FORM TP 2026–026

TEST CODE **01238020**

JANUARY 2026

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

HYBRID

Paper 02 – General Proficiency

2 hours 30 minutes

08 JANUARY 2026 (a.m.)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions in two sections. Answer ALL questions.
2. **All responses, with the appropriate units, MUST be written in the answer booklet provided.**
3. Your responses MUST be written in English.
4. All working MUST be shown. Where appropriate, ALL formulas MUST be clearly stated as part of your working.
5. Where appropriate, ALL WORKING MUST BE SHOWN in the booklet provided.
6. It is an offence to share your keycode with any other candidate or to log in with another candidate's details.
7. Any attempt to change the configuration of this machine, connect external devices, connect to external networks or to in any way initiate communication with resources other than the URL provided will result in your disqualification, you being shut out of the system and the cancellation of your entire test.

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

SECTION A

Answer ALL questions.

1. A class is investigating whether the amount of insulation around a container affects the rate at which a liquid cools.

For this experiment, two test tubes, A and B, were set up as shown in Figure 1. Test tube A has insulation of a given thickness around it. The insulation around Test tube B, which was made of the same material as the insulation around Test tube A, was much thicker.

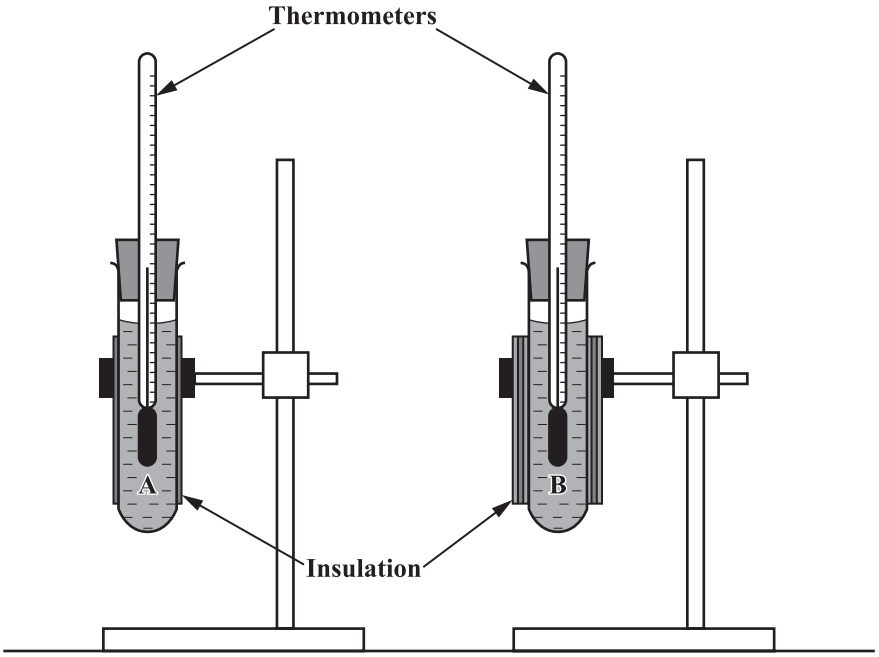

Figure 1. Setup for the experiment

Procedure

1. Hot water was poured into Test tube A and Test tube B, up to the level of the top of the insulation.

2. The initial temperature, θ, of the water in each test tube was recorded and the stop clock was immediately started.

3. Temperature readings were taken from both test tubes A and B at 30-second intervals over a period of 240 seconds.

(a) A student touched the bottom of each test tube and exclaimed that they were very hot. State the method of heat transfer by which heat was transmitted from the test tube to the student's hands. **(1 mark)**

(b) Complete Table 1 by inserting the missing values under the time column to show the results of the experiment.

TABLE 1: RESULTS OF THE EXPERIMENT

Time (t/s)	**Temperature of Test tube A (θ/°C)**	**Temperature of Test tube B (θ/°C)**
0.0	71.0	71.0
	69.0	69.4
60.0	66.0	68.2
	64.0	66.3
	62.5	65.2
150.0	60.5	65.0
	58.5	63.7
	56.0	61.8
	54.0	60.5

(3 marks)

(c) On the grid provided on your answer booklet, plot a graph of temperature against time and draw a line of best fit for **Test tube A ONLY**. **(8 marks)**

(d) Using your graph, calculate the gradient, G, of the line. Show clearly on the graph the coordinates used to obtain the gradient. **(6 marks)**

(e) What physical quantity does the gradient represent? **(1 mark)**

(f) The magnitude of the gradient for the graph for Test tube B is less than that for Test tube A. Hence, or by using the information given in Table 1 for Test tube B, state how the thickness of the insulation affects the rate at which the water cools. Give a reason to justify your answer. **(2 marks)**

(g) State TWO actions that the students would have taken to ensure that the temperature readings in this experiment were made as accurate as possible. **(2 marks)**

(h) Suggest TWO improvements that could be made to the apparatus or procedures to ensure that the investigation into the effect of insulation on the rate of cooling is more reliable. **(2 marks)**

Total 25 marks

2. (a) Distinguish between the terms 'gravitational potential energy (E_p)' and 'kinetic energy (E_k)'.
(3 marks)

(b) A baggage handler at an airport lifts suitcases from the carriage that brings them from the plane and places them on a conveyor belt. The moving belt then transfers the suitcases to the passengers. Figure 3 shows the position of the suitcase at different stages in its motion.

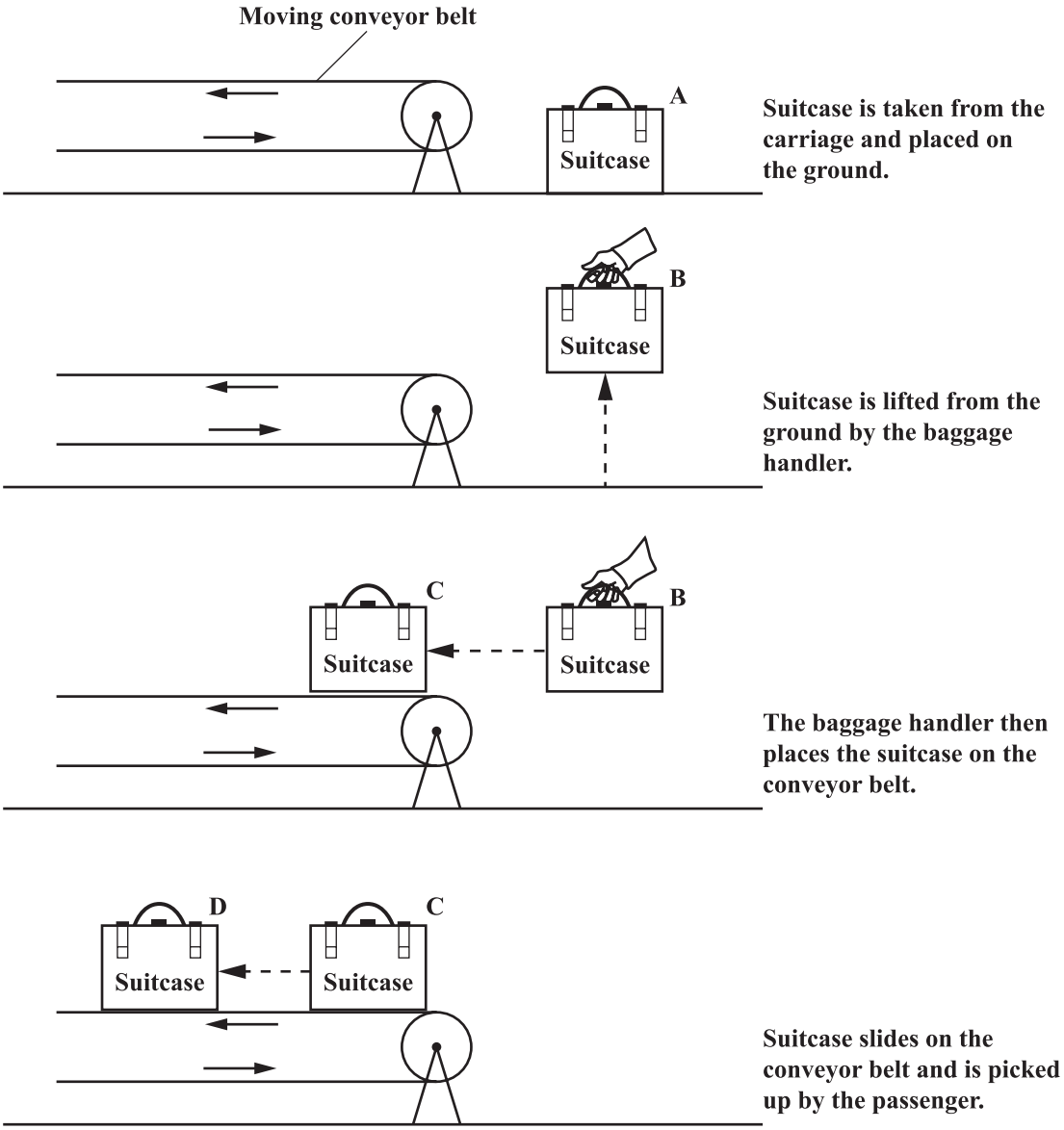

Figure 3. Stages of the position of the motion of the suitcase

(i) Describe how the total energy of the suitcase at Position A compares with the total energy of the suitcase at Position B. **(2 marks)**

(ii) Describe how the total energy of the suitcase at Position D compares with the total energy of the suitcase at Position C. **(2 marks)**

(c) At the airport, a motor lifts the luggage from the ground and places it on a belt so it can pass through the scanner.

The current in the motor is 5.0 A and the voltage across it is 110 V. The motor takes 2.5 s to lift the mass.

(i) Calculate the electrical energy transferred to the motor as it lifts the mass. **(3 marks)**

(ii) The motor lifts a 30 kg suitcase to a height of 75 cm. Calculate the gravitational potential energy (E_p) gained by the 30 kg suitcase. **(2 marks)**

(iii) Calculate the efficiency of the motor. **(3 marks)**

Total 15 marks

3. Figure 4 shows the structure of a transformer.

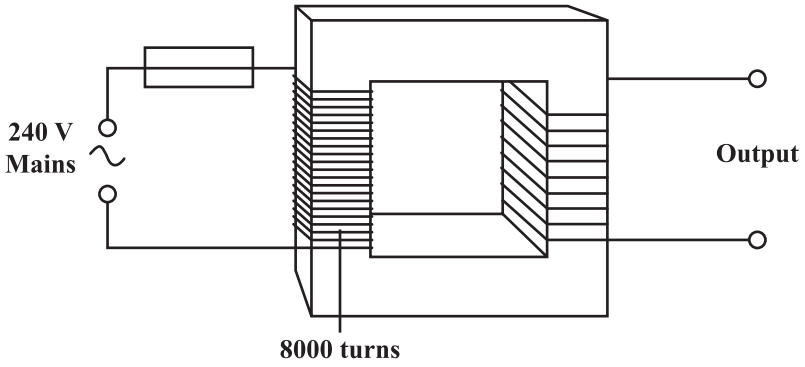

Figure 4. The structure of a transformer

The primary coil is connected to an alternating current supply of voltage 240 V and an output voltage is induced in the secondary coil. There are 8000 turns on the primary coil.

(a) Explain the meaning of the term 'alternating current'. **(2 marks)**

(b) State TWO features of the core of transformers, as the one shown in Figure 4. **(2 marks)**

(c) Using Figure 4, suggest why the transformer is classified as a step-down transformer. **(1 mark)**

(d) Describe how the output voltage is induced in the secondary coil. **(2 marks)**

(e) Given that the output voltage is 6 V, calculate the number of turns on the secondary coil. **(3 marks)**

(f) A fuse is connected in series with the primary coil.

(i) What is the function of the fuse? **(2 marks)**

(ii) A current of 150 mA flows in the primary coil. Assuming that the transformer is ideal, calculate, in Amperes, the current through the secondary coil. **(3 marks)**

Total 15 marks

SECTION B

Answer ALL questions.

4. Electromagnetic waves have many practical uses.

(a) Draw one line from each type of electromagnetic wave to match it with its use.

Electromagnetic wave	Use
Gamma rays	Thermal imaging
Infrared	Optical fibres
Microwaves	Statellite communications
Ultraviolet	Detecting fake bank notes
	Medical imaging and treatments

(4 marks)

(b) Figure 5 shows circular wave fronts produced at the centre of a wave pool. Two paddle boats, P and Q, float on the water in the pool. Boat P is on the crest of a wave at the instant shown in Figure 5.

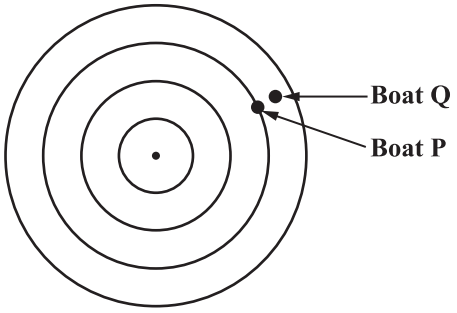

Figure 5. Circular wave fronts

In Figure 6, a snapshot of the displacement–distance graph of a wave at a particular instant is shown. The wave takes 0.95 s to move from Boat P to Boat Q.

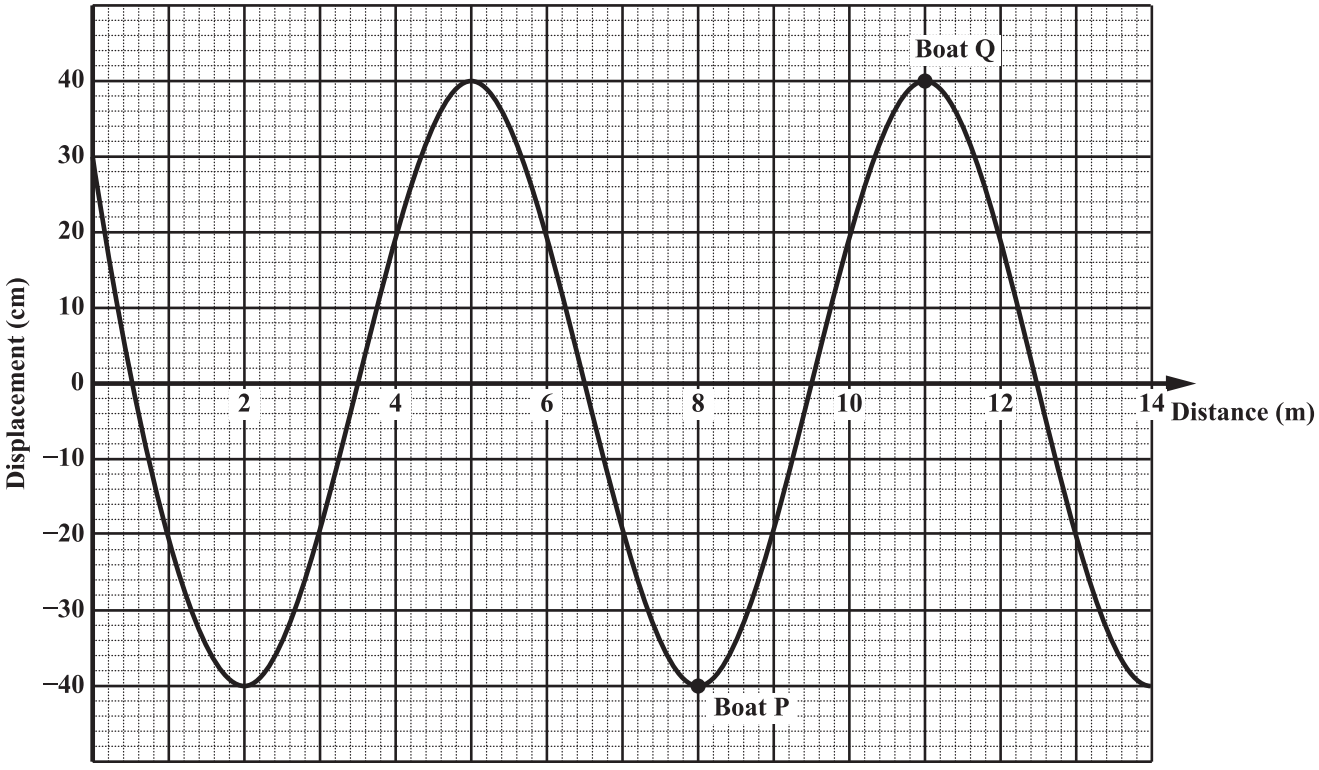

Figure 6. Displacement–distance graph of a wave

(i) Define the following terms associated with waves.

Wavelength

Period

(2 marks)

(ii) Using Figure 6 **on page 9** AND/OR the other information given, calculate

a) the period of the wave **(1 mark)**

b) the frequency of the wave **(2 marks)**

c) the speed of the wave. **(3 marks)**

(c) A student investigates the refraction of light when it travels from glass to air. Figure 7 shows the arrangement of the apparatus for the investigation.

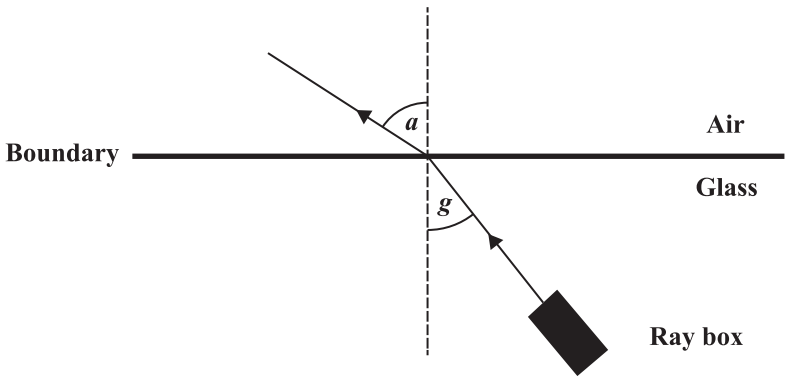

Figure 7. Apparatus for experiment

The student measures the Angle *a* in air and Angle *g* in glass and records the results as shown in Table 2.

TABLE 2: RESULTS FROM THE EXPERIMENT

Angle *a* in the Air	Angle *g* in the Glass
48°	27.5°

Use the data in Table 2 to calculate the refractive index of glass. (*Take the refractive index of air to be 1.0*.) **(3 marks)**

Total 15 marks

5. Figure 8 shows a standing steam iron which Kaleb uses in his laundry mart. The tank is filled with water, and the steam iron is used until 80% of the water has been converted to steam and released through the ironing plate.

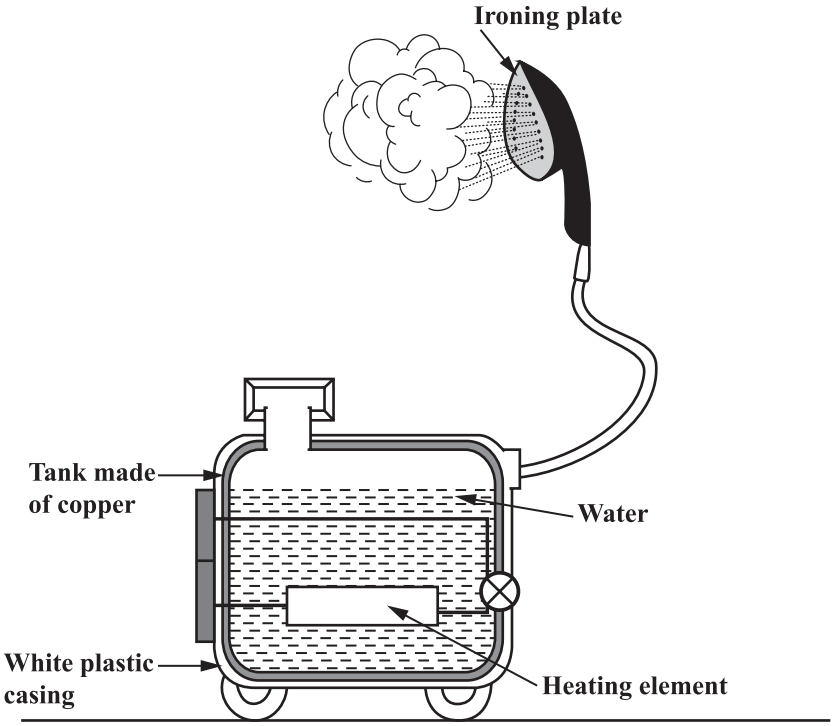

Figure 8. Standing steam iron

(a) Explain how the water in the tank of the standing steam iron is heated by the process of convection. **(2 marks)**

(b) (i) State the name of the process by which water is converted to steam. **(1 mark)**

(ii) Using the kinetic theory of matter, fully describe the process named in (b) (i). **(3 marks)**

(c) Explain how the white plastic casing and the tank being made of copper help to reduce thermal energy loss to the surroundings. **(2 marks)**

(d) The following information about the standing steam iron is given.

- Initial temperature of water is 32 °C
- Mass of water = 1.5 litres
- The mass of 1.0 litre of water is 1.0 kg
- Amount of water converted to steam = 80%
- The specific heat capacity of water = 4.2 Jg^{-1} $(°C)^{-1}$
- Specific latent heat of vaporization of water = 2.3 kJg^{-1}

Using the information given above, calculate the amount of energy used to

(i) raise the temperature of the water in the tank to its boiling point **(4 marks)**

(ii) produce the steam released. **(3 marks)**

Total 15 marks

6. (a) Radon, $^{220}_{86}Rn$, is a radioactive gas which escapes from underground rocks and causes a large part of the natural background radiation in Country A. This element has three isotopes.

(i) State the number of

a) protons in a nucleus of $^{220}_{86}Rn$ **(1 mark)**

b) electrons that orbit the nucleus. **(1 mark)**

(ii) Calculate the number of neutrons in a nucleus of $^{220}_{86}Rn$. **(2 marks)**

(iii) Explain what is meant by the term 'isotope'. **(2 marks)**

(iv) Homeowners in areas where Radon gas is produced were made aware that $^{220}_{86}Rn$ emits alpha particles. State ONE way in which the presence of Radon gas in buildings can be a health hazard. **(1 mark)**

(b) Some pond water became contaminated by the release of radioactive waste. The radioactivity of a sample of contaminated water is tested every 5 days for 50 days. The data obtained was plotted as a graph as shown in Figure 9.

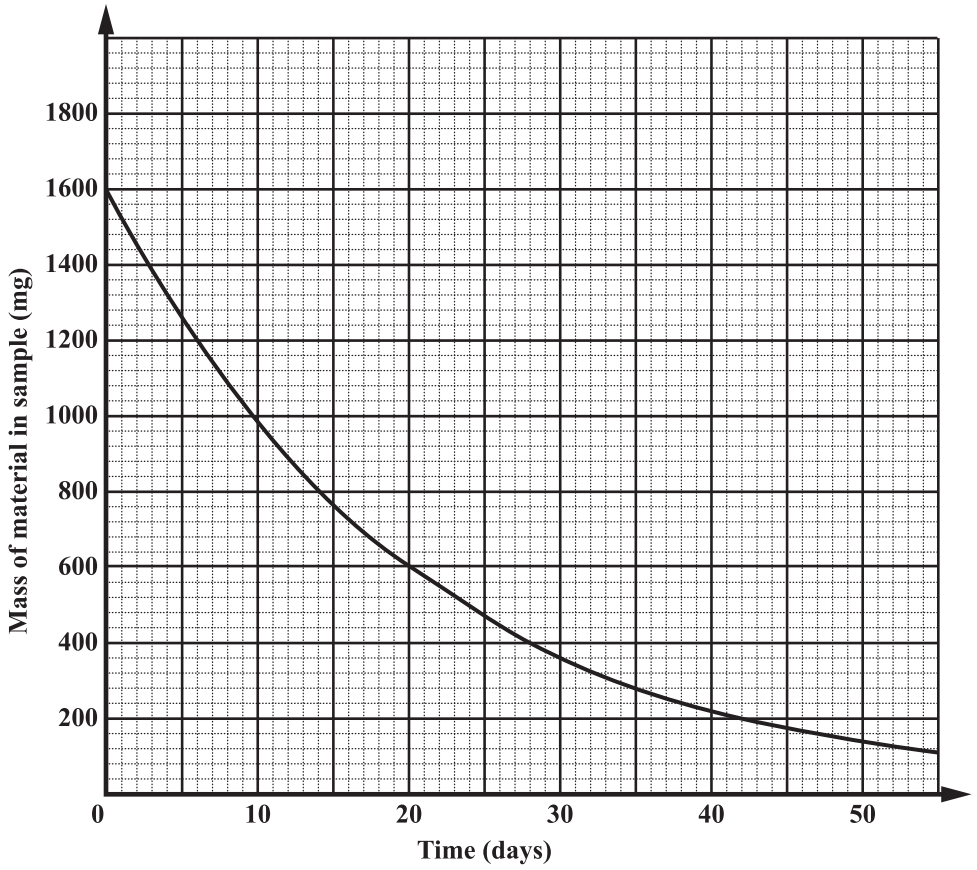

Figure 9. Graph showing the radioactivity of a sample of contaminated water

(i) Using the graph, determine the

a) half-life of the radioactive material in the sample. Draw lines on the graph or use alternative points to justify your answer. **(2 marks)**

b) time it takes for the mass of the radioactive material in the sample to fall to $\frac{1}{16}$ of its initial value. **(3 marks)**

c) mass of the radioactive material remaining in the sample after six half-lives. **(2 marks)**

(ii) If the sample of the contaminated water had been smaller, state how this would have affected the activity readings. **(1 mark)**

Total 15 marks

END OF TEST

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