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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE (9–1)

Centre Number | Candidate Number

Time 2 hours

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

Physics

Science (Double Award) 4SD0
PAPER: 1P

You must have:
Calculator, ruler, protractor

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **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.
- 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 ☒.

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.
- Good luck with your examination.

Turn over ▶

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1/1/1/1/1/1/

P 6 7 1 5 9 A 0 1 2 8

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FORMULAE

You may find the following formulae useful.

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

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

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

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

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

(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, $g = 10\ \text{m/s}^2$.

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Answer ALL questions.

1 (a) (i) Which of these coloured stars has the highest surface temperature?

(1)

- ☒ **A** orange
- ☒ **B** red
- ☒ **C** white
- ☒ **D** yellow

(ii) Which of these is a stage in the life cycle of the Sun?

(1)

- ☒ **A** black hole
- ☒ **B** neutron star
- ☒ **C** supernova
- ☒ **D** white dwarf

(iii) Which of these is the stage nearest the end of the life cycle of a star with a mass much greater than the Sun?

(1)

- ☒ **A** main sequence
- ☒ **B** protostar
- ☒ **C** supernova
- ☒ **D** white dwarf

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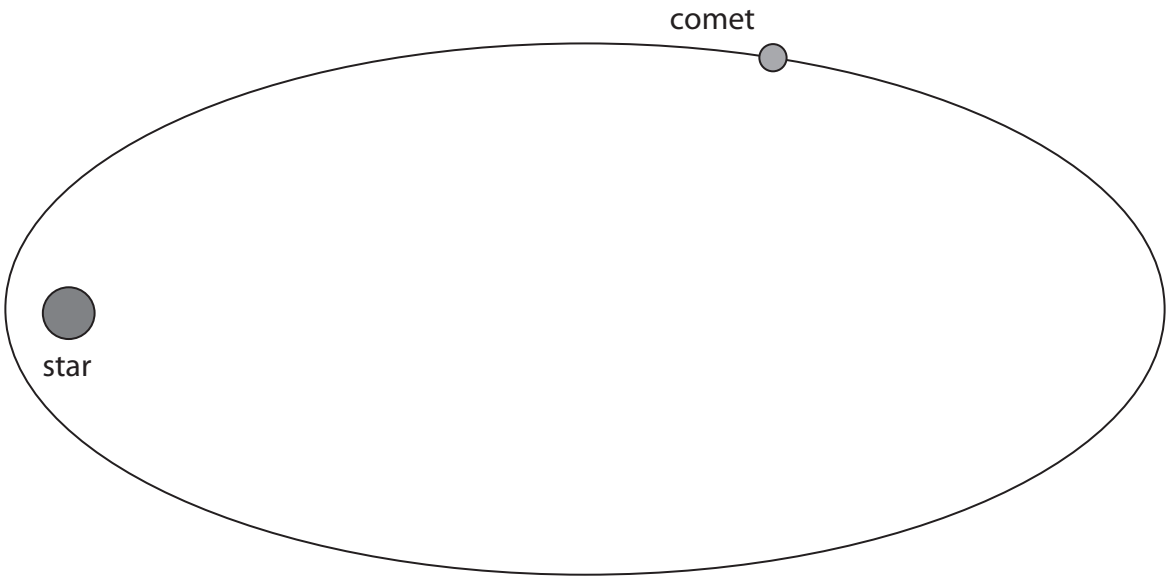
(b) The diagram shows the orbit of a comet around a star.

Draw a labelled arrow to show the force acting on the comet due to the star.

(2)

not to scale



(Total for Question 1 = 5 marks)

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2 A student uses iron filings to investigate the magnetic field pattern around a bar magnet.

(a) Name the apparatus that the student could use to find the direction of the field lines.

(1)

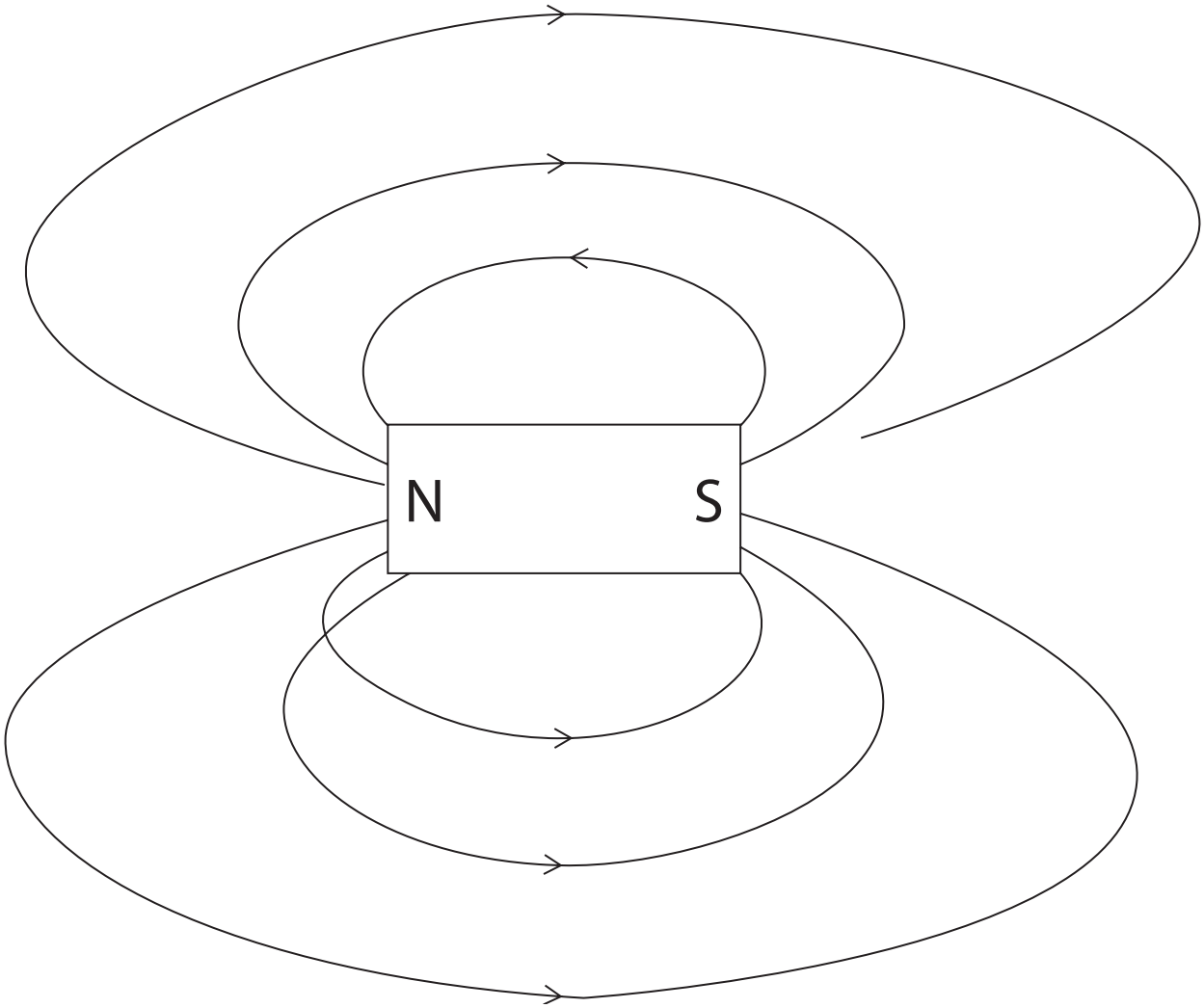
.....

(b) The student draws a diagram of the magnetic field pattern of the magnet.

The student makes three mistakes.

Draw a circle around each mistake on the diagram.

(3)



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(c) The magnet is made of a magnetically hard material.

Describe what is meant by the term **magnetically hard**.

(2)

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(Total for Question 2 = 6 marks)

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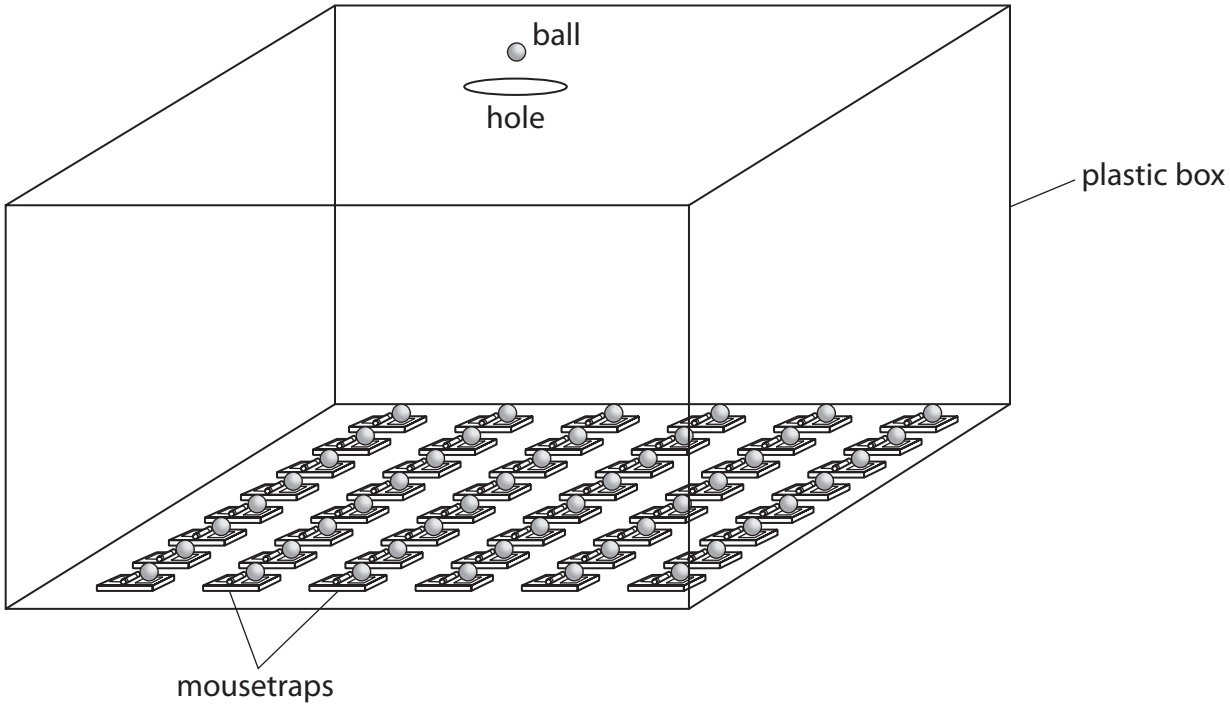
3 The diagram shows a model of a chain reaction in a nuclear fission reactor.

A ball falls through the hole and hits a mousetrap.

This mousetrap then releases another ball.

Each released ball hits a different mousetrap.



(a) Each mousetrap represents a uranium-235 nucleus.

(i) Name the particle represented by the balls.

(1)

.....

(ii) Describe what is meant by the term **nuclear fission**.

(2)

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(iii) Describe what is meant by the term **chain reaction**.

(2)

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(b) The walls of a real nuclear reactor are not made of plastic.

Give a suitable material for the walls of a real nuclear reactor.

(1)

.....

(c) Use words from the box to complete the sentences about the moderator and control rods in a nuclear reactor.

(4)

absorb	ionise	neutralise	reflect	slow
boron	granite	graphite	paper	uranium

The moderator in a nuclear reactor can be made of ..... .

The moderator is designed to ..... neutrons.

The control rods in a nuclear reactor can be made of ..... .

The control rods are designed to ..... neutrons.

(Total for Question 3 = 10 marks)

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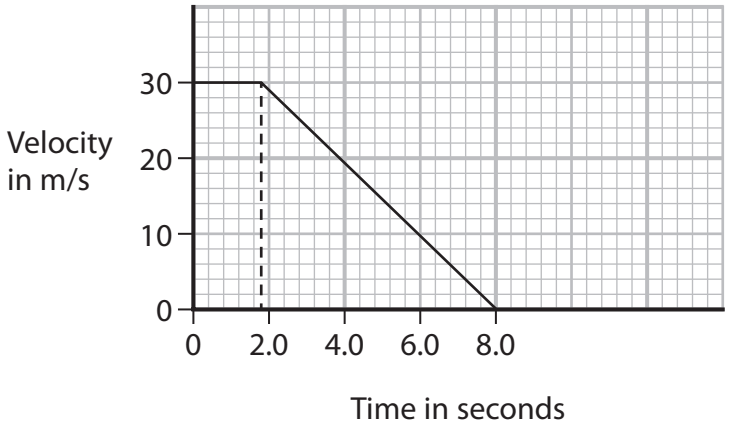
4 The diagram shows a velocity-time graph for a car from the time the driver sees an obstacle in the road until the car comes to rest.



(a) (i) Calculate the acceleration of the car between 1.8 and 8.0 seconds.

(3)

acceleration = ... m/s^2

(ii) Calculate the braking distance of the car.

(3)

braking distance = ... m

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(iii) Explain the effect, if any, of increased driver tiredness on the thinking distance and on the braking distance of the car.

(4)

thinking distance .....

.....

.....

.....

braking distance .....

.....

.....

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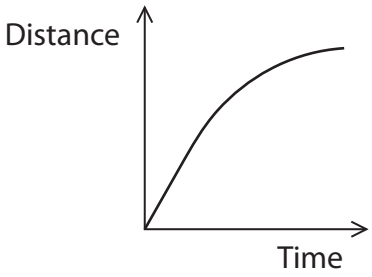
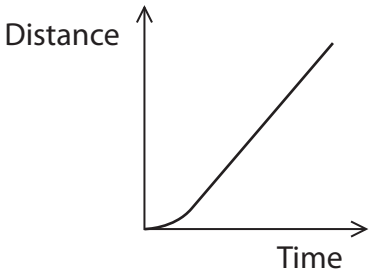
(b) Which of these represents the distance-time graph for the car?

(1)

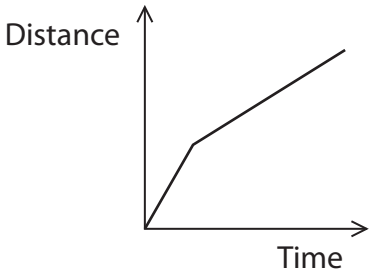
☒ **A**



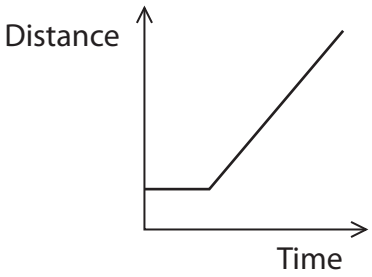
☒ **B**



☒ **C**



☒ **D**



(Total for Question 4 = 11 marks)

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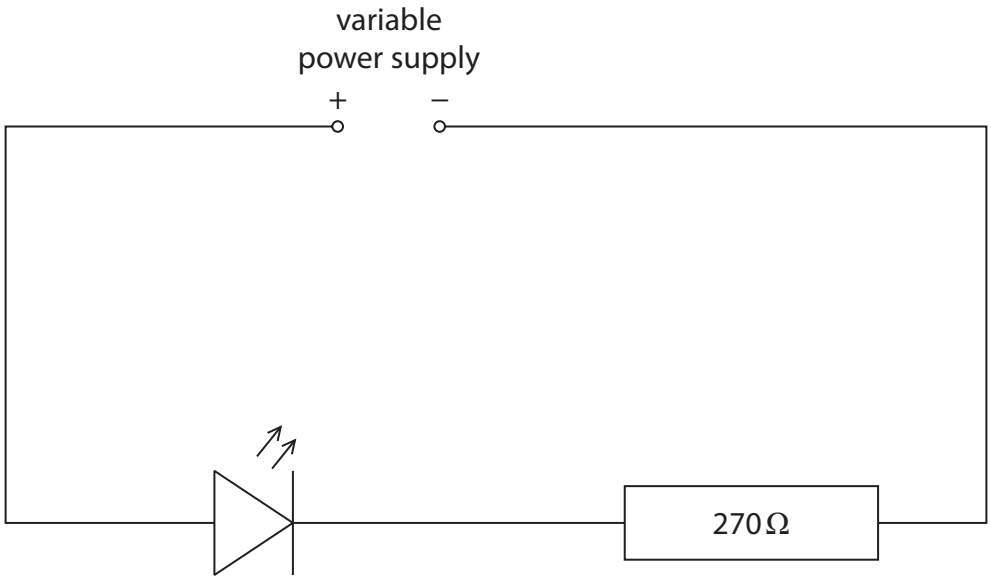
5 The diagram shows a circuit used to investigate the relationship between current and voltage for a light-emitting diode (LED).



(a) Draw meters on the diagram to measure the voltage of the LED and the current in the LED.

(3)

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(b) The table shows the results of the investigation.

Voltage in V	Current in mA
0.00	0.0
0.30	0.5
0.35	2.5
0.40	1.5
0.45	2.0
0.50	4.5
0.55	9.0
0.60	15.0

(i) Plot the results on the grid.

(3)

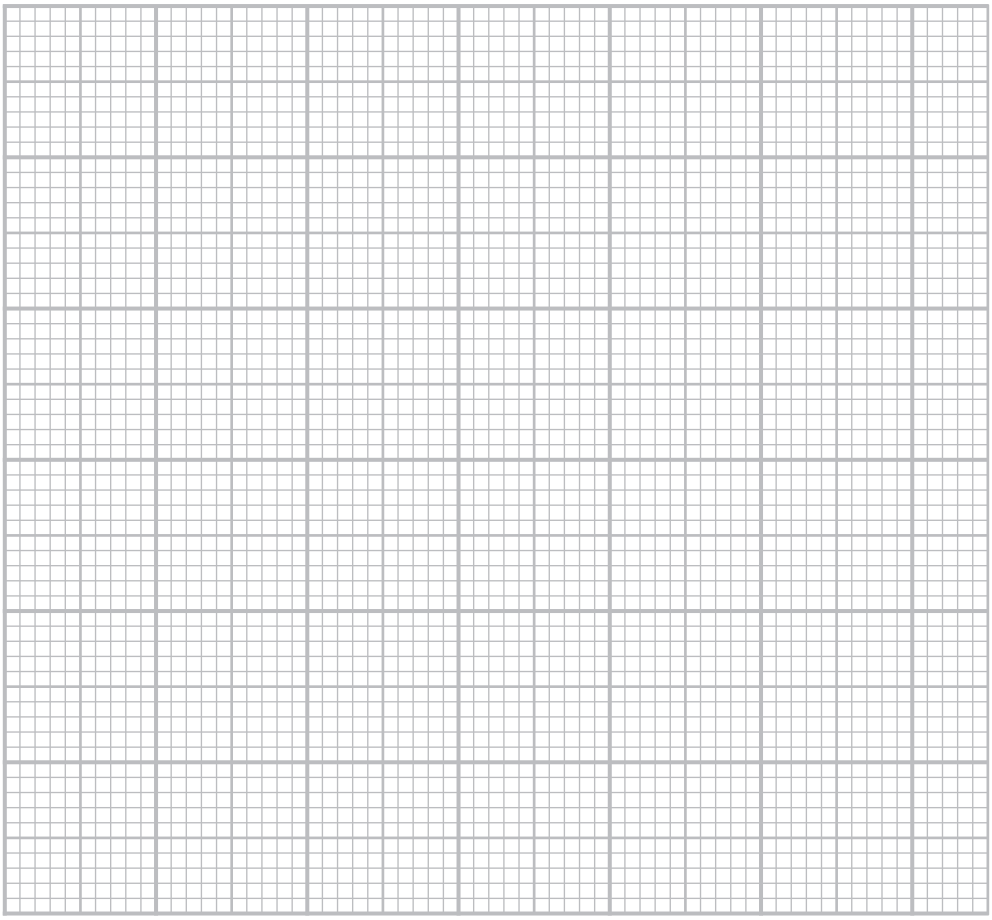
(ii) One of the results is anomalous.

On the graph, draw a circle around the anomalous result.

(1)

(iii) Draw a curve of best fit.

(1)



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(iv) Give a reason why a line graph is the best way of showing these results.

(1)

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(v) State the formula linking voltage, current and resistance.

(1)

(vi) Any current larger than 15 mA will permanently damage the LED.

The resistor in the circuit has a resistance of 270 Ω.

Use the results from the investigation to determine the maximum voltage of the power supply without damaging the LED.

(4)

maximum voltage = ... V

(Total for Question 5 = 14 marks)

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6 The diagram shows a container of water.

The container has a heater in the bottom corner, a temperature sensor and a lid.



(a) Explain how a convection current is formed in the container.

You may add to the diagram or draw your own diagram to support your answer.

(4)

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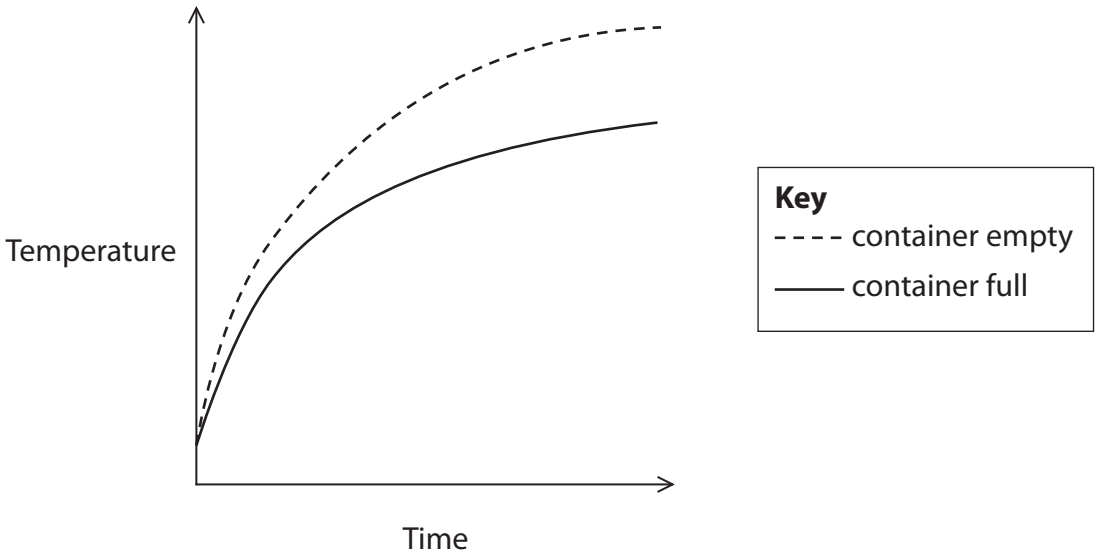
(b) The graph shows how the temperature sensor reading changes with time.

It shows the change in temperature when the container is full of water and when the container is empty.



(i) Describe the relationship between temperature and time when the container is full of water.

(2)

.....

.....

.....

.....

(ii) Explain the differences between the two curves on the graph.

(3)

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(Total for Question 6 = 9 marks)

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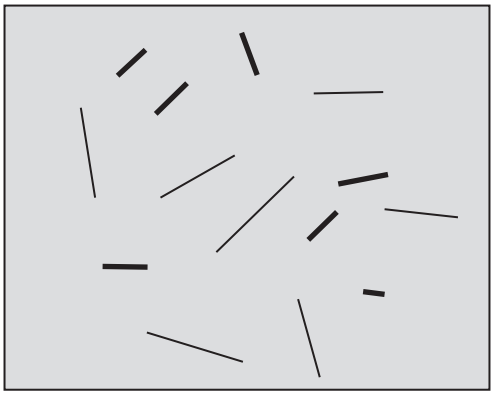
7 (a) The diagram shows tracks produced by radiation in a device called a cloud chamber.

The tracks are formed when particles ionise the material in the cloud chamber.



Alpha particles produce the shorter, thicker tracks.

Beta particles produce the longer, thinner tracks.

Explain why alpha particles produce the shorter, thicker tracks.

(2)

.....

.....

.....

.....

(b) Uranium-235 is an isotope of uranium that can decay by emitting an alpha particle.

(i) Describe what is meant by the term **isotope**.

(2)

.....

.....

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(ii) Complete the equation for the decay of uranium-235

(2)

$$^{235}_{92}U \rightarrow \square^{231}Th + \square^{}_{2}\alpha$$

(iii) Uranium-235 decays to thorium-231 with a half-life of 700 million years.

When a rock was formed, it contained 6400 million uranium-235 nuclei and no thorium-231 nuclei.

Show that after 2100 million years there are seven times more thorium nuclei than uranium nuclei in the rock.

(5)

(Total for Question 7 = 11 marks)

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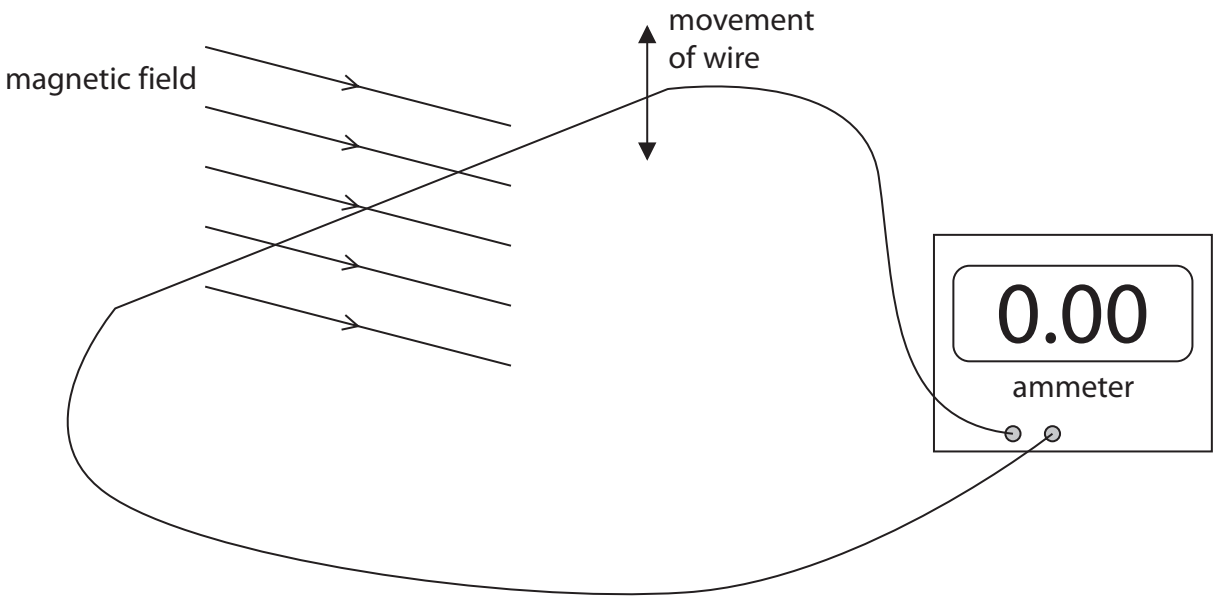
8 (a) Describe how two magnets can be arranged to produce a uniform magnetic field.

You may draw a diagram to support your answer.

(2)

(b) The diagram shows a wire in a uniform magnetic field.



(i) The wire is moved up and down repeatedly in the magnetic field.

Explain the effect that this movement has on the ammeter reading.

(3)

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(ii) Explain the effects on the ammeter reading of moving the wire with the same amplitude but at a higher frequency.

(4)

(Total for Question 8 = 9 marks)

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9 The photograph shows a whale jumping out of the surface of the sea.



(Source: © Alexander Baumann/Shutterstock)

(a) At the top of the jump, the whale's velocity is 0 m/s.

The whale falls 2.2 m from the top of the jump to the surface of the sea.

Calculate the velocity of the whale when it hits the surface of the sea.

(4)

velocity = ... m/s

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(b) A resultant force causes the whale to slow down when it hits the surface of the sea.

(i) Draw an arrow to show this resultant force.

(1)



(Source: © Eugenia Petrovskaya/Shutterstock)

(ii) The resultant force acting on the whale is 18 000 N.

The mass of the whale is 4100 kg.

Calculate the acceleration of the whale.

(3)

acceleration = ... m/s^2

(Total for Question 9 = 8 marks)

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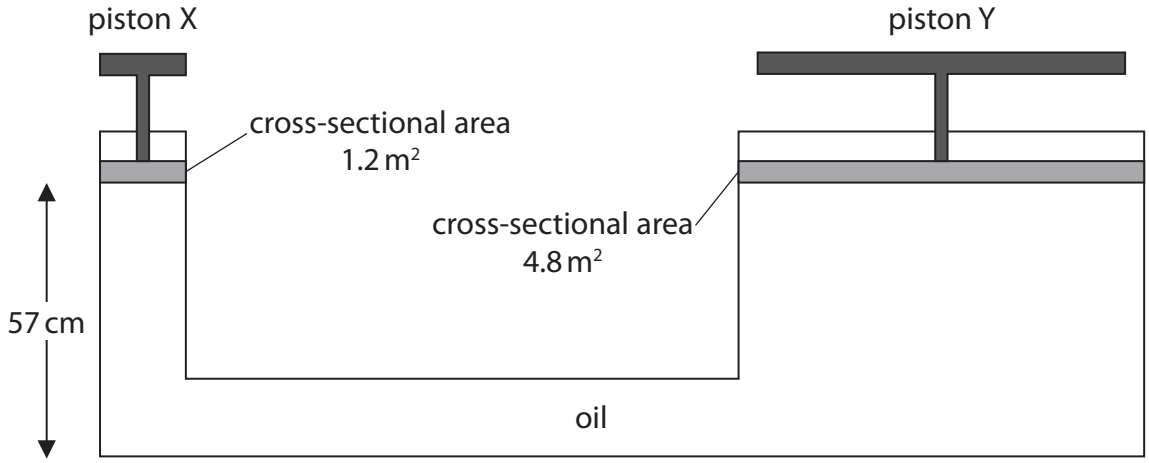
10 The diagram shows a device called a hydraulic lift.

The hydraulic lift consists of a tube of oil with a piston at each end.



(a) Calculate the pressure difference between the bottom of piston X and the bottom of the oil.

[density of oil = 820 kg/m³]

(3)

pressure difference = ... Pa

(b) A 24 kg mass is placed on piston X.

(i) Calculate the weight of the 24 kg mass.

Give the unit.

(3)

weight = ... unit .....

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(ii) Calculate the extra pressure on the oil due to the mass.

(2)

extra pressure = ... Pa

(iii) The oil transfers the same extra pressure to piston Y.

Calculate the force acting upwards on piston Y due to the extra pressure.

(3)

force = ... N

(c) Piston Y starts at rest, rises slowly and then comes to rest.

State how the following energy stores have changed from before the motion to after the motion is complete.

(4)

Energy store	Change
gravitational potential energy of piston X	
gravitational potential energy of piston Y	
chemical energy of piston Y	
kinetic energy of piston Y	

(Total for Question 10 = 15 marks)

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11 Diagram 1 shows what happens when light is incident on a piece of transparent material.

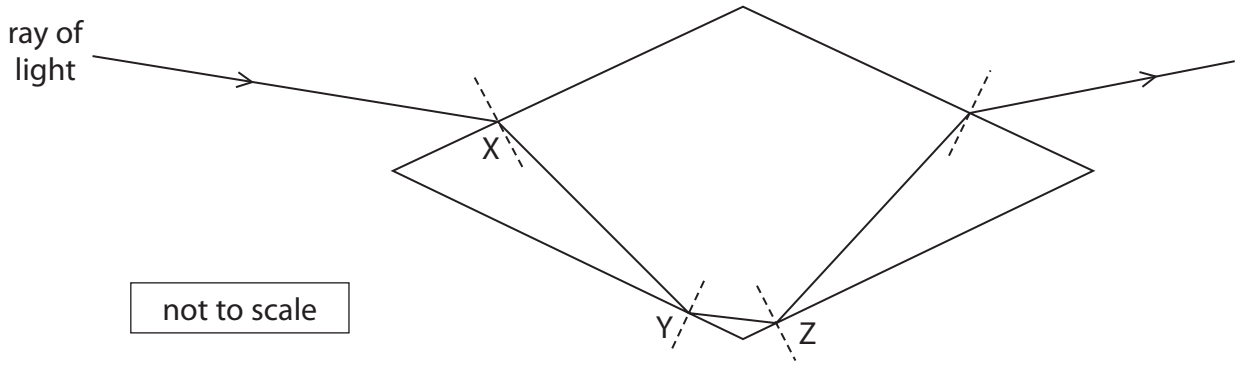

Diagram 1

(a) When very bright light shines on this transparent material, a small amount of light is reflected at point X.

(i) On diagram 2, draw the reflected ray from point X.

(2)

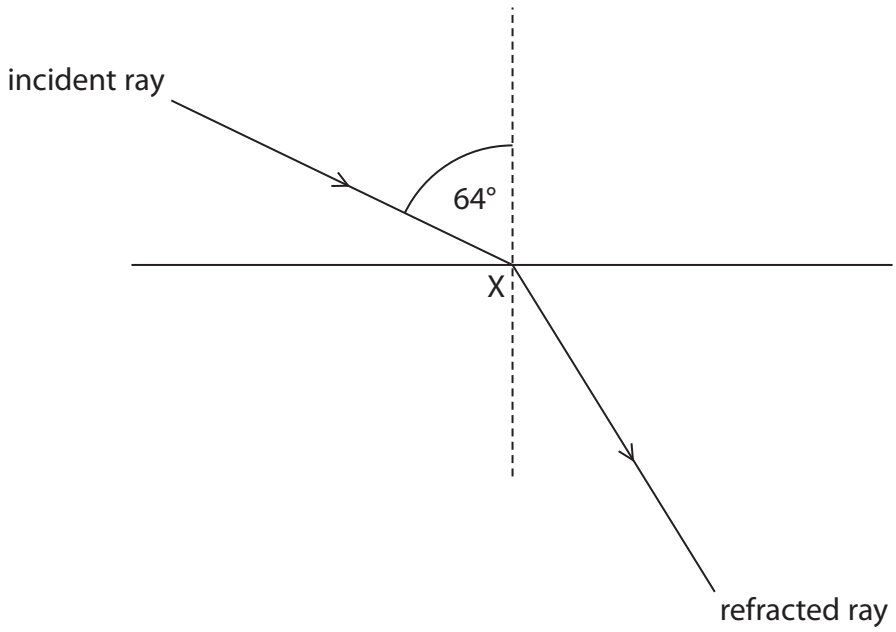

Diagram 2

(ii) Measure the angle of **refraction** at point X on diagram 2.

(1)

angle = ... degrees

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(iii) State the formula linking refractive index, angle of incidence and angle of refraction.

(1)

(iv) Show that the refractive index of the transparent material is about 1.7

(2)

(v) State the formula linking refractive index and critical angle.

(1)

(vi) Calculate the critical angle for the transparent material.

(2)

critical angle = ... degrees

QUESTION 11 CONTINUES ON NEXT PAGE

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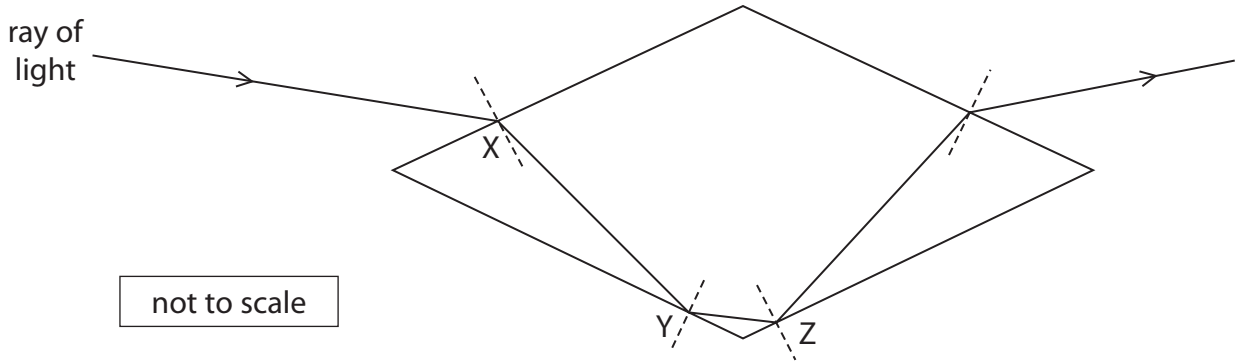
(b) Explain the behaviour of the light at points Y and Z.

(3)



(Total for Question 11 = 12 marks)

TOTAL FOR PAPER = 110 MARKS

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