Physics Model Paper 2025

Time Allowed: 2 Hours
Total Marks: 75

You must bring a soft pencil (preferably type B or HB), a clean eraser, and a dark blue or black pen.

Before attempting the paper, write your name, candidate number, centre name, and centre number clearly in the designated spaces.

Instructions for Candidates

- **Section A** contains multiple choice questions. You are required to attempt all questions by selecting the most appropriate option and marking it on the separate MCQ answer sheet using a soft pencil.
- **Section B** comprises both theory questions and a practical component. All questions in this section are compulsory. Answers must be written in the space provided on the question paper using a dark blue or black pen. You may use an HB pencil for any diagrams or graphs.
- You may use a scientific calculator.
- You should show all your working and use appropriate units.
- Do not use an erasable pen or correction fluid.
- Avoid writing over any barcodes printed on the paper.

Information for Candidates

- This paper consists of a total of **75 marks**.
- **Section A** includes **20 multiple choice questions**, each carrying **1 mark**. There is no negative marking for incorrect answers.
- **Section B** carries a total of **55 marks**, divided as follows:
  Theory Questions: 30 marks
  Practical Component: 25 marks
- The number of marks for each question or part question is shown in brackets [ ].
- A formula sheet will be provided with this paper.

Please read all questions carefully and follow the instructions exactly to ensure your responses are properly evaluated.

Section A: Multiple Choice Questions (20 questions)

Question 1

A car starts from rest.

The table shows the readings from its speedometer every 10 s.

Time / s	0	10	20	30	40	50	60
Speed m/s	0	4	8	12	12	12	12

Which row describes the car's motion in the first 30 seconds and in the last 30 seconds?

	motion during first 30 s	motion during last 30 s
A	non-zero acceleration	at rest
B	zero acceleration	constant speed
C	zero acceleration	at rest
D	non-zero acceleration	constant speed

Question 2

The diagram shows the dimensions of a solid rectangular block of metal of mass m.
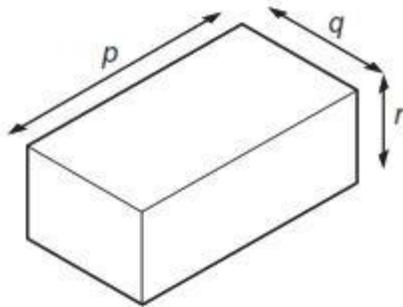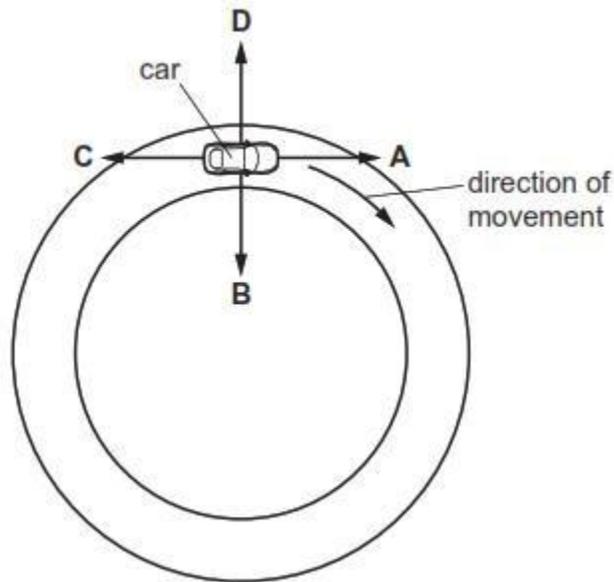

Which expression is used to calculate the density of the metal?

A $\quad \dfrac{}{p \times q}$

B $\quad \dfrac{m}{p \times q \times r}$

C $\quad m \times p \times q$

D $\quad m \times p \times q \times r$

Question 3

A car is travelling around a circular track at a constant speed, as shown.

In which direction is the resultant force on the car?

Question 4

The diagram shows part of a hose used by a firefighter.
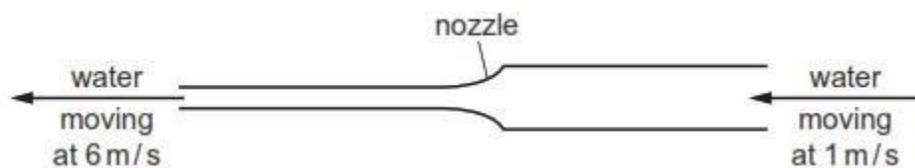
15 kg of water flows through the hose each second.

Which force is applied to the hose by the water?

A 15 N   **B** 75 N   **C** 90 N   **D** 105 N

Question 5

An object has kinetic energy of 200 J.

A constant resultant force of 190 N is applied in the direction of its motion through a distance of 10 m.

What is the final kinetic energy of the object?

A 390 J   **B** 1700 J   **C** 2000 J   **D** 2100 J

Question 6

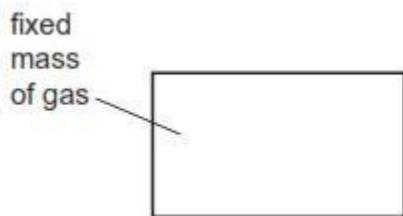A fixed mass of gas is trapped in a container. The temperature of the gas is increased but the volume of the gas is kept constant.

fixed
mass
of gas

How does this change affect the average kinetic energy of the molecules and the pressure on the walls of the container?

	average kinetic energy	pressure
A	increases	increases
B	stays the same	increases
C	increases	decreases
D	decreases	increases

Question 7

Which row correctly describes boiling and evaporation of water?

|	boiling	evaporation
A	bubbles seen	occurs at surface only
B	bubbles seen	occurs throughout the water
C	no bubbles	occurs at surface only
D	no bubbles	occurs throughout the water

Question 8

A wave source produces 3000 crests every minute. The wave has a speed of 300 m / s.

What is the wavelength of the wave?

A 0.10 m   **B** 0.17 m   **C** 6.0 m   **D** 10.0 m

Question 9

A ray of light is shone onto the surface of a mirror.
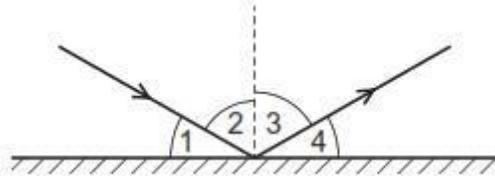
Which two angles represent the angle of incidence and the angle of reflection?

A 1 and 2   **B** 1 and 4   **C** 2 and 3   **D** 3 and 4

Question 10

An observer stands at the finish line of a 100 m race. He wants to time the winner's run. He starts his stop-watch as soon as he sees the smoke from the starting gun instead of when he hears the bang. What is the reason for doing this?

A   Light travels much faster than sound.

B   There is a risk he might respond to an echo from a wall.

C   Humans react slower to sound than to light.

D   Humans react more quickly to sound than to light.

Question 11

The diagram shows a circuit containing a variable resistor connected to a variable power supply.
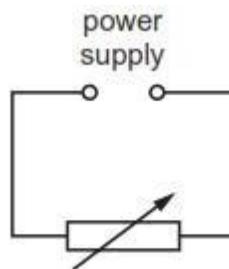
The table shows the currents for different values of the potential difference (p.d.) and the resistance.

p.d. / V	resistance / Ω	current
3.6	12	I_1
1.2	12	I_2
3.6	6	I_3

What is the order of the currents from smallest to largest?

A $I_1 \rightarrow I_2 \rightarrow I_3$ **B** $I_1 \rightarrow I_3 \rightarrow I_2$ **C** $I_2 \rightarrow I_1 \rightarrow I_3$ **D** $I_3 \rightarrow I_1 \rightarrow I_2$

Question 12

Which diagram shows the electric field pattern around a positive charge?

A	B	C	D
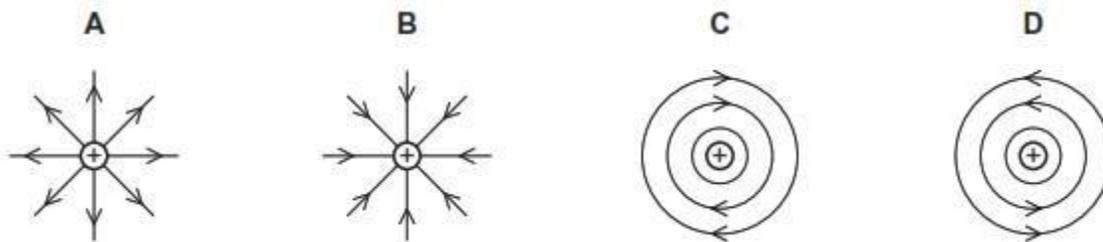
Question 13

A negatively charged plastic rod P is placed above a positively charged plastic rod Q.
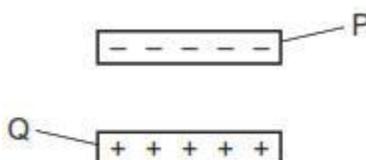
What are the directions of the electrostatic forces on rod P and on rod Q?

	electrostatic force on rod P	electrostatic force on rod Q
A	downwards	downwards
B	downwards	upwards
C	upwards	downwards
D	upwards	upwards

Question 14

A lamp rated 12 V, 2.0 A is switched on for one minute.

How much energy is transferred by the lamp?

A 6.0 J **B** 24 J **C** 360 J **D** 1440 J

Question 15

A student makes four resistors using different pieces of wire. The wires have different diameters and lengths. All the pieces of wire are made of the same material.

Which piece of wire will make the resistor with the largest resistance?

	diameter / mm	length / cm
A	0.8	10
B	0.8	17
C	2.0	10
D	2.0	17

Question 16

Which diagram shows a circuit containing a battery, a fuse and a buzzer?
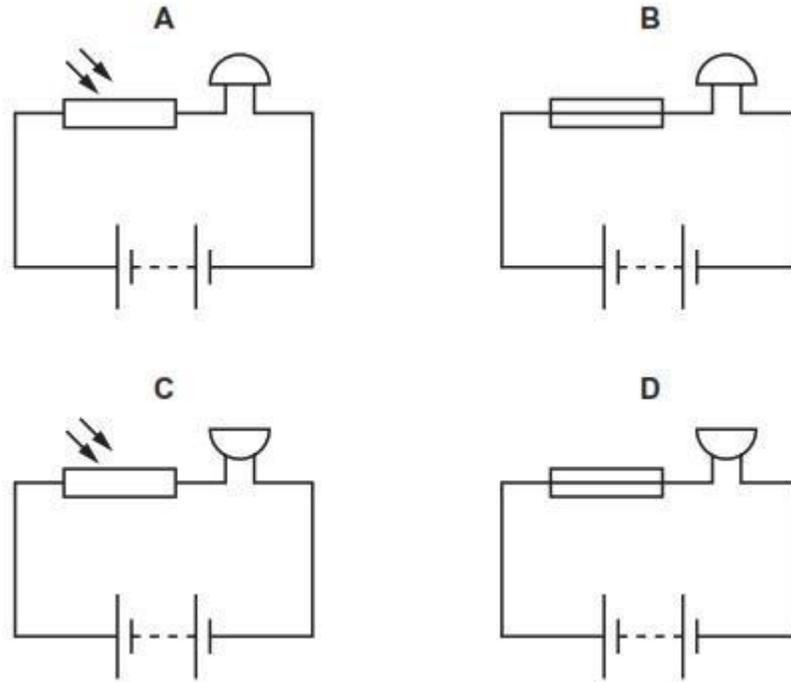
Question 17

The diagram represents a transformer.
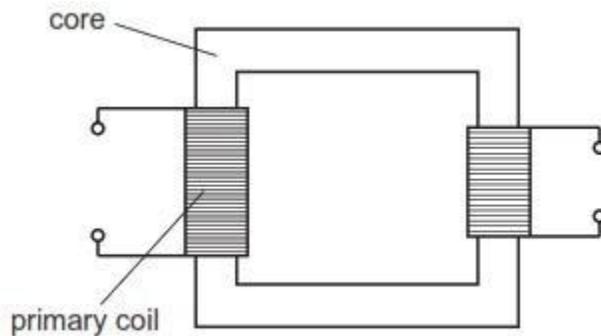
Which row shows materials suitable for making the core and the primary coil?

	core	primary coil
A	iron	copper
B	iron	plastic
C	steel	copper
D	steel	plastic

Question 18

Polonium, Po, has a proton number equal to 84 and a nucleon number equal to 218.
Polonium changes into astatine, At, by emitting a β-particle.
Which equation represents this decay?

A $\quad ^{84}_{218}\text{Po} \rightarrow \ ^{85}_{218}\text{At} + \ ^{-1}_{0}\beta$

B $\quad ^{84}_{218}\text{Po} + \ ^{-1}_{0}\beta \rightarrow \ ^{85}_{218}\text{At}$

C $\quad ^{218}_{84}\text{Po} \rightarrow \ ^{218}_{85}\text{At} + \ ^{0}_{-1}\beta$

D $\quad ^{218}_{84}\text{Po} + \ ^{0}_{-1}\beta \rightarrow \ ^{218}_{85}\text{At}$

Question 19

The graph shows how the count rate from a radioactive isotope changes with time.
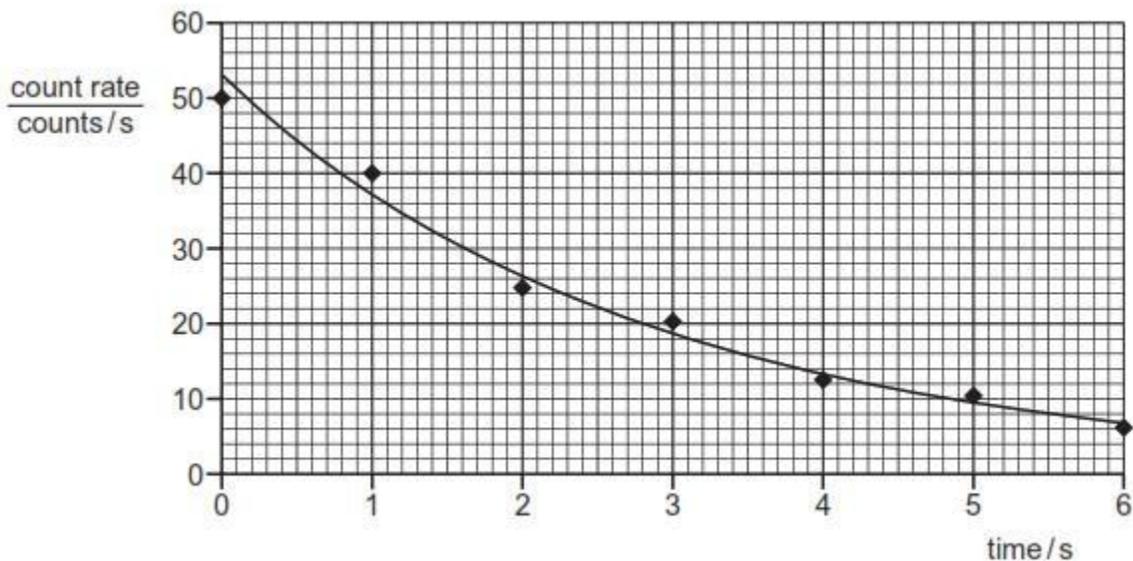
What is the half-life of this isotope?

A 2.0 s **B** 6.0 s **C** 12 s **D** 53 s

Question 20

What is the nature of α-emission?

A electromagnetic waves

B negatively charged particles

C positively charged particles

D uncharged particles

Section B (55 marks)
Theory (30 marks)
1 In an experiment, forces are applied to a spring as shown in Fig. 2.1a. The results of this experiment are shown in Fig. 1.1b.
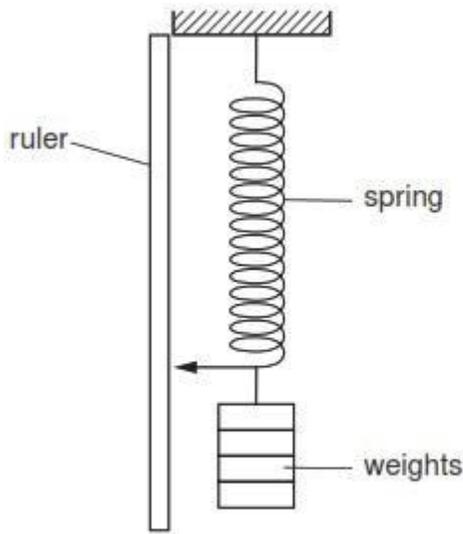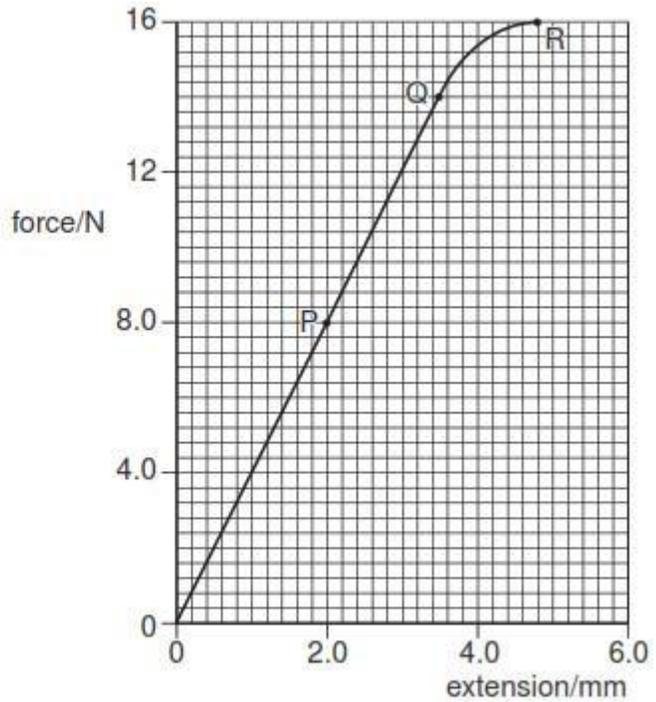
Fig. 1.1a   **Fig. 1.1b**

(a) What is the name given to the point marked Q on Fig. 2.1b?

....[1]

(b) For the part OP of the graph, the spring obeys Hooke's Law.

State what this means.

....

....[1]

(c) The spring is stretched until the force and extension are shown by the point R on the

graph. Compare how the spring stretches, as shown by the part of the graph OQ, with

that shown by QR.

....

....[1]

(d) The part OP of the graph shows the spring stretching according to the expression

$$F = kx.$$

Use values from the graph to calculate the value of k.

$k =$.................................... [2]

2 Fig. 2.1 shows a low-voltage lighting circuit.

12 V d.c.
supply
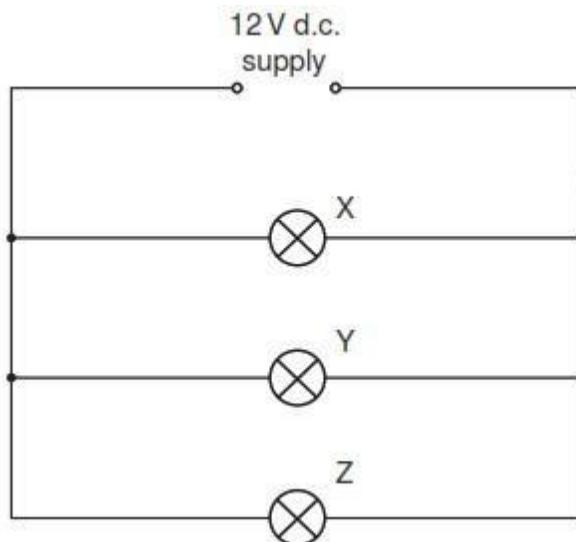
Fig. 2.1

(a) On Fig. 2.1, indicate with a dot and the letter S, a point in the circuit where a switch could be placed that would turn off lamps Y and Z at the same time but would leave lamp X still lit. [1]

(b) (i) In the space below, draw the circuit symbol for a component that would vary the brightness of lamp X.
   (ii) On Fig. 2.1, mark with a dot and the letter R where this component should be placed. [2]

(c) Calculate the current in lamp Y.

current =...........................[2]

(d) The current in lamp Z is 3.0 A. Calculate the resistance of this lamp.

resistance =...........................[2]

(e) The lamp Y is removed.

   (i) Why do lamps X and Z still work normally?

   ....

   ....

   (ii) The current in lamp X is 1.0 A. Calculate the current supplied by the battery with lamp Y removed.

current =...........................[2]

3 Fig. 3.1 shows a laptop and a charger. The charger contains a step-down transformer.
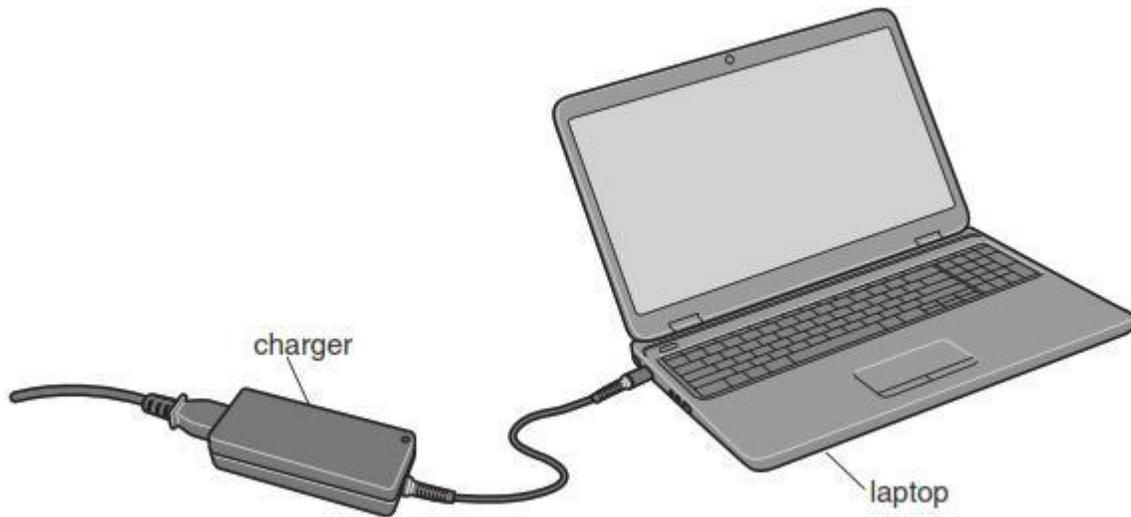
Fig. 3.1

(a) The transformer has an input voltage of 240 V and an output voltage of 12 V. There are 10 000 turns on the input coil.

Calculate the number of turns on the output coil.

number of turns =.. [3]

4 (a) Carbon-14 is a radioactive element.

Describe what is meant by the term *radioactive*.

....

....

.... [2]

(b) The radioactive decay curve for carbon-14 is shown in Fig. 4.1.

count rate / counts/min vs time/years
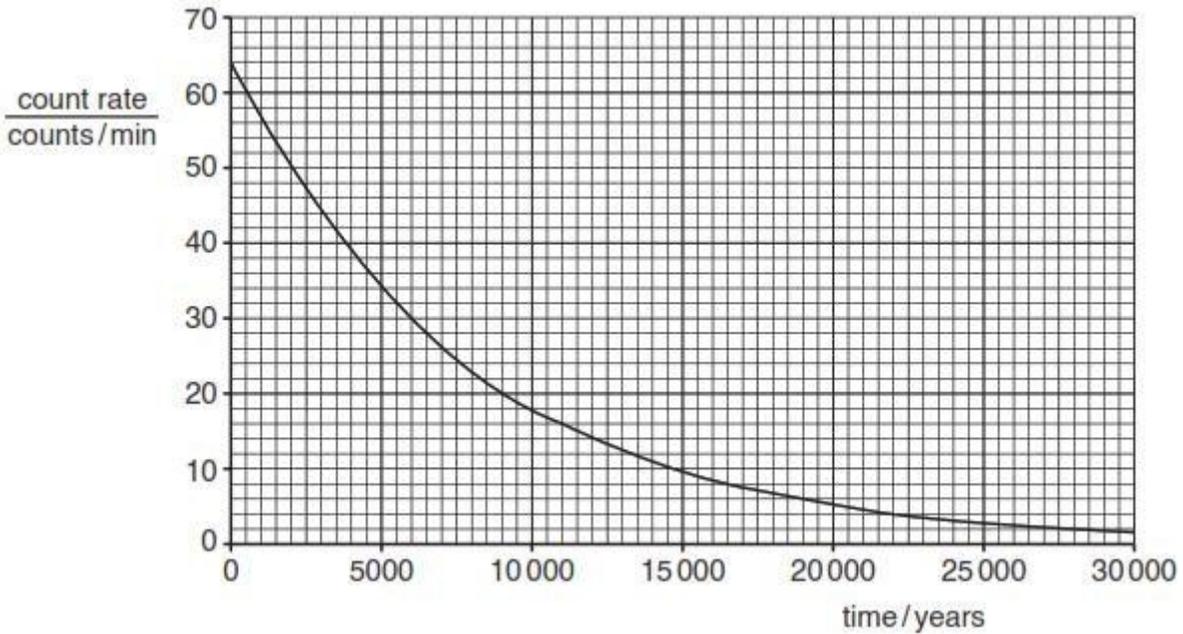
Fig. 4.1

(i) Complete the table using information from Fig. 5.1. The first value has been done for you.

Count rate Counts/minute	Time/years
40	2800
20	
10	

[1]

(ii) Determine the half-life of carbon-14.

half-life =.. years [1]

(c) A radioactive iodine isotope has a half-life of 8 days. A sample contains 10 g of this iodine isotope.

Calculate the mass of the iodine isotope remaining in the sample after 16 days.

mass remaining =... g [2]

(d) State **one** safety precaution taken by people who use radioactive sources.

.... [1]

5 When astronomers look at distant galaxies, they find that the frequency of the light from the galaxy is shifted towards the red end of the spectrum.

(a) Describe what is meant by the red end of the spectrum.

....

....[1]

(b) The speed of recession of a galaxy is the speed at which the galaxy is moving away from Earth.

Astronomers use redshift to measure the speed of recession.

Astronomers can also measure the distance d of the galaxy from Earth. Such large distances are measured in light-years.

Astronomers can estimate the time T that the galaxy has been moving away from Earth using the equation

$$T = \frac{d}{speed\ of\ recession}$$

Table 5.1 shows their estimates for four different galaxies.

Table 5.1

d / light-years	speed of recession km /s	T / billions of years
4.9 x 10^7	1100	13
1.0 x 10^8	2400	13
3.2 x 10^8	6700	14
3.9 x 10^8	9000	13

(i) State what is meant by a galaxy.

....

.... [2]

(ii) Show that 1.0 light-year is equal to 9.5×10^{15} m.   [3]

Practical Component (25 marks)

Question 1

A student is investigating the position of a sheet of card that is hanging from a pivot.
Fig. 1.1 shows the apparatus drawn full size.
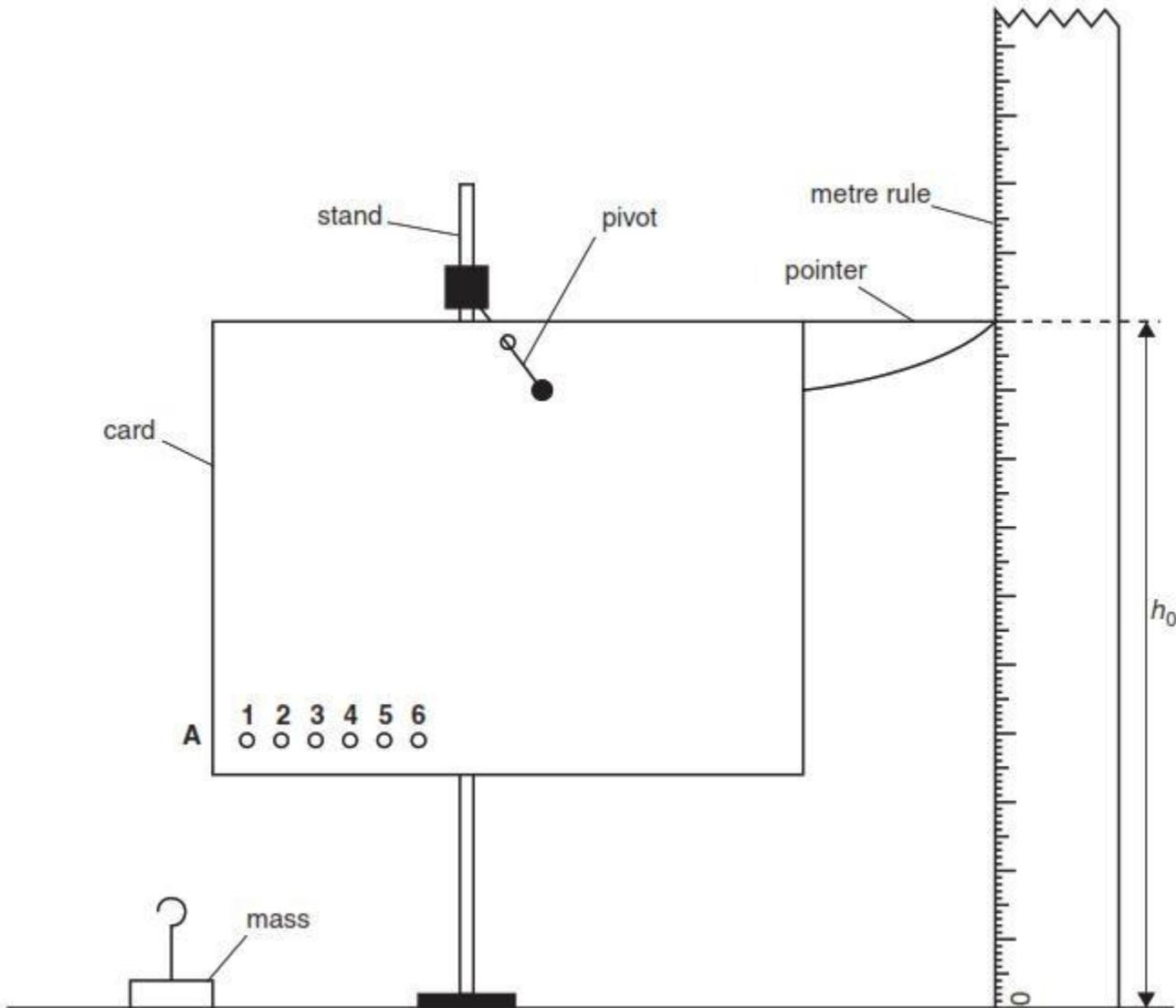
Fig. 1.1

(a) On Fig. 1.1 measure the distance **d** between the centre of the hole labelled **1** and the edge of the card at **A**. Record this value in the table.

hole	d / mm	h / mm	b / mm
1		140	
2		135	
3		132	
4		128	
5		124	
6		120	

[3]

(b) Repeat step **(a)** for each of the remaining holes **2 – 6**.

(c) On Fig. 1.1 measure the height h_0 of the pointer above the bench.

$$h_0 = \text{...}[1]$$

(d) A student hangs a 10 g mass from the hole **1** in the card. She records the height h of the end of the pointer above the bench. She then repeats this procedure by hanging the mass from each hole in turn. Her results are shown in the table above.

(e) Calculate the differences in heights b using the equation

$$b = (h - h_0)$$

and record the results in the table above.

(f) Plot the graph of **b** / mm (**y**-axis) against **d** / mm (**x**-axis).
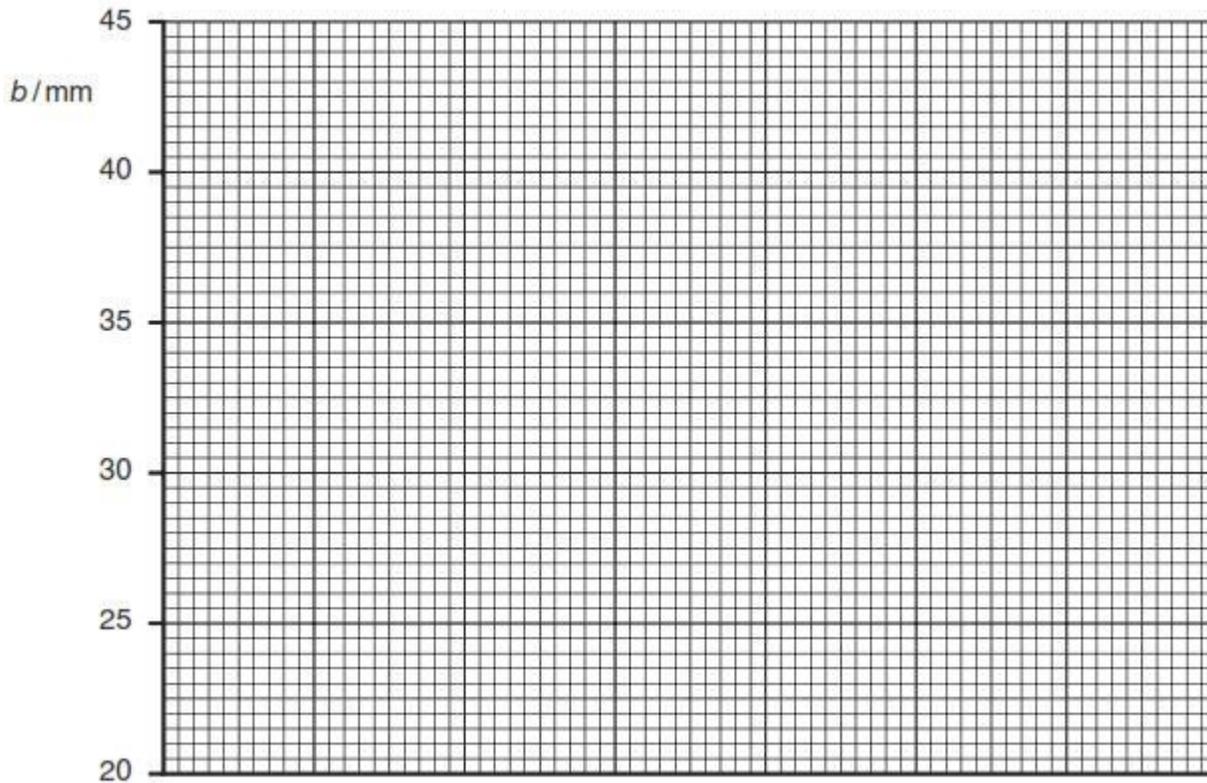
[4]

(g) It is important when recording the heights that the rule is vertical. State briefly how you would check that the rule is vertical.

....

.... [1]

Question 2

A student is investigating whether the diameter of a pendulum bob affects the period of a pendulum. The period is the time taken for one complete oscillation of the pendulum. Fig. 2.1 shows a pendulum.

Fig. 2.2 shows one complete oscillation.
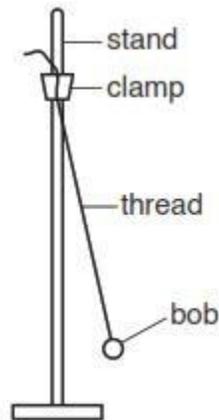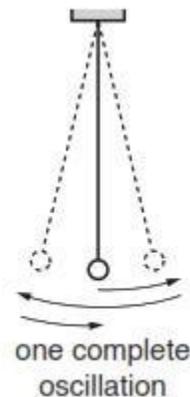
Fig. 2.1   **Fig. 2.2**

The student has the following apparatus:

> pendulum bobs made of polystyrene with diameters 1 cm, 2 cm, 3 cm, 4 cm and 5 cm

> a supply of thread and a pair of scissors

> clamp and stand.

Plan an experiment to investigate whether the diameter of a pendulum bob affects the period of a pendulum.

You should:

> • list additional apparatus that you would require

> • explain briefly how you would carry out the investigation

> • state the key variables that you would control

> • draw a table with column headings, to show how you would display your readings (You are **not** required to enter any readings in the table.)

> • explain briefly how you would use your readings to reach a conclusion.

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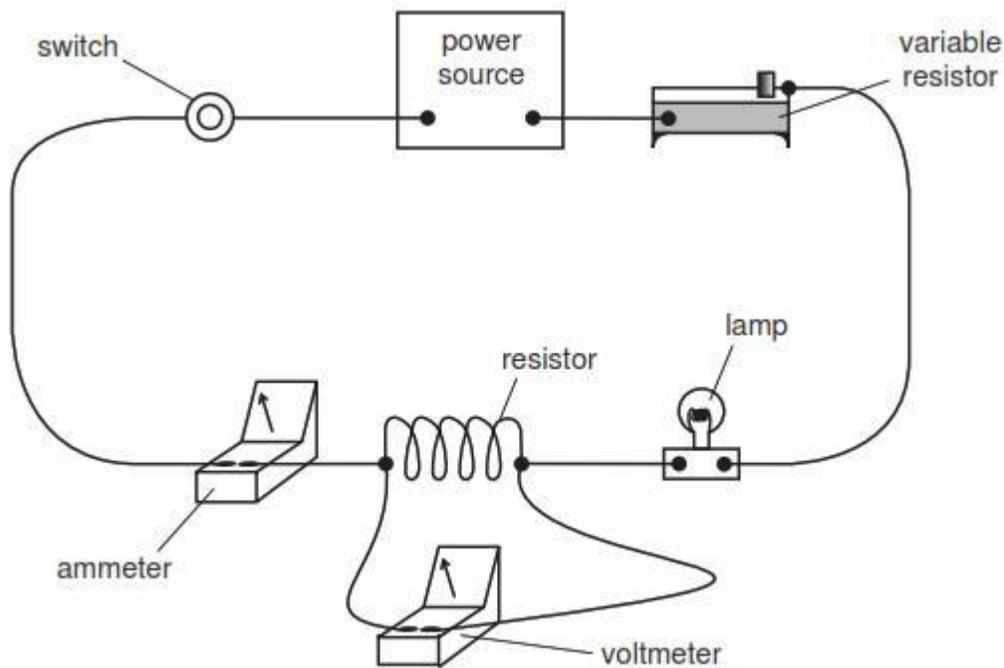... ....

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....

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....

....[7]

Question 3

A student is investigating the relationship between potential difference V across a resistor and the current I in it. Fig. 5.1 shows the apparatus that the student is using.

Fig. 3.1

**(a)** Draw the circuit diagram of the circuit shown in Fig. 3.1. Use standard circuit symbols.

[3]

(b) The student removes the lamp from the circuit. He is told that the resistance of a conductor is constant if the temperature of the conductor is constant. He knows that the current in the resistor has a heating effect. Suggest two ways in which the student could minimise the heating effect of the current in the resistor.

1. ....

2.. [2]

(c) Fig. 3.2 shows a variable resistor with the sliding contact in two different positions.
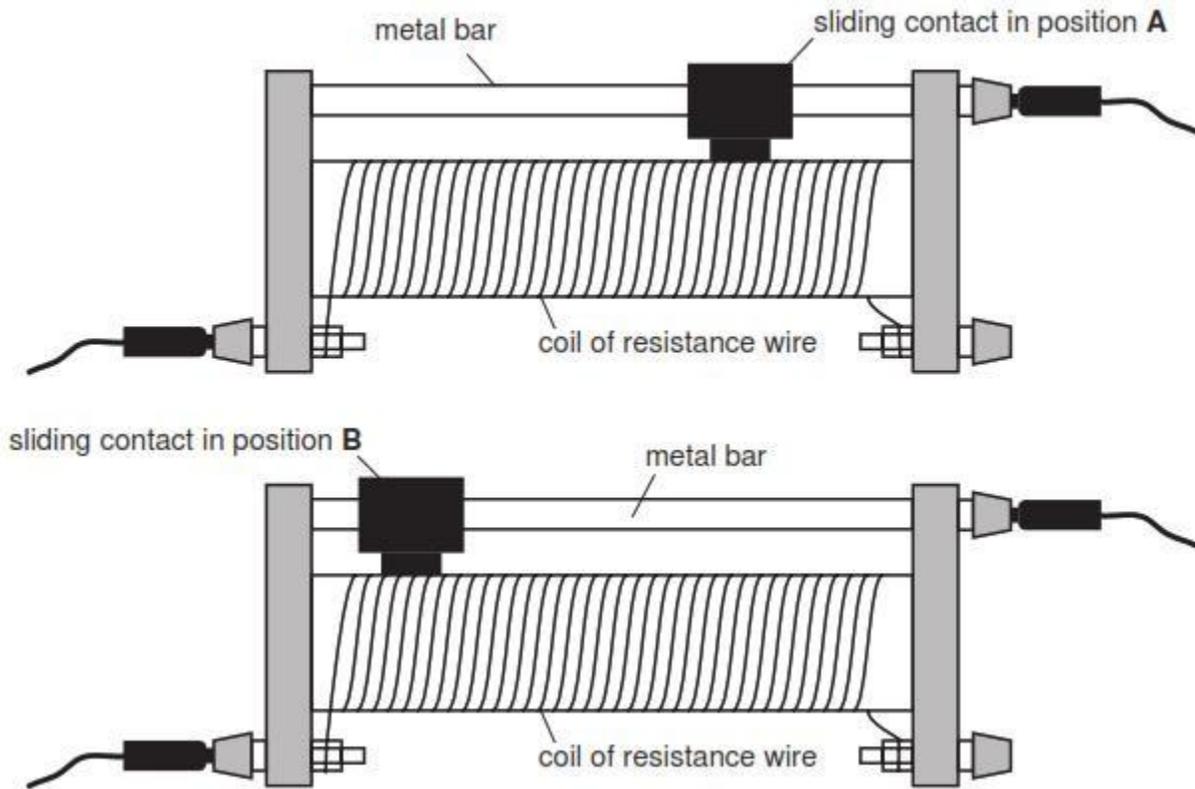
Fig. 3.2

State which position, A or B, shows the higher resistance setting. Explain your answer.

statement ....

explanation ....

....[1]

Question 4

A student is investigating the rate of cooling of water in different containers.

Fig. 4.1 shows the two containers.

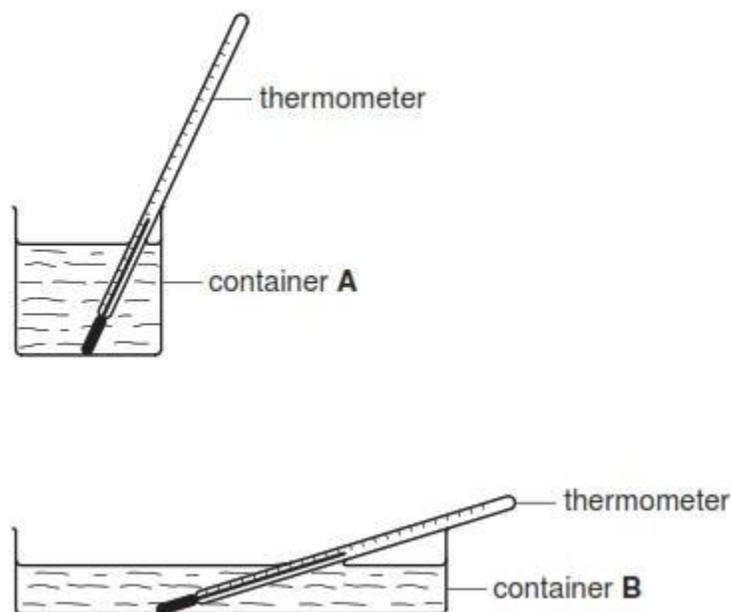**Fig. 4.1**

Approximately 200 cm³ of hot water is poured into container **A**. A stopclock is started and the temperature of the water is recorded at 30 s intervals. Hot water is then poured into container **B** until there is sufficient to cover the thermometer bulb. The stopclock is started and the temperature of the water is recorded at 30 s intervals. All the temperature readings are shown in Table 4.1.

Table 4.1

	container **A**	container **B**
t /	θ/	θ/
0	80	78
	71	66
	65	59
	59	55
	56	51
	55	49
	54	48

(a) (i) Complete the column headings in the table.

    (ii) Complete the time column in the table. [2]

(b) Calculate the temperature change of the water in each container over the period of 180 s.

                          Container **A** temperature change = ...

                          Container **B** temperature change =...[1]

Proposed Model Paper Marking Scheme: Physics 6321
Proposed Model Paper Marking Scheme: Physics
By: Abdul Samad Jamal
By: Abdul Samad Jamal
2nd Draft
2nd Draft

Paper 2: Physics   **Model Paper 2025**   **(Time: 2 hours)**

Marking Scheme

INFORMATION:

- This paper has a total of 75 marks.

- In objective section there are 20 questions, each carries one mark. There is no negative marking for incorrect responses.

- In subjective section, 30 marks are for extended theory and 25 marks for practical component.

MCQ section

Question Number	Answer Key
1	D
2	B
3	B
4	B
5	D
6	A
7	A
8	C
9	C
10	A
11	C
12	A
13	B
14	D
15	B
16	D
17	A
18	C
19	A
20	C

Section B: Theory (30 marks)

1 (a)	limit of proportionality (allow elastic limit)	1
1 (b)	force is proportional to extension or in terms of doubling	1
1 (c)	(up to Q extension proportional to force applied) Q to R extension/unit force more however expressed	1
1 (d)	k = force/extension or 8/2 or other correct ratio	1
	= 4.0 N/mm	1
2 (a)	switch in correct position	1
2 (b) (i)	rheostat/variable resistance symbol drawn	1
2 (b) (ii)	dot and R in line to 12 W lamp	1
2 (c)	Correct calculation	1
	Ampere	1
2 (d)	R = V/I or 12/.3	1
	= 4Ω	1
2 (e) (i)	parallel circuit/all lamps connected separately across the 12V	1
2 (e) (ii)	4 A	1
3 (a)	Vs/Vp = Ns/Np in any form	1
	(12/240) × 10 000 ÷ 20	1
	500	1
4 (a)	unstable atoms	1
	random/spontaneous decay (of atoms)	1
4 (b) (i)	20 cpm = approx. 9000 AND 10 cpm = approx. 15 000	1
4 (b) (ii)	5000 – 6500	1
4 (c)	two half-life indicated	1
	2.5 (g)	1
4 (d)	any sensible precaution: tongs/screening/lead apron minimise time exposure maximise distance between source and people restrict access to sources etc	1
5 (a)	(end with) the longest wavelength or lowest frequency	1
5 (b) (i)	collection of stars	1
	billions of stars	1
5 (b) (ii)	use of 3.0×10^8 m / s	1
	365 (days in a year) and 24 (hours in a day) seen	1
	$3.0 \times 10^8 \times 365 \times 24 \times 60 \times 60$ or 9.46×10^{15} seen	1

Practical Component (25 marks)

1 (a) + (b) + (d)	6 d values	1
	correct values for d 5, 10, 15, 20, 25, 30	1
1 (e)	correct values for b 40, 35, 32, 28, 24, 20 (ecf)	1
1 (c)	h0 = 100mm (including unit, cm/m allowed).	1
1 (f)	Graph: correct d axis labelled with symbol / unit	1
	plots to nearest ½ sq (-1 each error or omission)	1
	best fit straight line	1
	single line, thin and best fit	1
1 (g)	line not through origin OR when b increases, d decreases OR negative gradient	1
2	Stopwatch (or equivalent) AND (metre) rule /ruler	1
	Measure time for 5 (+) oscillations	1
	Divide by number of oscillations to find period (T)	1
	Repeat for each bob	1
	Variable; one from: Initial amplitude / starting position Length of pendulum / thread Number of oscillations	1
	Table with column headings for t, or period (T), or both AND d, with correct units	1
	Conclusion: Plot graph(s) of d against period (T) or t (or vice versa) OR compare period (T) or t values for different diameters	1
3 (a)	correct symbols for ammeter and voltmeter	1
	correct symbols for variable resistor, lamp and resistor	1
	circuit correct	1
3 (b)	lower voltage/add another lamp	1
	switch off between readings	1
3 (c)	A, more resistance in circuit	1
4 (a) (i)	table: t in s, θ in °C (either in words or mixture of symbols and words) (NOT degrees/centigrade)	1
4 (a) (ii)	times 30, 60, 90, 120, 150, 180	1
4 (b)	both temperature falls correct (ignore unit or lack of unit) 26, 30	1

Question-wise Breakdown

Section	Question	Related Chapter	AO
MCQS	1	2	2
	2	1	1
	3	3	2
	4	3	1
	5	4	2
	6	8	1
	7	8	1
	8	5	2
	9	5	1
	10	5	2
	11	6	2
	12	6	1
	13	6	2
	14	4	2
	15	6	2
	16	6	2
	17	7	2
	18	9	2
	19	9	2
	20	9	1
Theory	1	3	1,2
	2	5	1,2
	3	6	1,2
	4	7	1,2
	5	9	1,2,3
	6	10	1,2
ATP	1	1	1,3
	2	1	1,3
	3	6	1,3
	4	8	1,3

Chapter-wise Breakdown

No.	Chapter Title	MCQs (1 mark)	AO	Theory	AO	ATP	AO
1	Physical Quantities and measuring techniques	1	AO1(1)	0	-	17	AO1 (4) AO3 (13)
2	Kinematics	1	AO2(1)	0	-	0	-
3	Dynamics	2	AO1(1) AO2 (1)	5	AO1 (2) AO2 (3)	0	-
4	Work, Power & Energy	2	AO2(2)	0	-	0	-
5	Waves	3	AO1 (1) AO2 (2)			0	-
6	Electricity	5	AO1 (1) AO2 (4)	9	AO1 (4) AO2 (5)	5	AO3 (5)
7	Magnetism and Electromagnetic Induction	1	AO2(1)	3	AO2 (3)	0	
8	Thermal Physics	2	AO1 (2)	0	-	3	AO3 (3)
9	Atomic Structure and Nuclear Physics	3	AO1 (1) AO2 (2)	7	AO1 (3) AO2 (3) AO3 (1)	0	-
10	The Universe and Cosmology	0	-	6	AO1 (3) AO2 (3)	0	-

Marks for AO1		Percentage
MCQ	7	
Theory	16	30%
TOTAL	23	

Marks for AO2		Percentage
MCQ	13	
Theory	17	40%
TOTAL	30	

Marks for AO3		Percentage
MCQ	0	
Theory	22	30%
TOTAL	22	