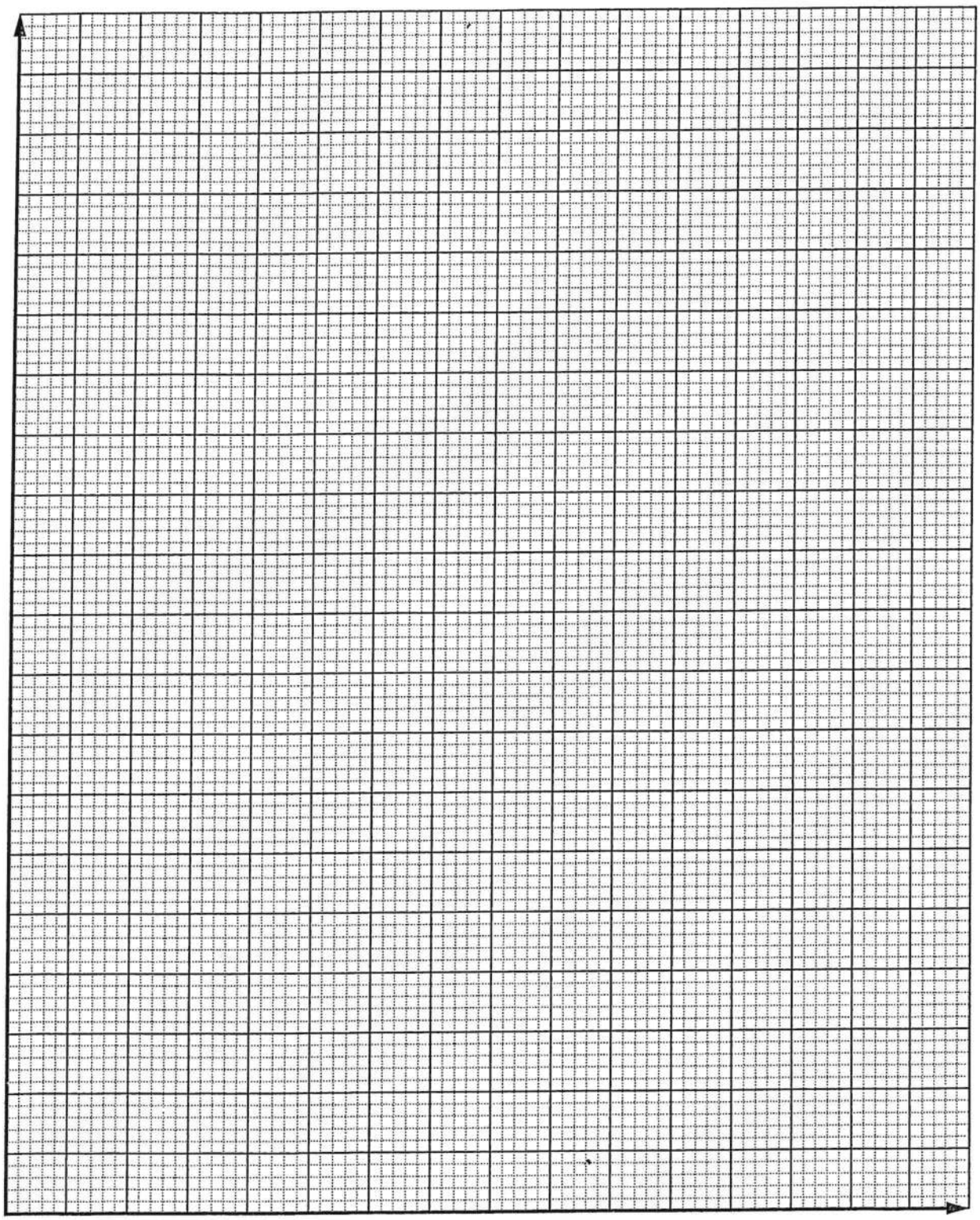


Figure 1. Graph of activity, *A* versus time, *t*

(ii) From your graph **on page 5**, calculate the average half-life of the radioactive substance.

(5 marks)

(iii) On your graph **on page 5**, use dotted lines to determine how long it would take for the activity of the sample to be reduced to ten disintegrations per minute from its original activity level.

Time taken .....

(2 marks)

(c) (i) Define the term 'nuclear fission'.

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(1 mark)

(ii) The equation below is an example of a nuclear fission reaction.

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{90}_{36}Kr + ^{144}_{56}Ba + 2\,^{1}_{0}n + energy$$

Using the atomic mass data for the nuclides given in Table 2, calculate the energy released in the reaction. State your answer in joules.

TABLE 2: NUCLIDE AND CORRESPONDING ATOMIC MASS

Nuclide	Atomic Mass/*u*
$^{235}_{92}U$	235.118
$^{144}_{56}Ba$	143.881
$^{90}_{36}Kr$	89.847
$^{1}_{0}n$	1.009

[where u = 1.66 × 10^{-27} kg, c = 3.0 × 10^{8} ms^{-1}]

(7 marks)

Total 25 marks

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2. (a) Complete Table 3 by inserting the missing physical quantities and their derived SI units.

TABLE 3: PHYSICAL QUANTITIES AND DERIVED SI UNITS

Physical Quantity	Derived SI Unit
	m^2
Density	
	$kg\ ms^{-2}$
Velocity	

(4 marks)

(b) State Newton's second law of motion.

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(3 marks)

(c) (i) A basketball has a mass of 500 g. Calculate its weight in newtons.

[Acceleration due to gravity, $g = 10\ ms^{-2}$]

(3 marks)

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(ii) Figure 2 is a scale drawing of a vector diagram representing a basketball's velocity, *OA*, and the wind's velocity, *OB*. Complete the scale drawing on Figure 2 to determine the resultant velocity of the basketball.

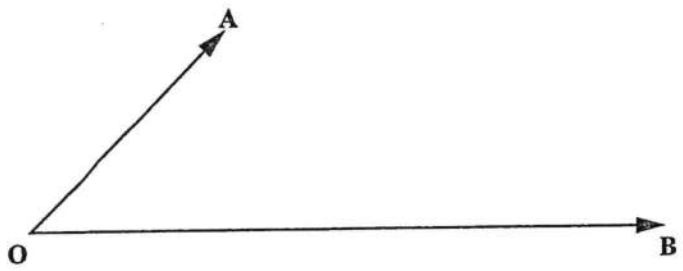


Figure 2. Scale drawing of a vector diagram

(3 marks)

(iii) Determine the magnitude of the resultant velocity in ms^{-1} and its direction in degrees from the wind's velocity, *OB*.

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(2 marks)

Total 15 marks

NOTHING HAS BEEN OMITTED.

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3. (a) Complete Table 4 by inserting the types of thermometers, their use and range.

TABLE 4: TYPE OF THERMOMETER, USE AND RANGE

Type of Thermometer	Use	Range
	Measures extremely high, rapidly changing temperatures	−200 °C to 1500 °C
		34 °C to 43 °C
	Mainly measures boiling and freezing point of water, and room temperature	

(5 marks)

(b) State the value of the ice point on the

(i) Celsius scale

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(ii) Kelvin scale.

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(2 marks)

(c) The graph in Figure 3 shows how the pressure, *p,* varies with the inverse volume, *1/v.*

(i) State the law associated with the graph in Figure 3.

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(1 mark)

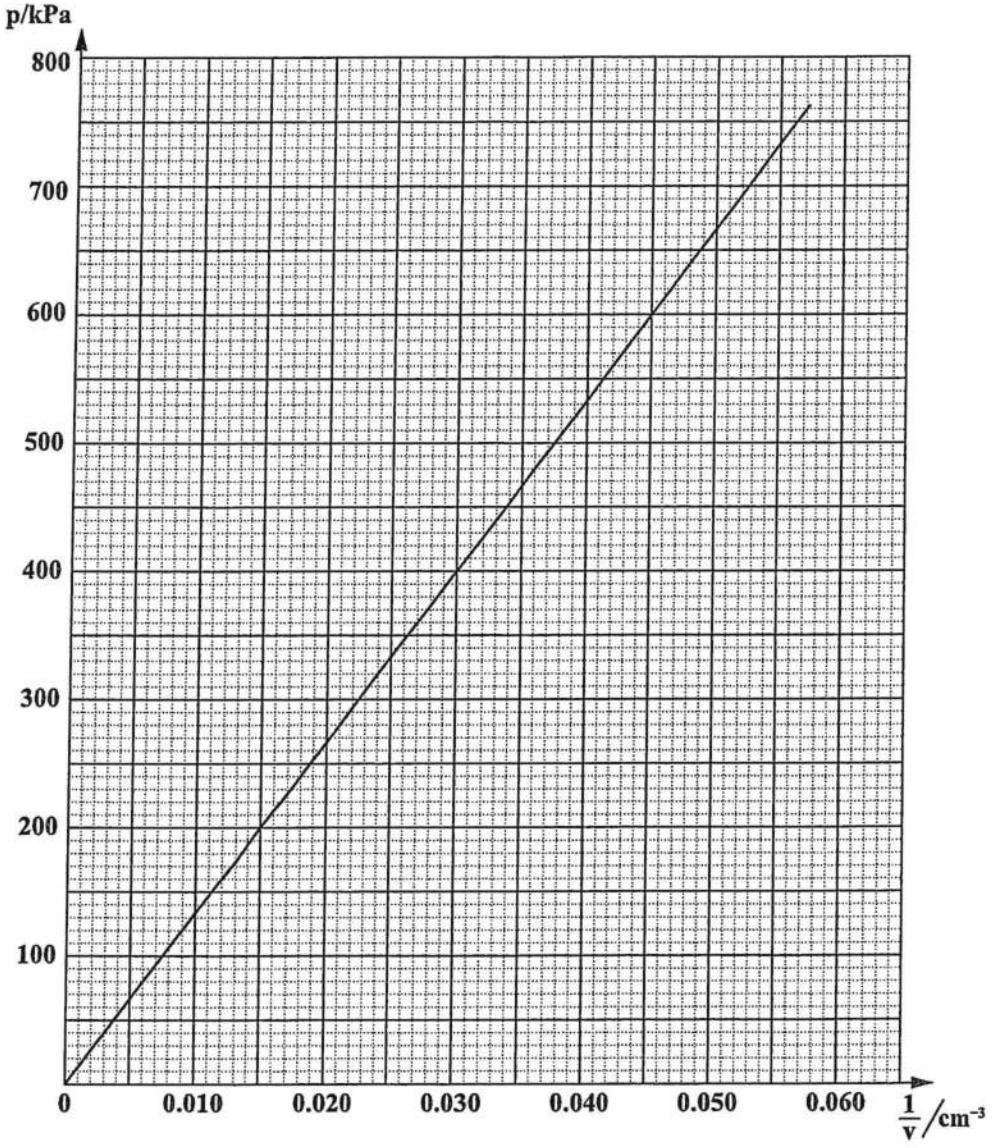


Figure 3. Graph of pressure, *p,* versus inverse volume, *1/v*

(ii) Use the graph in Figure 3, **on page 12**, to determine the volume when the pressure is 250 kPa.

(3 marks)

(iii) Use your answer in (c) (ii) to calculate the new volume when the pressure is increased from 250 kPa to 975 kPa.

(4 marks)

Total 15 marks

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SECTION B

Answer ALL questions.

4. (a) (i) Define the term 'pressure'. State its SI unit.

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(3 marks)

(ii) Calculate the liquid pressure that a diver experiences at a depth of 0.5 km below the surface of the sea, given that acceleration due to gravity, $g = 10 Nkg^{-1}$ and the density of sea water, $\rho = 1025$ kg m^{-3}.

(4 marks)

(b) (i) State Archimedes' principle.

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(3 marks)

(ii) A boat which has a weight of 83 000 N floats in sea water. If the density of the sea water is 1025 kg m^{-3}, calculate the volume of the sea water displaced by the boat.

(5 marks)

Total 15 marks

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5. (a) Define the term 'longitudinal wave'.

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(2 marks)

(b) Figure 4 is a wave train on which the points *K* to *S* and *a* to *d* are shown.

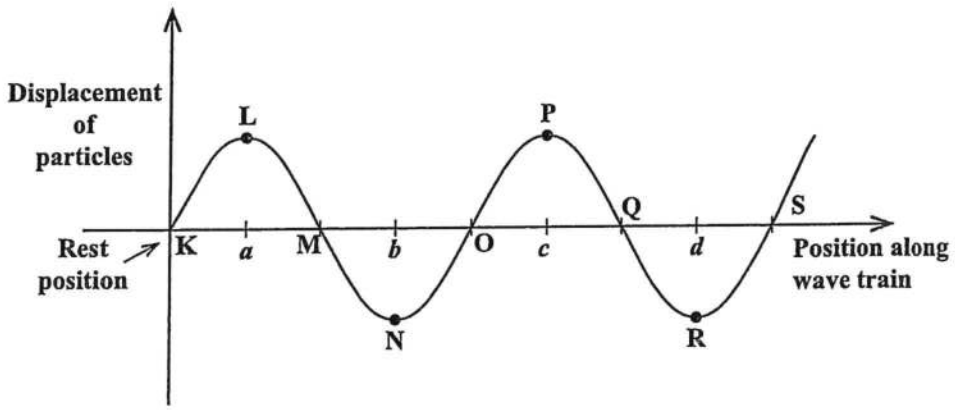


Figure 4. Wave train

Write TWO letters whose distance between them on the wave train in Figure 4 represents

(i) the amplitude .....

(ii) a wavelength. .....

(2 marks)

(c) State TWO differences between 'light waves' and 'sound waves'.

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(2 marks)

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(d) An object is placed 15 cm in front of a converging lens with a focal length 10 cm.

(i) Calculate the image distance, v.

(4 marks)

(ii) Determine the magnification of the image formed.

(2 marks)

(iii) State the nature and position of the image formed.

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(3 marks)

Total 15 marks

6. (a) Complete Table 5 by inserting the missing electrical circuit symbols and their names.

TABLE 5: ELECTRÍCAL CIRCUIT SYMBOLS AND NAMES

Name	Circuit Symbol
Filament lamp	
	
Fuse	
	
Cell	
	

(6 marks)

(b) The manufacturer of a popular cellphone has upgraded the battery capacity to 9600 C.

(i) If the standard charger can deliver a current of 0.8 A, calculate the time taken to charge the battery.

(3 marks)

(ii) Calculate the voltage, given that the power supply of the cellphone is 4.4 W.

(3 marks)

(iii) Determine the work done to fully charge the cellphone battery.

(3 marks)

Total 15 marks

END OF TEST

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

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