Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Thursday 22 May 2025

Morning (Time: 2 hours)

Paper reference 4PH1/1P 4SD0/1P

Physics

UNIT: 4PH1
Science (Double Award) 4SD0
PAPER: 1P

You must have:
Ruler, calculator, Equation Booklet (enclosed)

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 110.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

FORMULAE

You may find the following formulae useful.

energy transferred = current × voltage × time $\qquad E = I \times V \times t$

$$\text{frequency} = \frac{1}{\text{time period}} \qquad f = \frac{1}{T}$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{E}{t}$$

$$\text{orbital speed} = \frac{2\pi \times \text{orbital radius}}{\text{time period}} \qquad v = \frac{2 \times \pi \times r}{T}$$

(final speed)^2 = (initial speed)^2 + (2 × acceleration × distance moved)

$$v^2 = u^2 + (2 \times a \times s)$$

pressure × volume = constant $\qquad p_1 \times V_1 = p_2 \times V_2$

$$\frac{\text{pressure}}{\text{temperature}} = \text{constant} \qquad \frac{p_1}{T_1} = \frac{p_2}{T_2}$$

Where necessary, assume the acceleration of free fall, $g = 10\ \text{m/s}^2$.

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Ice hockey is a team sport played on ice. Players try to hit a disc called a puck into the other team's goal.

(Source: © Alexandr Grant / Shutterstock)

(a) Diagram 1 shows a puck travelling across some smooth ice.

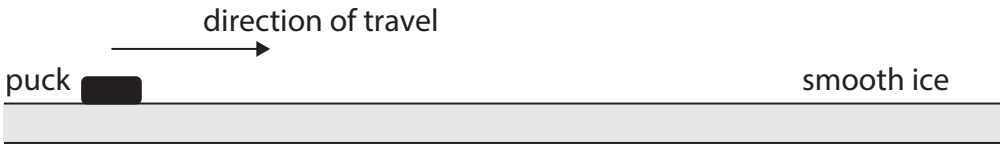

Diagram 1

(i) State the formula linking average speed, distance moved and time taken.

(1)

(ii) The puck travels at a constant speed of 2.8 m/s.

Calculate the distance moved by the puck in a time of 3.5 s.

(3)

distance moved = ... m

(b) Diagram 2 shows a puck travelling across some rough ice.

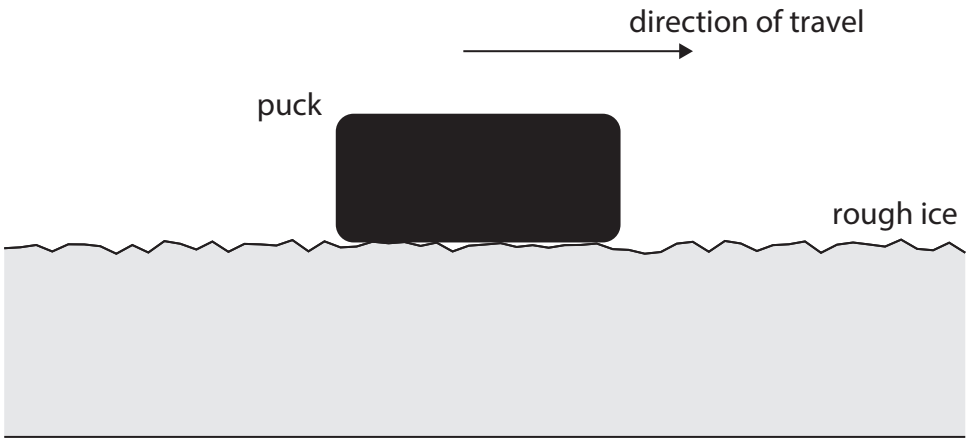

Diagram 2

The rough ice exerts a frictional force on the puck.

(i) Draw a labelled arrow on diagram 2 to show the force of friction acting on the puck.

(1)

(ii) Explain how the force of friction changes the velocity of the puck.

(2)

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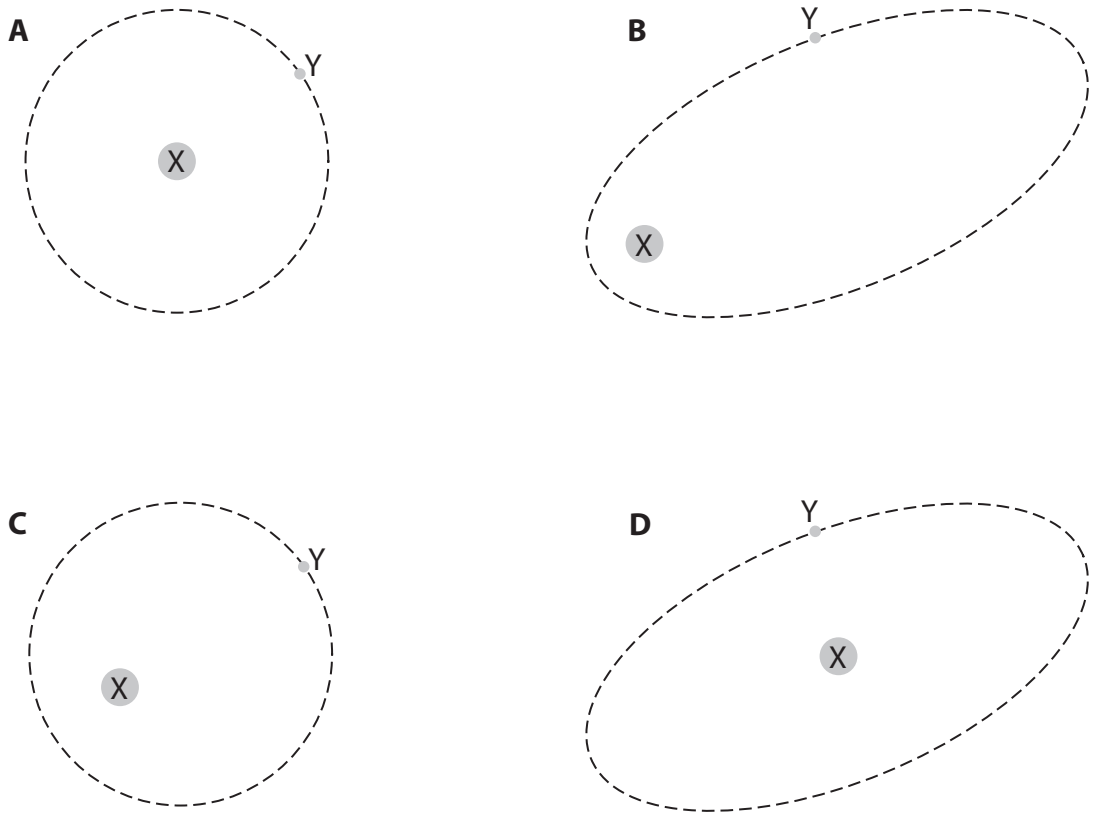
(Total for Question 1 = 7 marks)

2 This question is about astrophysics.

(a) Diagrams A, B, C and D show different orbital paths for object Y orbiting object X.



(i) Table 1 gives some possible names for object X and object Y.

Complete the table by placing **one** tick (✓) in each row to show which orbital path is correct for each combination of object X and object Y.

Each orbital path may be used once, more than once, or not at all.

(3)

Object X	Object Y	Orbital path			
		A	B	C	D
the Earth	the Moon				
the Sun	a comet				
the Sun	the Earth				

Table 1

(ii) Give the name of the force that causes one object to orbit another object in space.

(1)

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(b) Table 2 gives information about four different stars in the same galaxy as the Sun.

Star	Colour	Evolutionary stage
Antares	red	red supergiant
Capella	yellow	main sequence
Sirius B	white	white dwarf
Vega	blue-white	main sequence

Table 2

(i) Give the name of the galaxy that contains the Sun and the stars shown in table 2.

(1)

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(ii) Explain how the stars in table 2 can be classified according to their colour.

(3)

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(iii) Describe the likely future evolution of Antares.

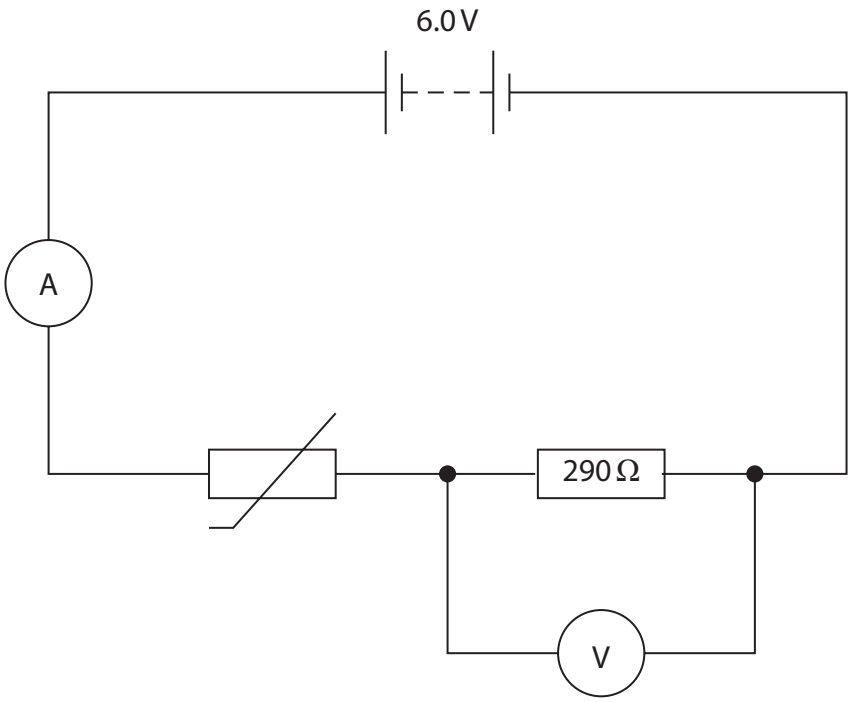
(3)

(iv) Describe what additional information is needed to predict the next evolutionary stage for Vega.

(2)

(Total for Question 2 = 13 marks)

3 A student builds this electric circuit to measure the temperature of a room.



(a) At 20 °C, the voltage across the thermistor is 3.9 V.

(i) Explain why the reading on the voltmeter is 2.1 V.

(2)

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(ii) The resistor in the circuit has a resistance of 290 Ω.

Calculate the current in the resistor.

Use the formula

$$\text{voltage} = \text{current} \times \text{resistance}$$

(3)

current = ... A

(iii) State the reading on the ammeter.

(1)

ammeter reading = ... A

(iv) Calculate the resistance of the thermistor.

(3)

resistance = ... Ω

(b) The student observes that the voltmeter reading increases as the temperature of the room increases.

(i) Explain this observation.

(3)

(ii) The student wants to use the circuit as a temperature-measuring device.

They have this additional equipment

- a large beaker
- water at different temperatures
- a thermometer

Describe what measurements the student needs to take so that the circuit could be used as a temperature-measuring device.

Assume that the thermistor in the circuit is waterproof.

You may draw a diagram to help your answer.

(3)

(Total for Question 3 = 15 marks)

4 This question is about the process of controlled nuclear fission in a nuclear reactor.

(a) In a nuclear reactor, uranium-235 nuclei are split to produce daughter nuclei and neutrons.

State what else is released in nuclear fission that makes the process useful in a nuclear reactor.

(1)

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(b) What is the function of the control rods in a nuclear reactor?

(1)

- ☒ **A** absorb excess neutrons
- ☒ **B** create additional neutrons
- ☒ **C** fuse neutrons together
- ☒ **D** split neutrons

(c) What is the function of the moderator in a nuclear reactor?

(1)

- ☒ **A** change protons into neutrons
- ☒ **B** change neutrons into protons
- ☒ **C** slow down neutrons
- ☒ **D** speed up neutrons

(d) Many of the daughter nuclei produced in nuclear fission are very radioactive.

These daughter nuclei decay by emitting ionising radiation in a random process.

(i) State what is meant by the term **ionising radiation**.

(1)

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(ii) State what is meant by the term **random process**.

(1)

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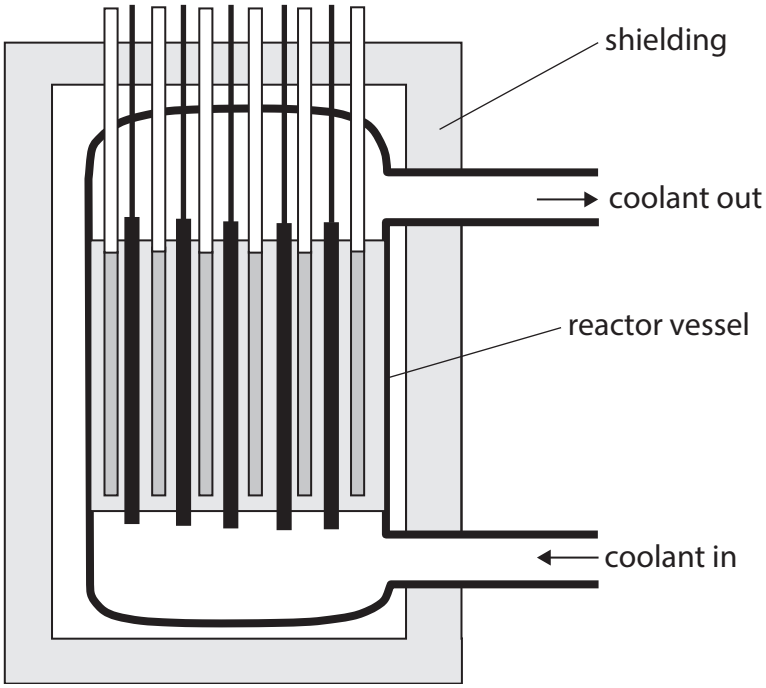
(iii) The diagram shows some parts of a nuclear reactor.



Explain the role of shielding in a nuclear reactor.

(3)

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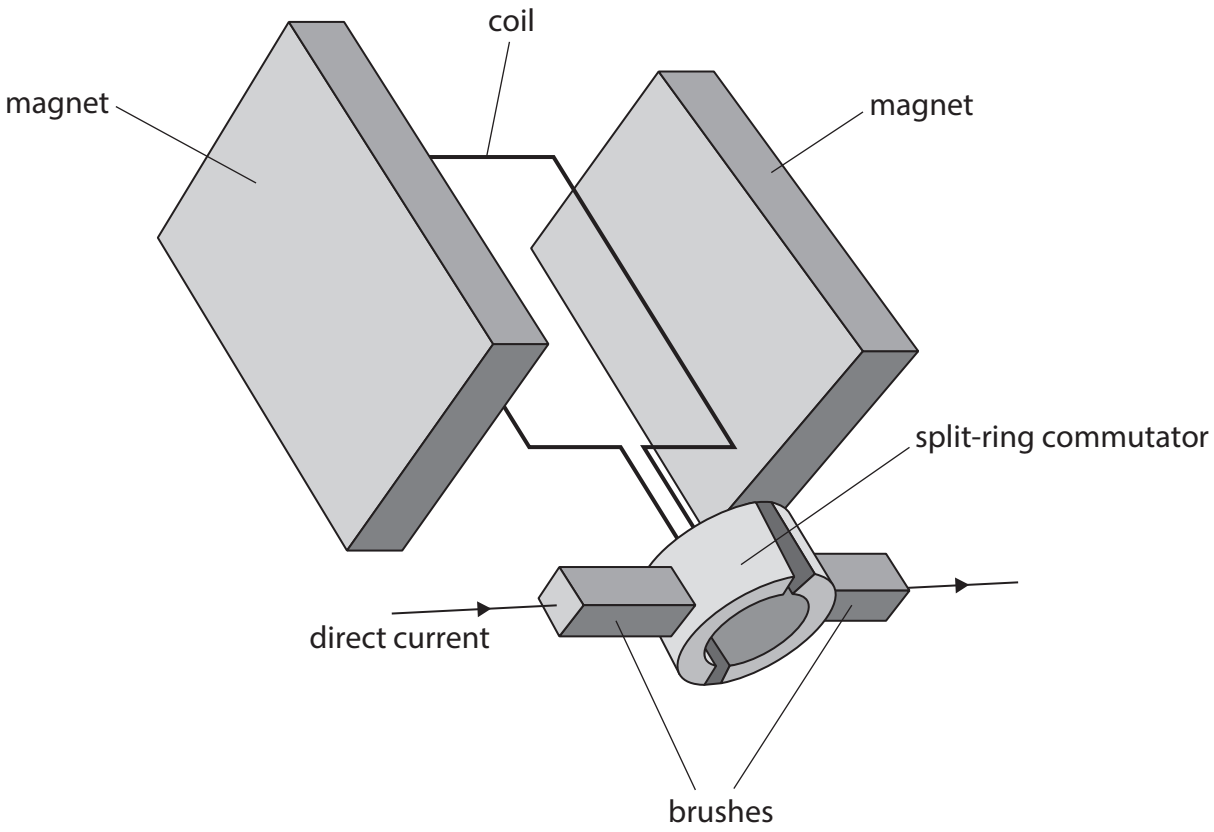
(Total for Question 4 = 8 marks)

5 The diagram shows a simple direct current (d.c.) electric motor.



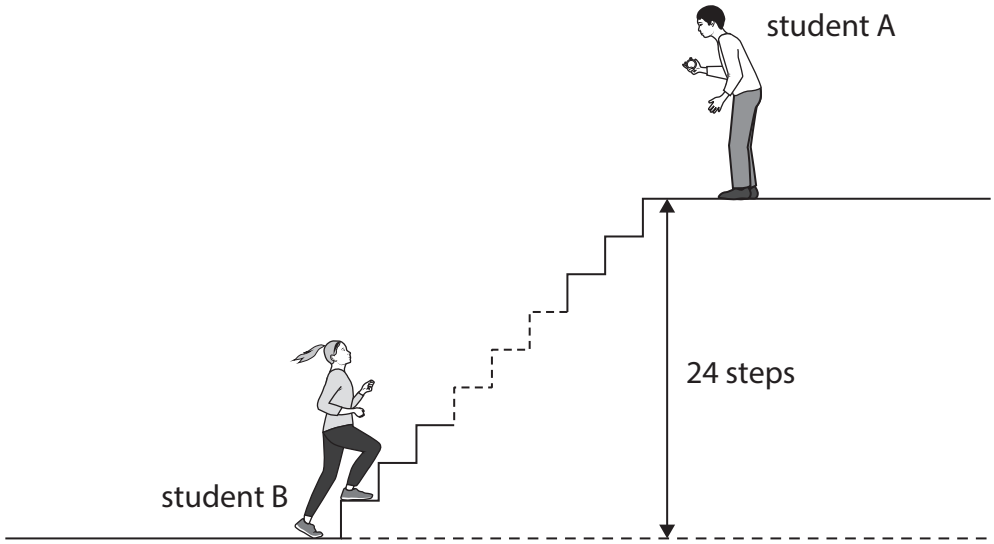
Explain why the coil turns continuously when the motor is connected to a direct current supply.

You should refer to the brushes and the split-ring commutator in your answer.

(Total for Question 5 = 6 marks)

6 Two students do an experiment to determine their power when running up a set of steps.

The diagram shows how they set up their experiment. Not all of the steps are shown in the diagram.



This is the students' method.

- student A stands with a stopwatch at the top of the steps
- student A starts timing on the stopwatch and shouts "go" at the same time
- student B begins to run up the steps when she hears student A shout
- student A stops timing when student B reaches the top of the steps

The students repeat their method two more times.

(a) Give a reason why the times recorded may not be accurate.

(1)

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(b) There are 24 steps in total and each step has a height of 19 cm.

(i) Student B has a mass of 67 kg.

Show that student B gains about 3000 J of energy in her gravitational store when she runs up the set of steps.

(3)

(ii) The table shows the times recorded for student B.

Time in s
4.28
4.95
4.65

Calculate the mean time from this data.

Give your answer to three significant figures.

(2)

mean time = ... s

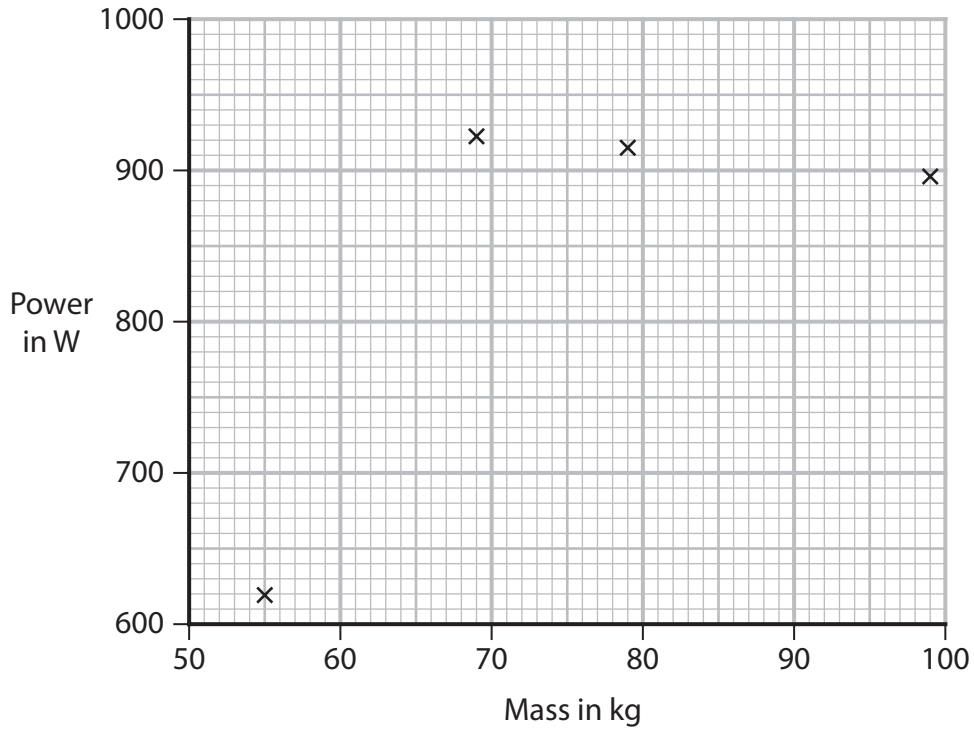
(iii) Calculate the mean power of student B transferring energy to her gravitational store as she runs up the steps.

(2)

mean power = ... W

(c) The students extend their investigation by calculating the power for students of different masses running up the steps.

The graph shows their results.



The students conclude that the greater the mass of the person, the greater the power of the person when running up the steps.

Comment on the students' conclusion.

(4)

(Total for Question 6 = 12 marks)

7 This question is about pressure.

(a) Small air bubbles form in a container of water.

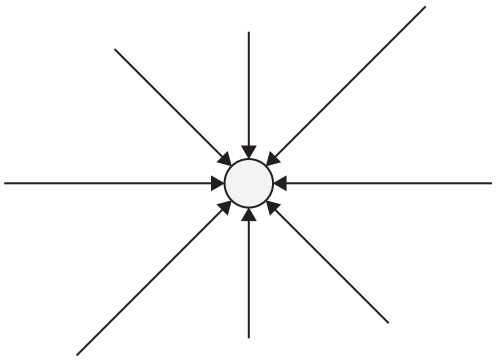
(i) The pressure of the water acts on these bubbles.

The diagrams show the forces that cause this pressure.

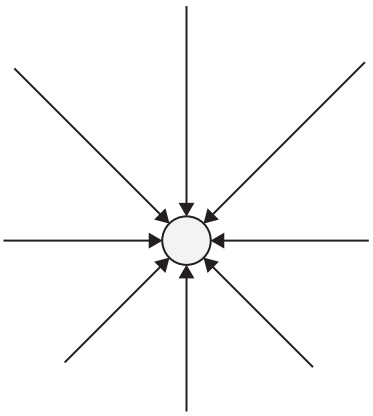
Which diagram correctly shows how the pressure of the water acts on a stationary air bubble?

(1)

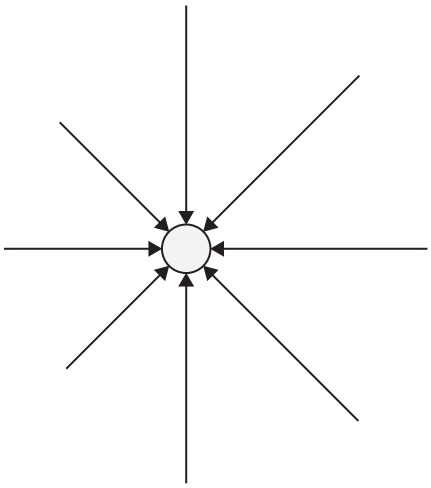
☒ **A**



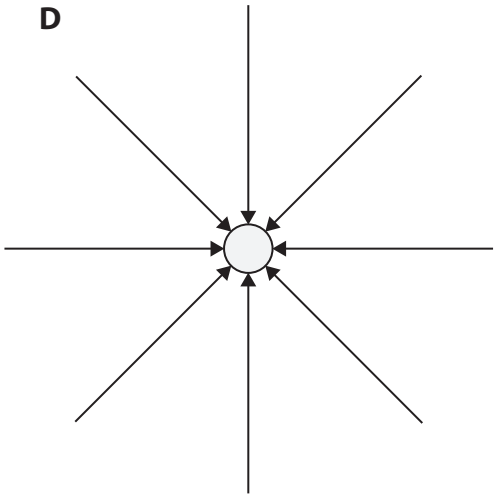
☒ **B**



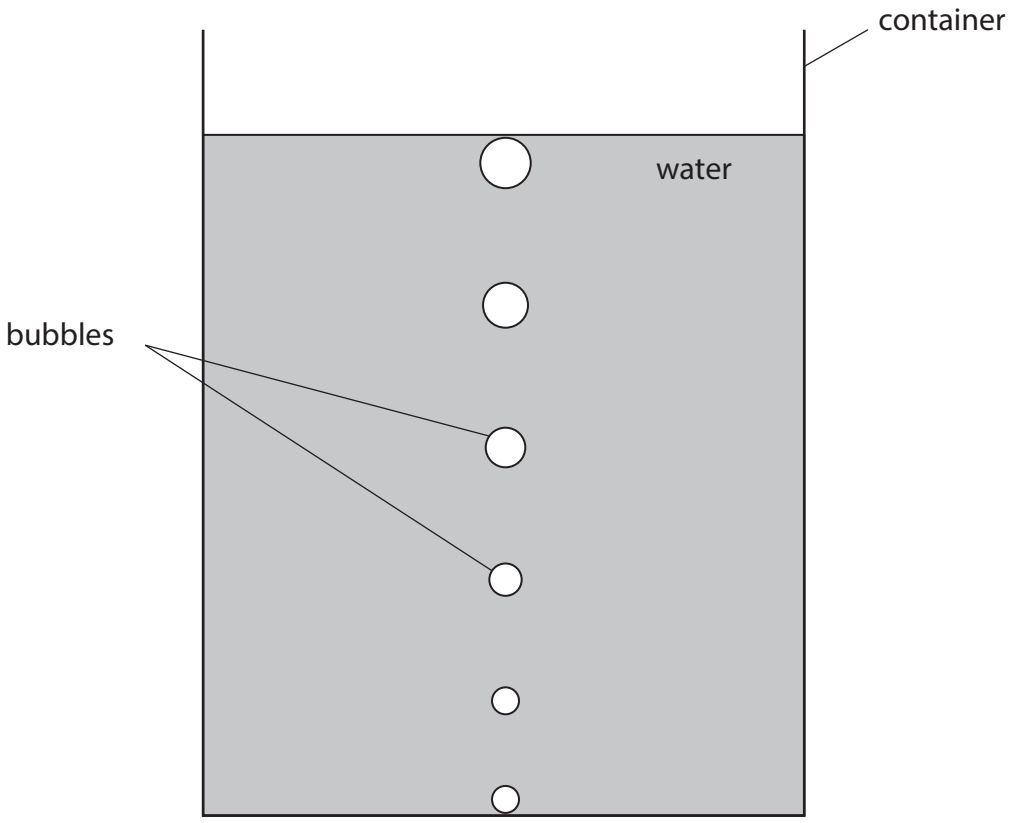
☒ **C**



☒ **D**



(ii) The diagram shows the air bubbles rising to the surface of the water in a container.



Explain why the bubbles increase in volume as they get nearer to the surface of the water.

Assume that the temperature of the water is the same throughout the container.

(3)

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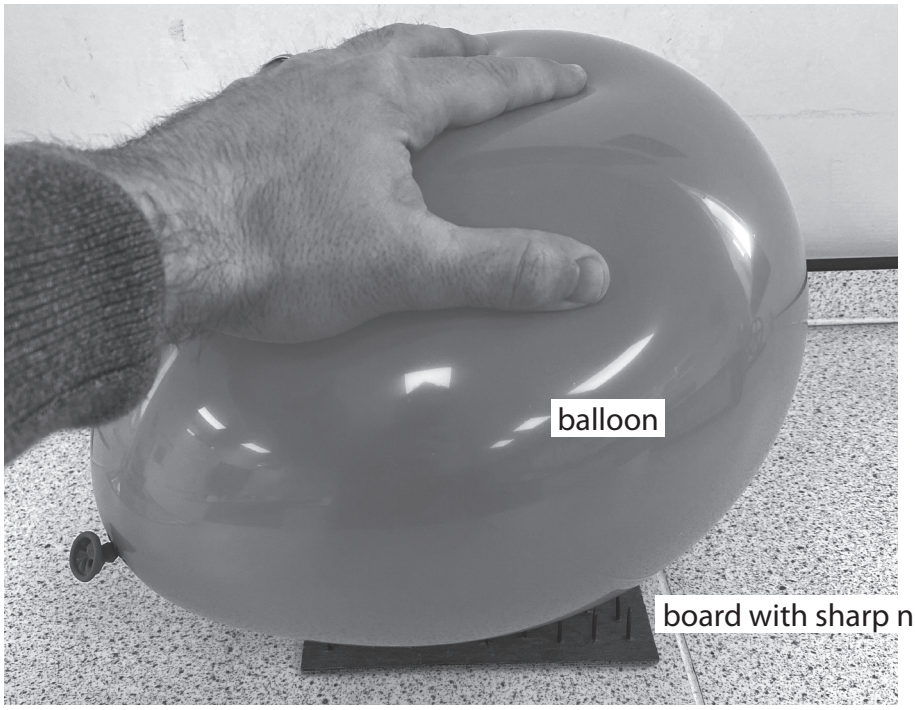
(b) A teacher does a demonstration using an inflated balloon and a board with many sharp nails.



The teacher pushes the balloon onto the board of nails. The balloon does not pop.

The teacher then pops the balloon using a single nail.

Explain why the balloon does not pop when pushed onto the board of nails.

(3)

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(Total for Question 7 = 7 marks)

8 A student uses a ripple tank to investigate water waves.

Diagram 1 shows the ripple tank when viewed from the side.

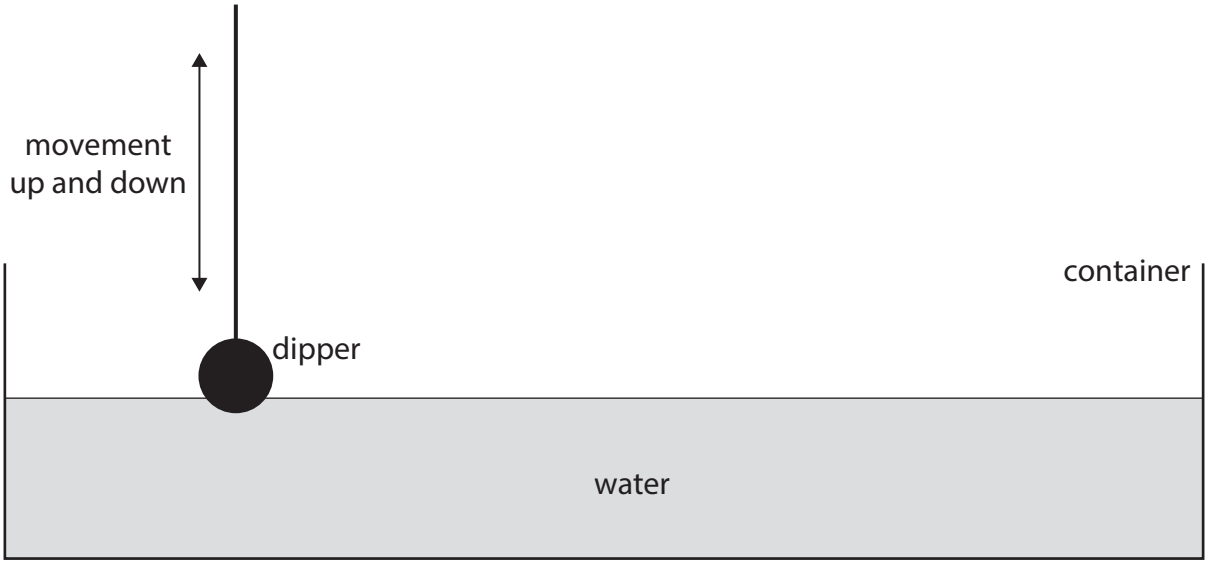


Diagram 1

A dipper moves up and down to produce waves on the surface of the water in the container.

(a) The waves on the surface of the water are transverse.

State what is meant by a **transverse wave**.

You may draw a diagram to help your answer.

(2)

(b) Diagram 2 shows the surface of the ripple tank, at an instant in time, when viewed from above.

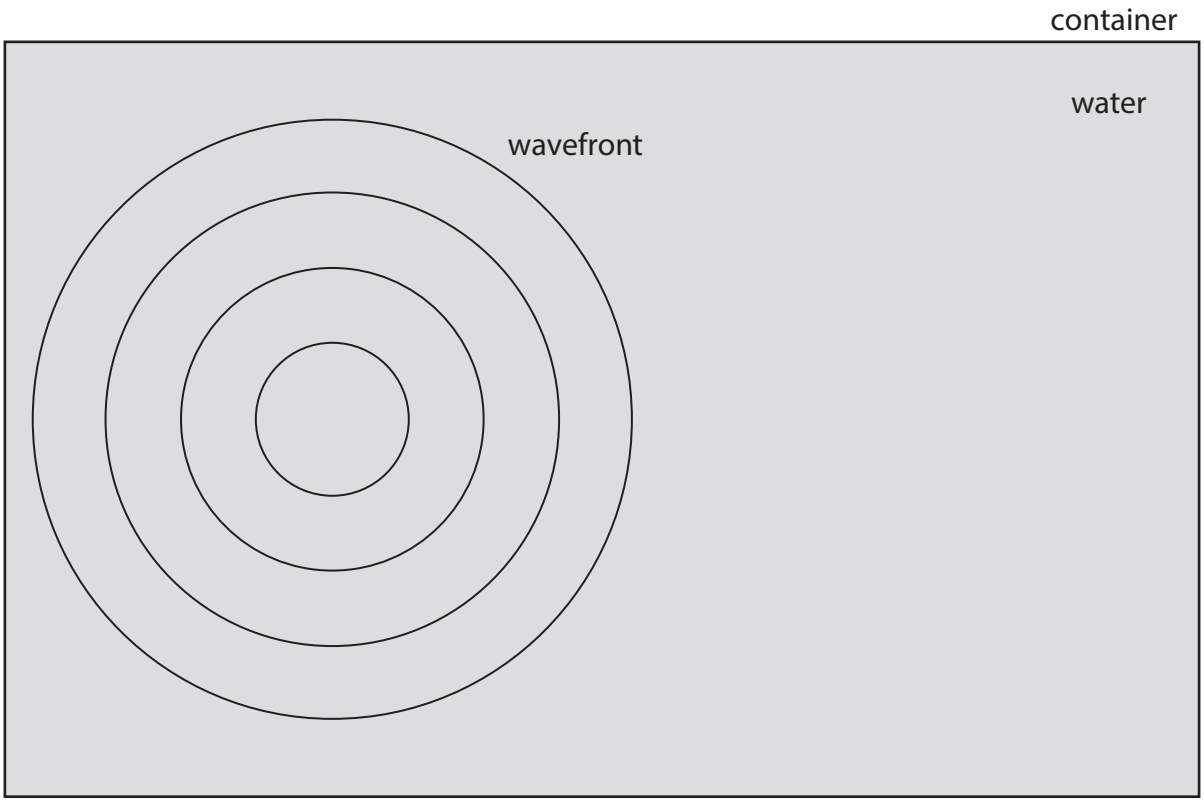


Diagram 2

The dipper produces circular waves on the surface of the water.

(i) 1 cm in diagram 2 is equal to 2 cm in the laboratory.

Use the diagram to measure the wavelength of the water waves.

(2)

wavelength = ... cm

(ii) The dipper moves up and down with a frequency of 15 Hz.

Calculate the speed of the waves.

(3)

wave speed = ... m / s

(c) The student then makes the dipper move horizontally to the right at constant speed.

The dipper continues to move up and down with a frequency of 15 Hz.

Diagram 3 shows the surface of the ripple tank, at an instant in time, when viewed from above.

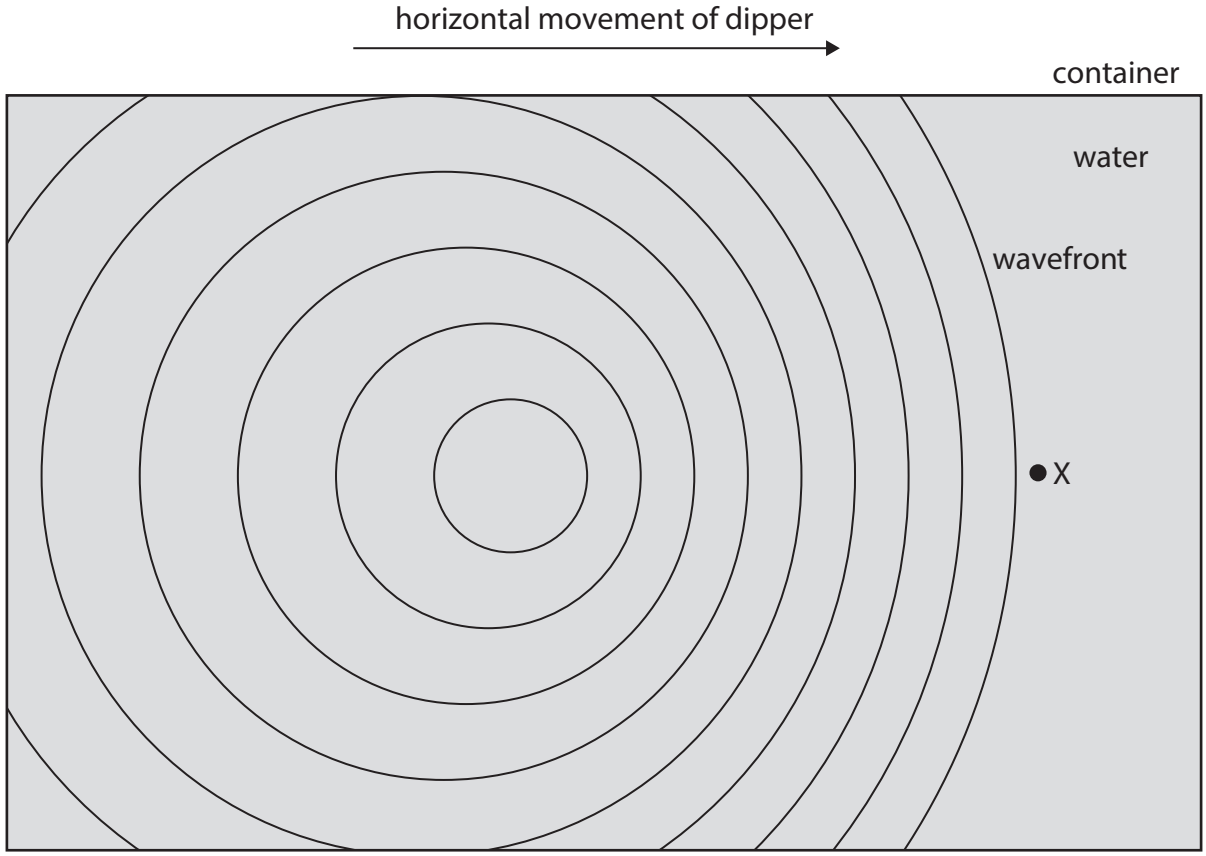


Diagram 3

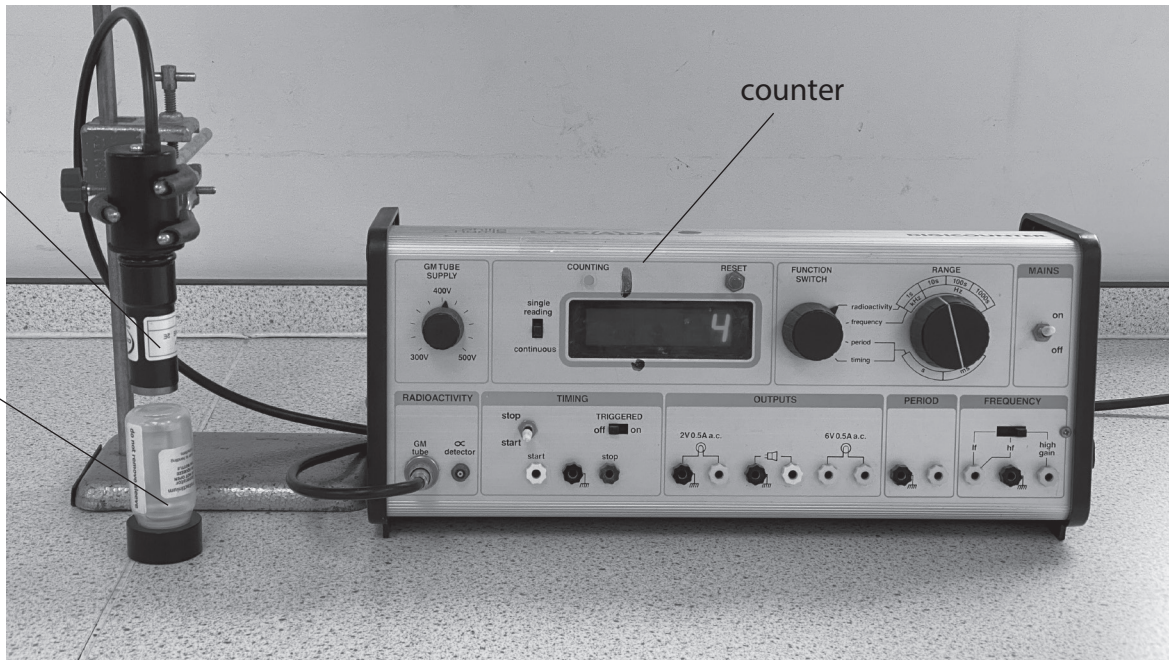
Explain how the frequency of the waves arriving at point X compares with the frequency at which the dipper moves up and down.

(4)

(Total for Question 8 = 11 marks)

9 A protactinium generator is a device that can produce samples of an isotope called protactinium-234m.

A teacher investigates the activity of protactinium-234m using the apparatus shown in the photograph.



(a) The teacher uses a radiation detector to detect the radiation emitted from the protactinium-234m.

Give the name of a suitable radiation detector.

(1)

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(b) Give two safety precautions to minimise the risk of harm to the teacher from the radiation emitted by the protactinium generator.

(2)

1 .....

.....

2 .....

.....

(c) Protactinium-234m decays with a half-life of 70 seconds.

(i) The initial count rate is 840 counts per second.

Calculate the expected count rate after 140 seconds.

(2)

count rate = ... counts per second

(ii) The activity of an isotope is the total amount of radiation emitted each second.

The teacher estimates that only 5% of the total radiation emitted is detected by the radiation detector.

Estimate the activity of the isotope when the count rate is 840 counts per second.

Give the unit.

(3)

activity = ... unit = ...

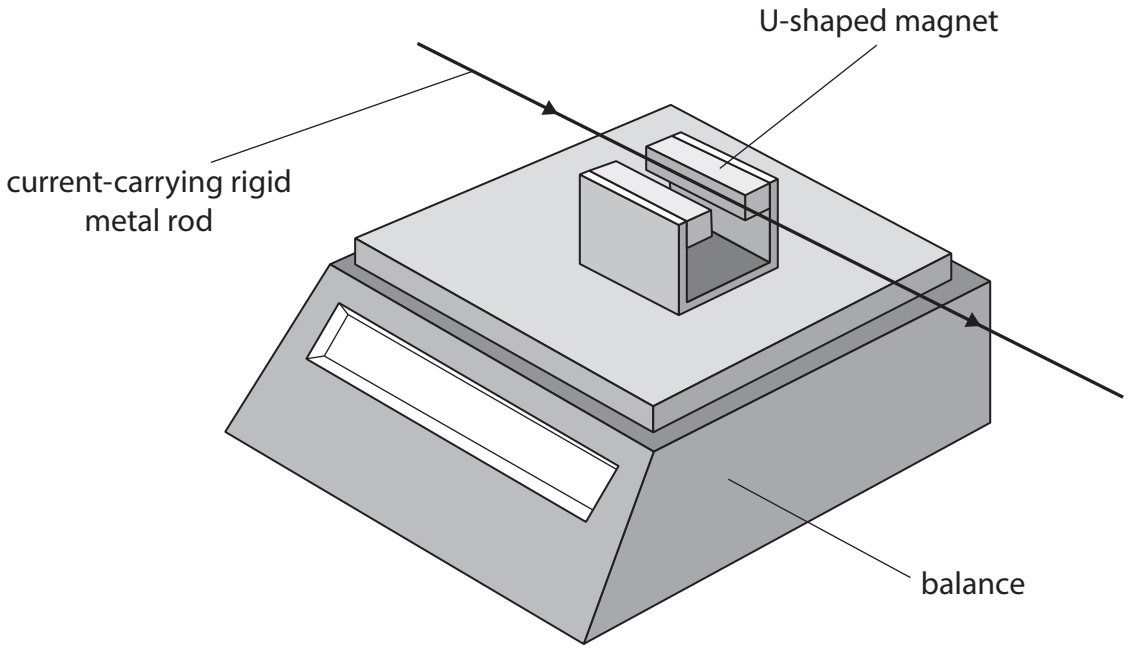
(Total for Question 9 = 8 marks)

10 A student investigates the magnetic force on a current-carrying metal rod.

The student places a U-shaped magnet on a sensitive balance.

They connect a rigid metal rod to a low-voltage power supply, and then fix the rod in place so that it passes between the poles of the magnet.

The diagram shows part of the student's apparatus.



When there is a current in the metal rod, the rod experiences a force due to the magnetic field of the magnet.

The reading on the balance changes because the magnet experiences a force that is the same magnitude as the force on the rod, but in the opposite direction.

(a) The student can increase the current in the metal rod up to a maximum of 5.0 A.

Suggest why the student should only have the power supply switched on for short periods of time.

(2)

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(b) Before the power supply is switched on, the reading of the balance is 194.95 g.

After the power supply is switched on, the reading of the balance is 193.80 g.

Calculate the force exerted on the current-carrying rod by the magnet.

(4)

force = ... N

(c) The student investigates how the balance reading varies as they change the current in the metal rod.

The table shows the student's results.

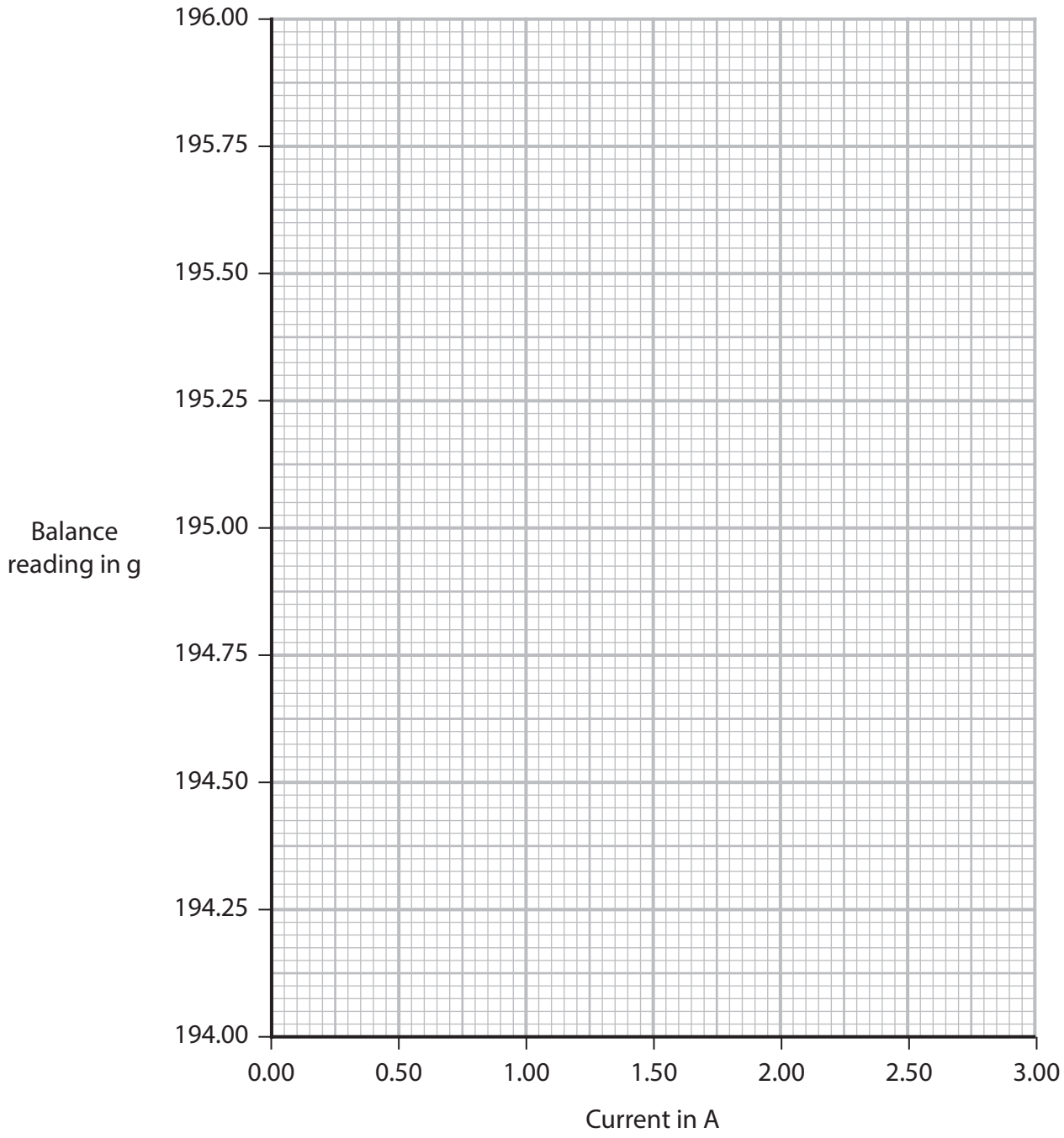
Current in A	Balance reading in g
0.00	194.95
0.50	194.80
1.00	194.65
1.50	194.50
2.00	194.35
2.50	194.20
3.00	194.05

(i) Plot the student's results on the grid.

(1)

(ii) Draw the line of best fit.

(1)



(iii) The student changes the connections between the metal rod and the power supply to reverse the direction of the current.

Draw another line on the graph to show how the balance reading will vary with current after this change has been made.

(3)

(Total for Question 10 = 11 marks)

11 Fluorescent tube lamps can be used in schools and office buildings for lighting.

The photograph shows an engineer installing a fluorescent tube lamp.

(Source: © Naparat / Shutterstock)

Diagram 1 shows a simplified view of the components of a fluorescent tube lamp.

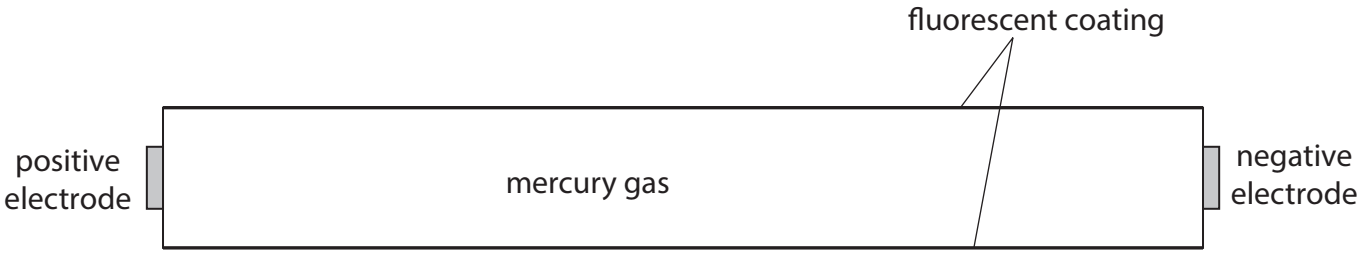


Diagram 1

(a) When the lamp is on, a large voltage is applied between the positive electrode and the negative electrode.

(i) State what is meant by the term **voltage**.

(1)

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(ii) The large voltage causes electrons to accelerate from the negative electrode towards the positive electrode.

An electron gains 1.0×10^{-16} J of energy when it accelerates between the electrodes.

Show that the voltage between the electrodes is about 600 V.

[magnitude of electron charge = 1.6×10^{-19} C]

(3)

(iii) The electron gains 1.0×10^{-16} J of energy in its kinetic store when it accelerates from the negative electrode to the positive electrode.

Calculate the speed of an electron when it reaches the positive electrode.

Assume the electron is initially at rest.

[electron mass = 9.1×10^{-31} kg]

(4)

speed = ... m / s

(b) When the electrons accelerate between the electrodes, they collide with mercury atoms.

Energy is transferred to the mercury atoms during the collisions. This causes the mercury atoms to emit ultraviolet light.

Atoms in the fluorescent coating absorb this ultraviolet light, which is then re-emitted as light from a different part of the electromagnetic spectrum.

Diagram 2 shows this process.

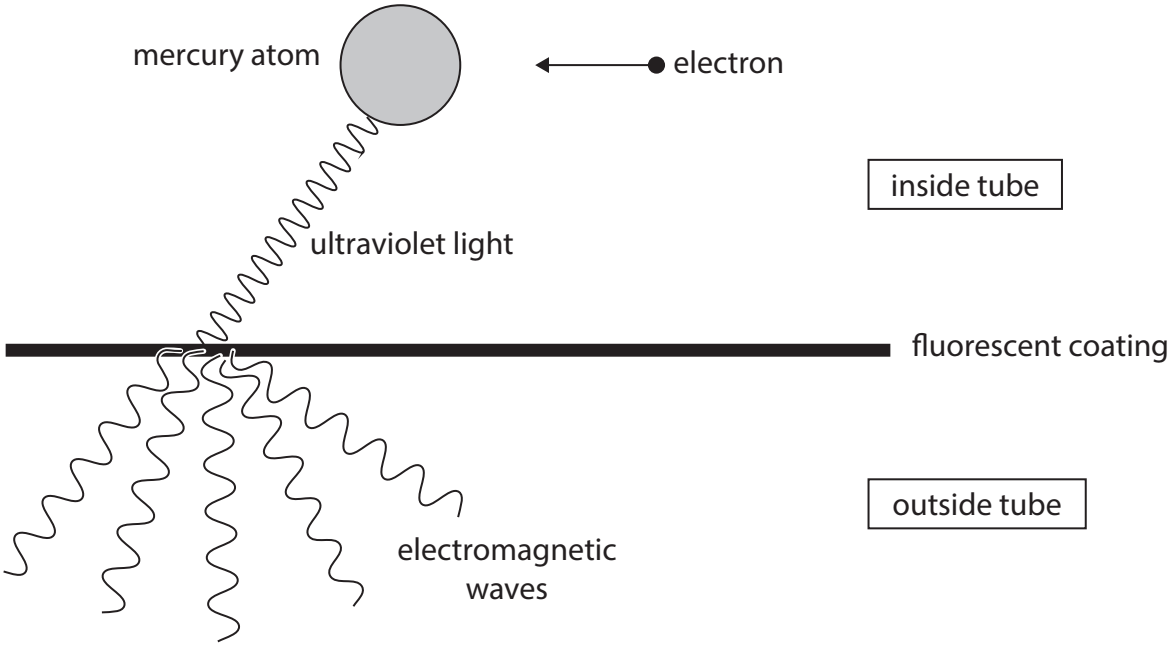

Diagram 2

(i) Suggest why the tube must have a fluorescent coating for the lamp to operate effectively.

(2)

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(ii) Explain why the fluorescent tube lamp is dangerous if the fluorescent coating becomes damaged.

(2)

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(Total for Question 11 = 12 marks)

TOTAL FOR PAPER = 110 MARKS