Write your name here

Surname	Other names

Edexcel IGCSE

Centre Number	Candidate Number

Physics

Unit: 4PH0
Science (Double Award) 4SC0
Paper: 1P

Friday 27 May 2011 – Morning **Time: 2 hours**	Paper Reference **4PH0/1P** **4SC0/1P**

Materials required for examination.
Ruler, protractor, calculator

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 120.
- 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.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 3 8 7 5 9 A 0 1 3 2

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EQUATIONS

You may find the following equations useful.

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

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

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

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

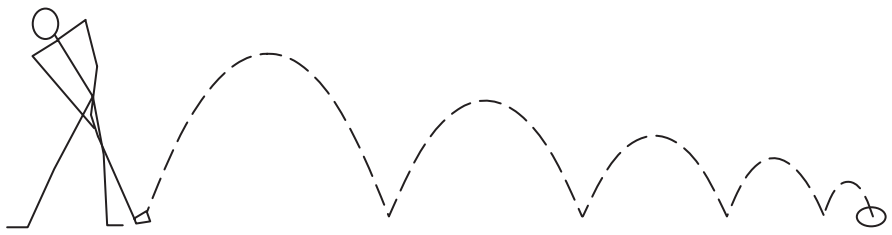
$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{W}{t}$$

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

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

Answer ALL questions.

1 A golfer hits a golf ball and it bounces into the hole.



(a) Use words from the box to complete the sentences below.

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

chemical	**elastic**	**electrical**	**gravitational**	**kinetic**

(i) Each time the golf ball moves upwards, it gains ..... potential energy.

(1)

(ii) Each time the golf ball hits the ground it changes shape and energy is stored as ..... potential energy.

(1)

(iii) When the golf ball is moving it has ..... energy.

(1)

(b) Each time the ball hits the ground, energy is transferred away from the ball.

(i) How can you tell this from the diagram?

(1)

.....

.....

(ii) Describe what happens to the energy that is transferred.

(1)

.....

.....

(Total for Question 1 = 5 marks)

2 This question is about radiations in the electromagnetic spectrum.

radio waves	microwaves	infrared	A	ultraviolet	B	gamma rays

(a) The names of two parts of the electromagnetic spectrum are missing.

Complete the table below, with the names of the missing parts.

(2)

	Name
A	
B	

(b) Which electromagnetic radiation is used for heating and night vision equipment?

(1)

☒ **A** radio waves

☒ **B** microwaves

☒ **C** infrared

☒ **D** ultraviolet

(c) Which electromagnetic radiation is used for cooking and satellite transmissions?

(1)

☒ **A** radio waves

☒ **B** microwaves

☒ **C** infrared

☒ **D** ultraviolet

(d) The list of electromagnetic radiations, from radio waves to gamma rays, is in order of

(1)

☒ **A** decreasing frequency

☒ **B** decreasing wavelength

☒ **C** increasing amplitude

☒ **D** increasing time period

(e) Exposure to excessive electromagnetic radiations can be harmful to the human body.

For **two** named types of electromagnetic radiation, describe

- a harmful effect
- how the risks of exposure can be reduced.

(4)

Name of radiation .....

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.....

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.....

.....

Name of radiation .....

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(Total for Question 2 = 9 marks)

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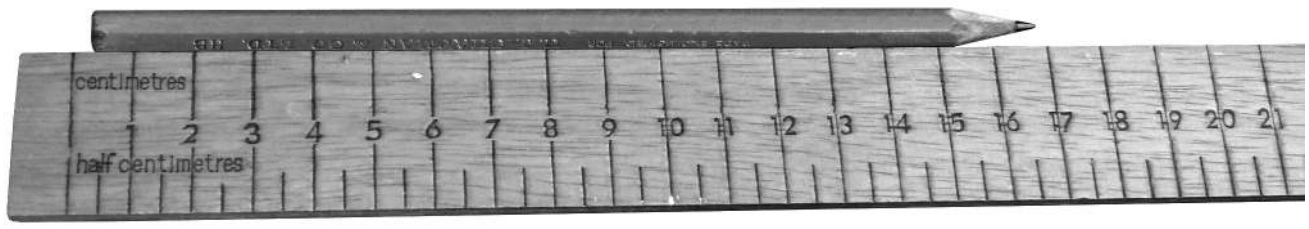
3 A student measures the length of a pencil.

The photograph shows the arrangement she uses.



The student says:

I think that the pencil is 16.9 cm long.

The student may not be correct.

(a) Use the photograph to estimate the length of the pencil and give its unit.

(2)

Length = ... unit .....

(b) Suggest **two** ways that the student could improve the accuracy of this measurement, using only the equipment shown in the photograph.

(2)

1 .....

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2 .....

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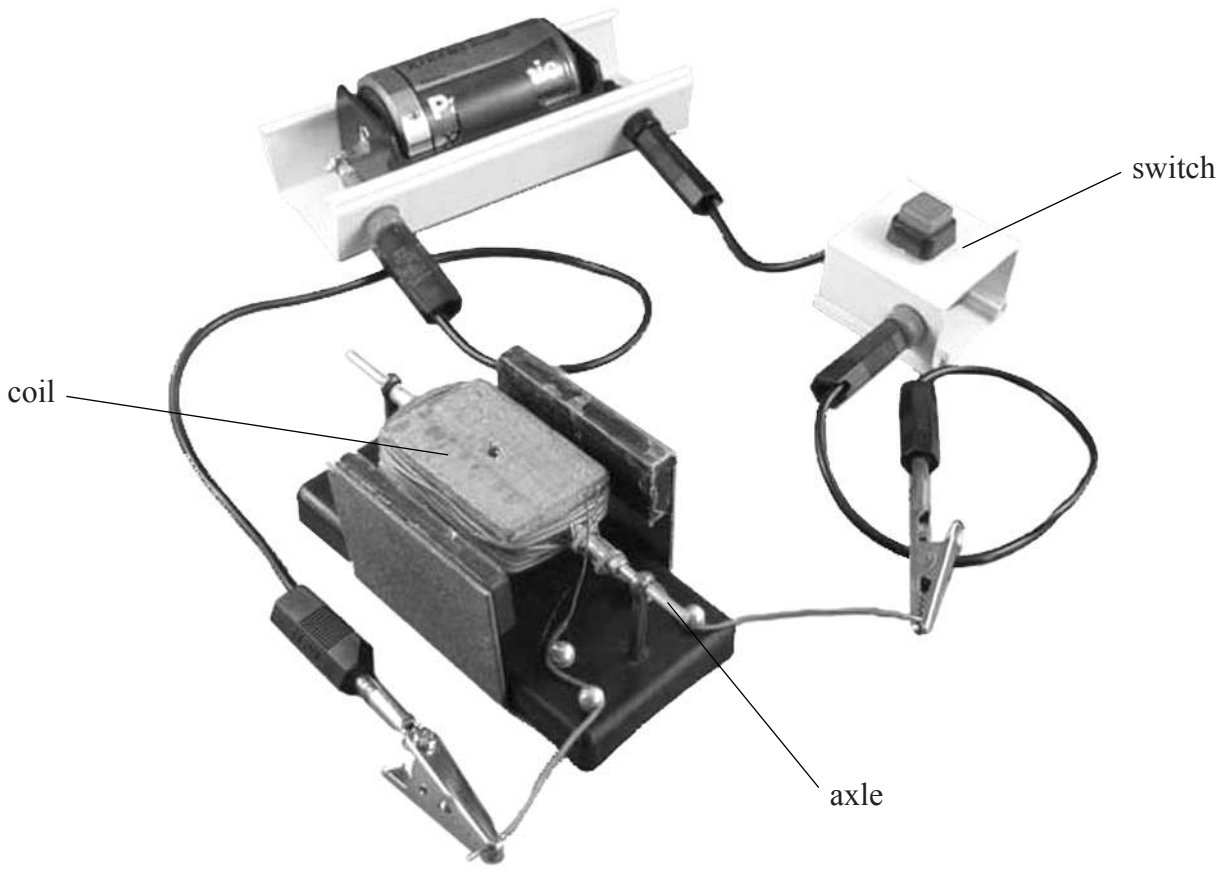
(Total for Question 3 = 4 marks)

4 Some students are investigating a simple electric motor.



(a) When the switch is closed the coil spins on the axle.

State why.

(2)

.....

.....

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(b) State **two** changes that would make the motor spin faster.

(2)

1 .....

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2 .....

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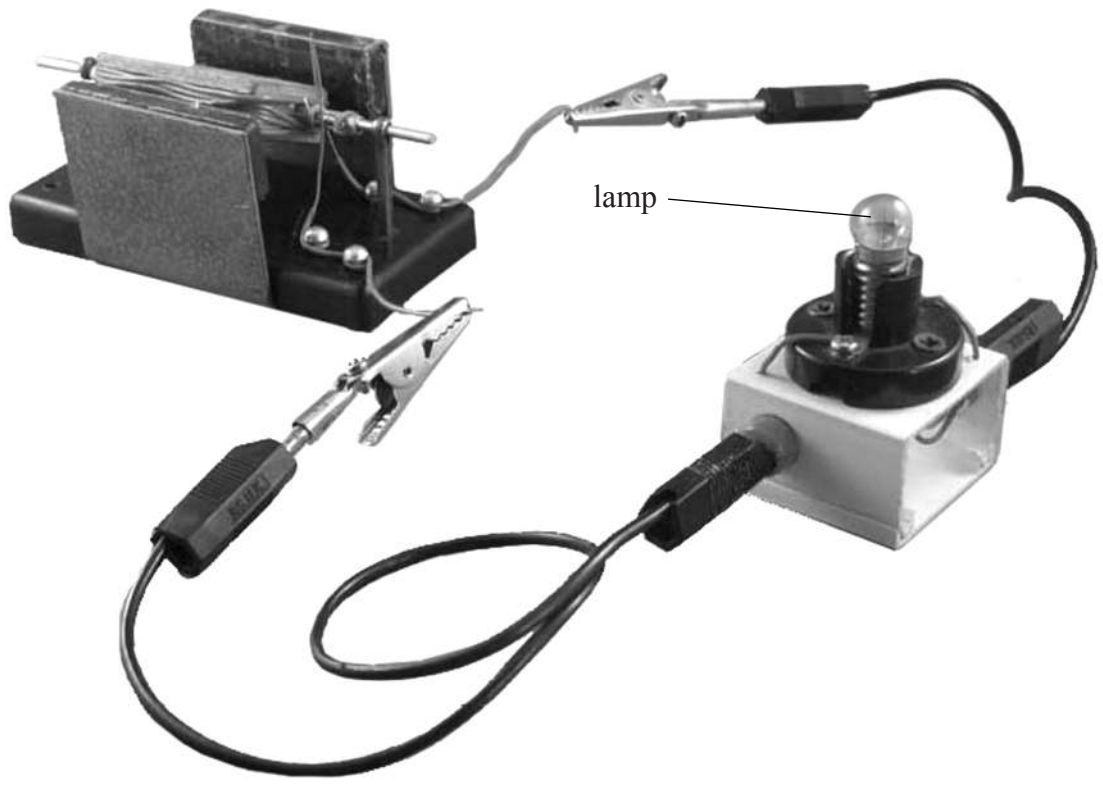
(c) The students change their circuit, replacing the cell and switch with a lamp.



When they spin the coil by hand, the lamp lights.

Explain why the lamp lights.

(2)

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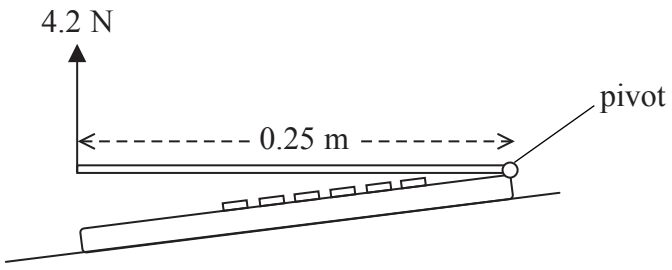
(Total for Question 4 = 6 marks)

5 The diagram shows the side view of a laptop computer.



A student opens the computer with an upward force of 4.2 N.

The force is applied 0.25 m from the pivot.

(a) (i) State the equation linking moment, force and distance.

(1)

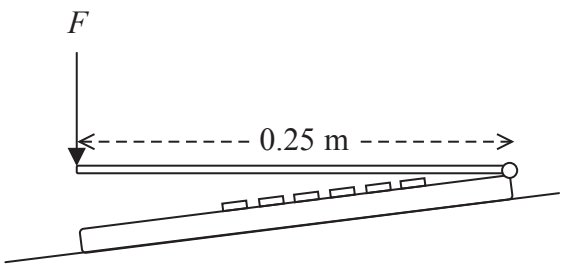
(ii) Calculate the moment of the force that opens the computer.

(2)

Moment = ... N m

(b) The student finds that 4.2 N is the **minimum** upward force needed to open the computer.

Then the student applies a downward force, F, to close the computer.



Explain why the minimum force needed to close the computer is likely to be **less** than 4.2 N.

(2)

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(Total for Question 5 = 5 marks)

6 Light from an object forms an image in a plane mirror.

(a) Tick (✓) the **two** correct statements.

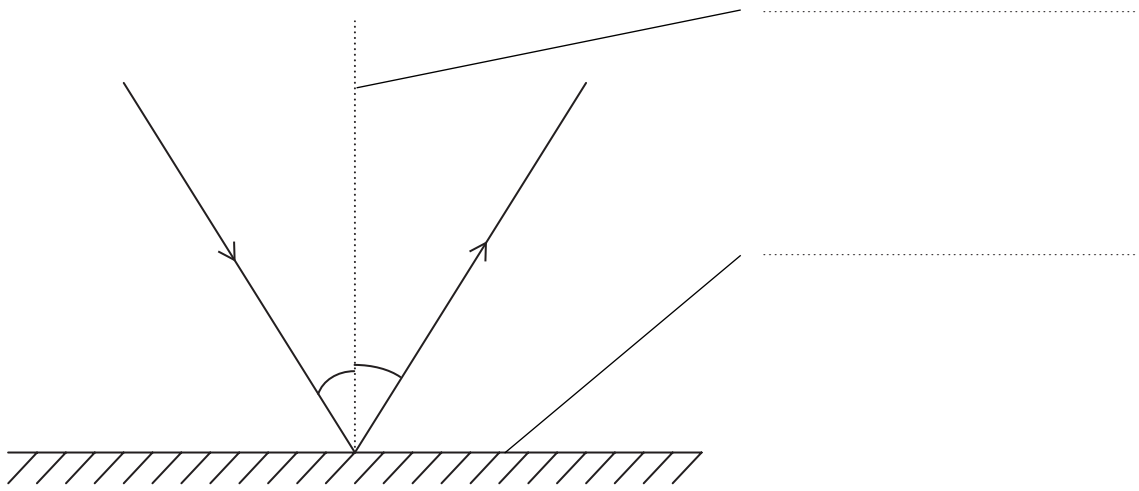
(2)

Statement	Tick
the image in a plane mirror is virtual	
light from the object passes through the image in a plane mirror	
light waves are longitudinal	
the angle of incidence equals the angle of reflection	
the incident ray is always at right angles to the reflected ray	

(b) (i) Use words from the box to complete the labels on the diagram below.

(2)

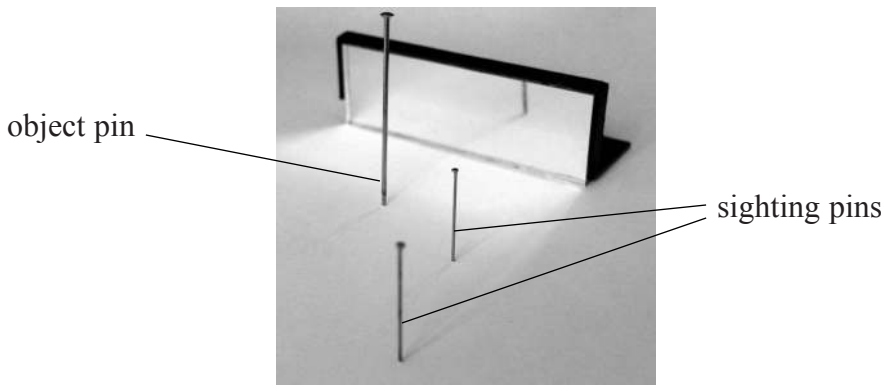
mirror	**normal**	**ray**	**reflection**



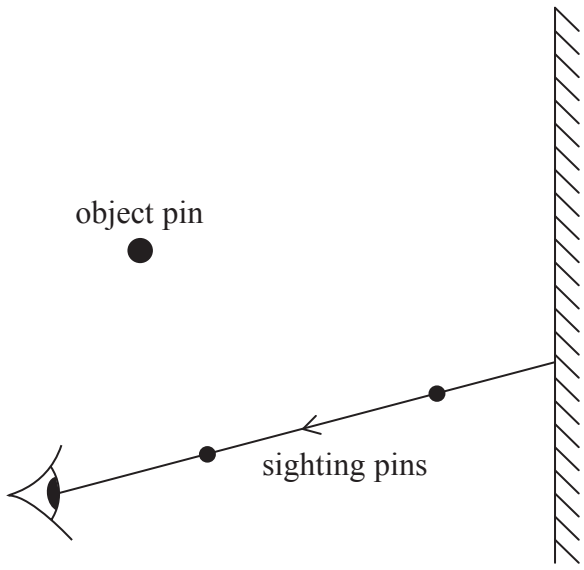
(ii) Write ***r*** on the diagram above to show the angle of reflection.

(1)

(c) A student investigates the formation of the image in a plane mirror, using the apparatus shown in the photograph.



She uses the holes that the pins make to construct this diagram.



(i) Add to the diagram to show how the student should find the position of the image.

(3)

(ii) Explain how the student could confirm that the position of the image is correct.

(2)

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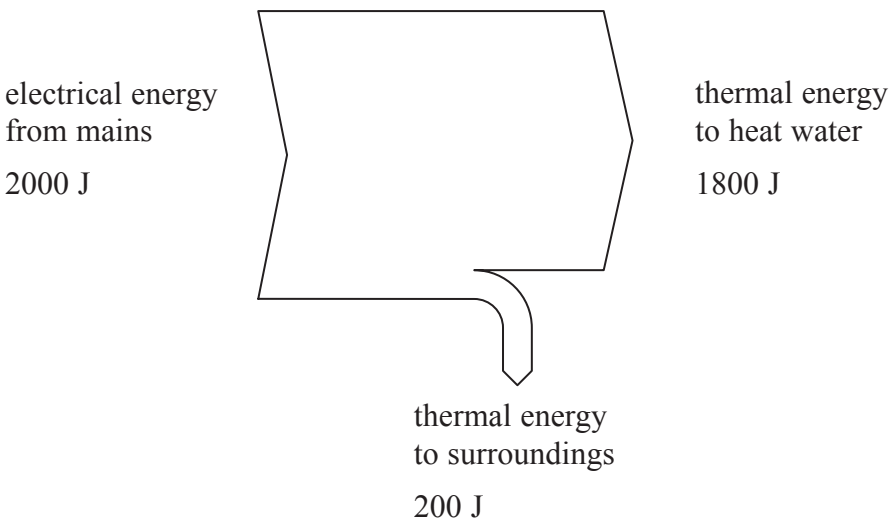
(Total for Question 6 = 10 marks)

7 This question is about an electric kettle.

(a) The Sankey diagram represents the energy transfers taking place when the kettle heats some water.



What is the efficiency of the kettle?

(1)

☒ **A** 0.1

☒ **B** 0.9

☒ **C** 200

☒ **D** 1800

(b) Why does the heating element in the kettle get hot when its electrical supply is switched on?

(2)

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.....

(c) The power of the heating element in the kettle is 2000 W when it is connected to a 230 V mains supply.

(i) State the equation linking power, current and voltage.

(1)

(ii) Show that the current in the heating element is approximately 9 A.

(2)

Current = ... A

(iii) The plug of the kettle has a fuse.

Fuses are available in values of

1 A 3 A 7 A 13 A

Identify the fuse that is the most suitable for this kettle, and explain why.

(2)

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.....

(Total for Question 7 = 8 marks)

8 A train travels 9 km from station A to station B.

It takes 15 minutes.

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

(1)

(ii) Calculate the average speed of the train and give its unit.

(3)

Average speed = ... unit .....

(iii) The maximum speed of the train must be higher than the value you have calculated.

Explain why.

(2)

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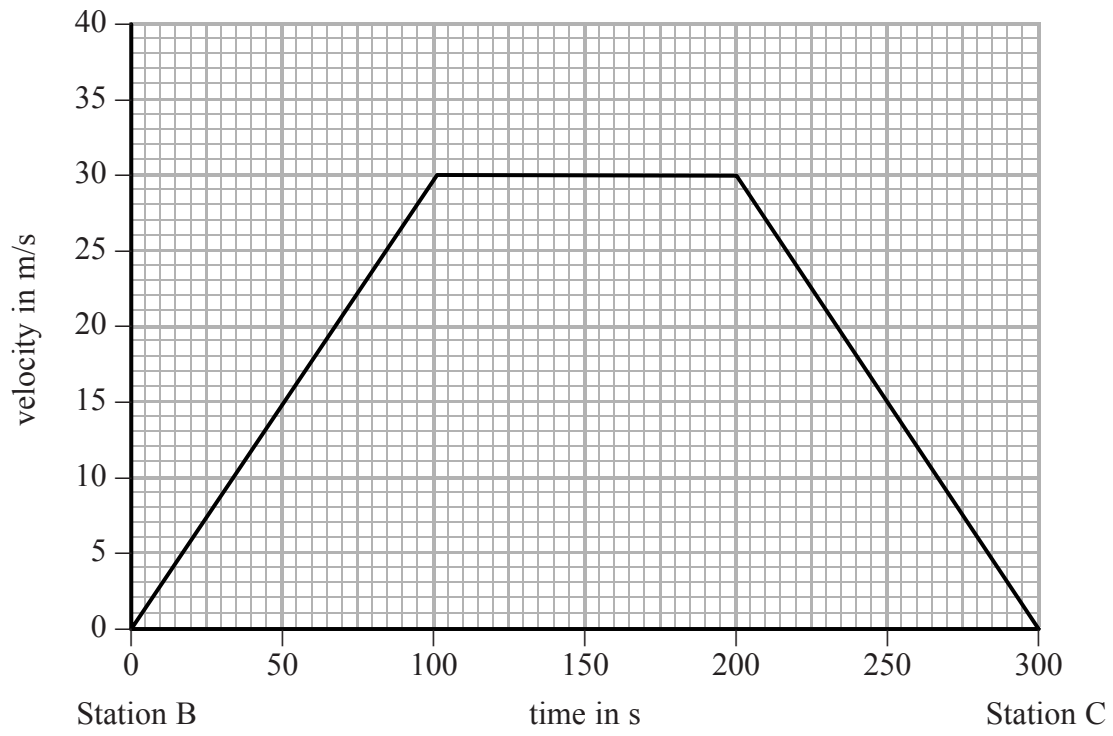
(b) The train continues along a straight track from station B to station C.

The graph shows how the velocity of the train changes with time during this part of the journey.



(i) Use the graph to calculate the acceleration of the train, in m/s^2, during the first 100 seconds after it leaves station B.

(3)

Acceleration = ... m/s^2

(ii) Use the graph to calculate the distance, in m, between station B and station C.

(3)

Distance = ... m

(Total for Question 8 = 12 marks)

9 Builders work on a new house.

A builder carries a concrete block from the ground up to the top of the scaffolding.

(a) (i) State the equation linking gravitational potential energy, mass, *g* and height.

(1)

(ii) The concrete block has a mass of 18 kg.

Calculate the gravitational potential energy gained by the concrete block if the scaffolding is 5 m high.

(2)

Gravitational potential energy = ... J

(iii) What is the link between the gravitational potential energy gained by the concrete block and the work done by the builder to lift it?

(1)

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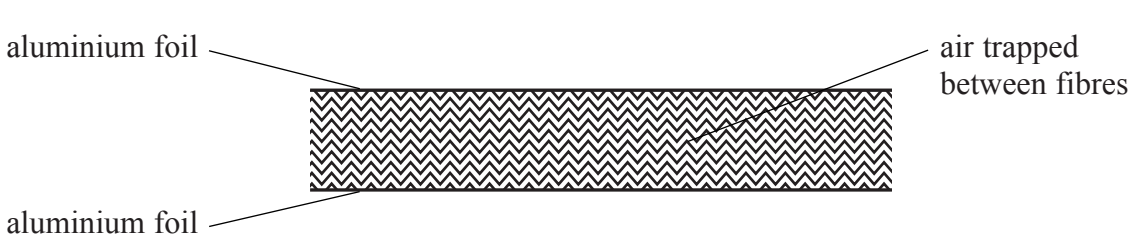
.....

(b) The builders fit a layer of insulating material in the roof of the house.
The diagram shows a section through the insulating material.



Explain how the insulating material reduces the amount of heat lost through the roof by conduction, convection and radiation.

(5)

conduction

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convection

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radiation

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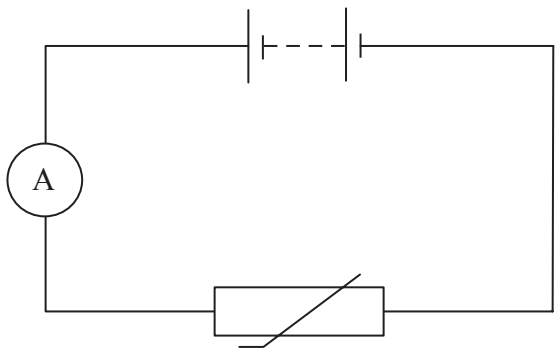
(Total for Question 9 = 9 marks)

10 A student investigates how the resistance of a thermistor changes with temperature.
He measures a current and a voltage.

The diagram shows part of the circuit that the student uses.



(a) (i) Label the thermistor on the diagram.

(1)

(ii) Add to the diagram to show how a voltmeter should be connected.

(2)

(b) The student varies the temperature of the thermistor and obtains the results below.

Temperature in °C	0	20	40	60	80	100
Current in mA	0.8	2.0	4.2	8.2	15.1	26.6

(i) State the equation linking voltage, current and resistance.

(1)

(ii) The voltage across the thermistor is 12 V.

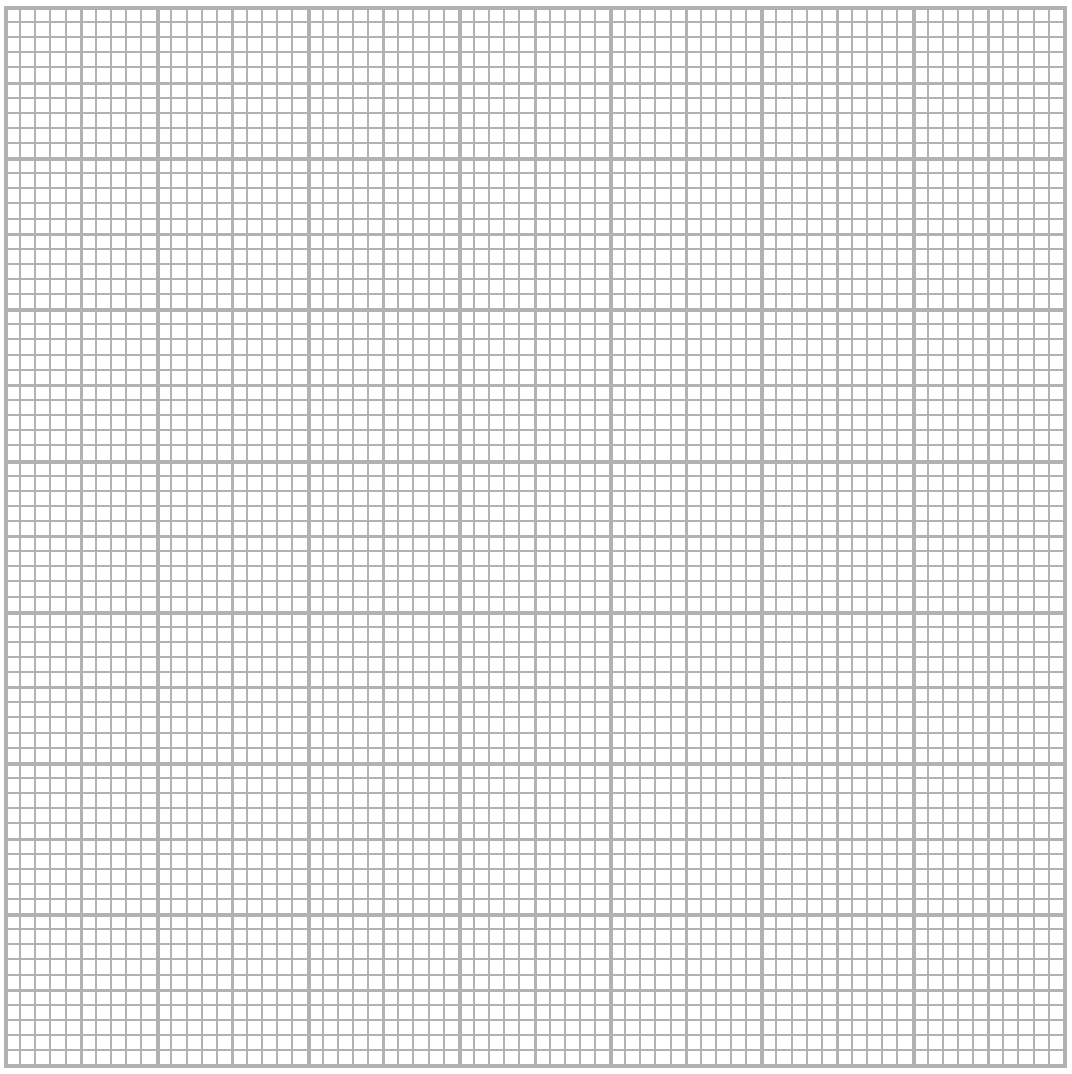
Calculate the resistance of the thermistor at 20 °C.

(2)

Resistance = ... Ω

(iii) Use the results from the table opposite to plot a graph of current against temperature.

(5)



(iv) Use your graph to describe how the current in the thermistor changes as the temperature increases.

(2)

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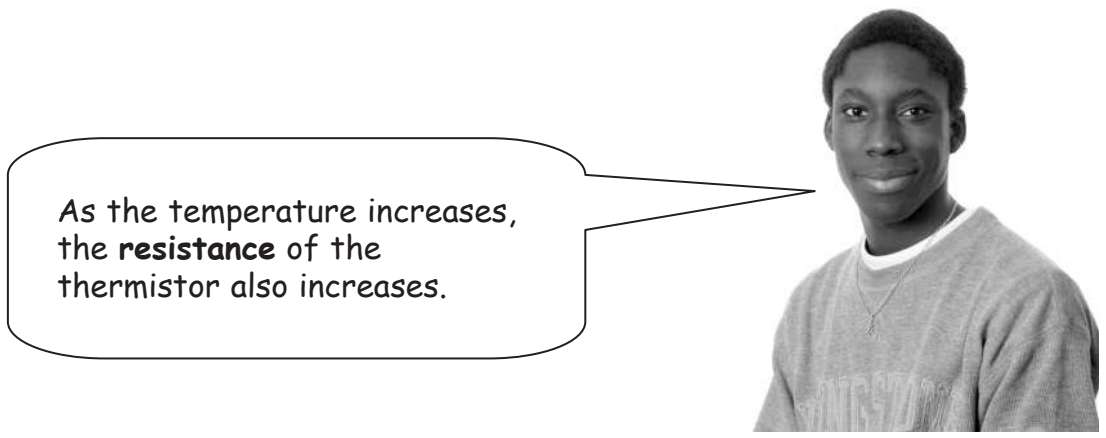
(v) The student concludes:



Evaluate this conclusion.

(2)

(Total for Question 10 = 15 marks)

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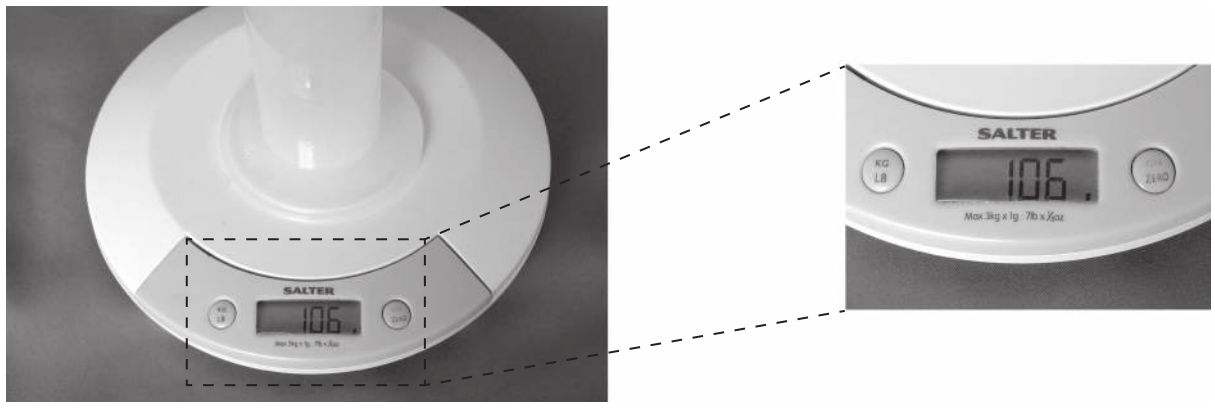
11 A student investigates the density of a liquid.

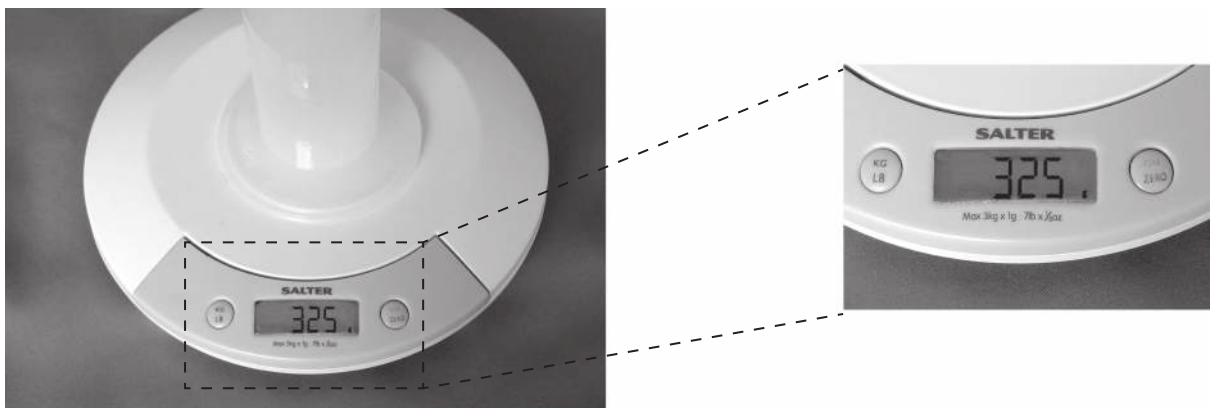
The student uses scales that show mass to the nearest gram.

The student uses a measuring cylinder that is marked with volume in cm^3.

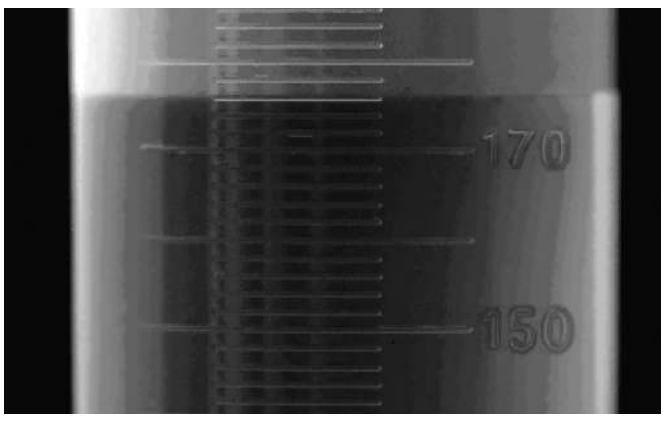
First the student puts an empty measuring cylinder on the scales.



Then the student puts some liquid into the measuring cylinder.



Then the student looks at the level of liquid in the measuring cylinder.



(a) Complete the results table for this investigation by transferring the information given opposite.

(6)

mass of measuring cylinder and liquid	
mass of empty measuring cylinder	
∴ mass of liquid in cylinder	
volume of liquid	

(b) Show how the student should use these results to calculate the density of the liquid.

(2)

(c) Suggest **two** ways in which the student could improve the investigation to give a more accurate value for the density.

(2)

1 .....

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2 .....

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(Total for Question 11 = 10 marks)

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12 The photograph shows two cups of coffee.

The cups are the same size.
One cup is full of coffee, the other cup is half full.

Compare the pressures in the coffee at the bottom of each cup.

(4)

(Total for Question 12 = 4 marks)

13 This question is about the use of radioactivity to treat tumours.

A horse has a tumour near one eye.

The tumour is several centimetres across.

A vet treats the tumour using radiotherapy.

The vet puts an isotope called iridium-192 into the tumour.

Iridium-192 emits beta particles.

(a) Iridium-192 is written using this symbol

$$^{192}_{77}\mathrm{Ir}$$

(i) How many protons does a nucleus of iridium-192 contain?

(1)

(ii) How many neutrons does a nucleus of iridium-192 contain?

(1)

(b) Iridium-191 is a different isotope of iridium.
What are isotopes?

(2)

(c) When iridium-192 decays, a beta particle is emitted and the iridium changes into platinum.

Complete the nuclear equation that shows this decay.

(2)

$$^{192}_{77}\mathrm{Ir} \rightarrow \text{.....} \quad \mathrm{Pt} + \text{.....} \quad ^{0}_{-1}\beta^{-}$$

(d) The tumour in the horse is several centimetres across.
Explain why beta radiation is more suitable than alpha or gamma radiations for this treatment.

(3)

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(e) The energy from the beta radiation is expected to destroy the cells in the tumour over a period of several weeks.

(i) The most suitable half-life for the radioactive source would be

(1)

☒ **A** 75 minutes

☒ **B** 75 hours

☒ **C** 75 days

☒ **D** 75 years

(ii) Explain your choice.

(2)

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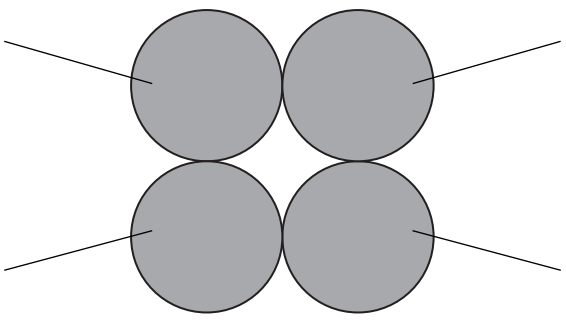
(Total for Question 13 = 12 marks)

14 Two scientists, Geiger and Marsden, used alpha particles in a famous experiment.

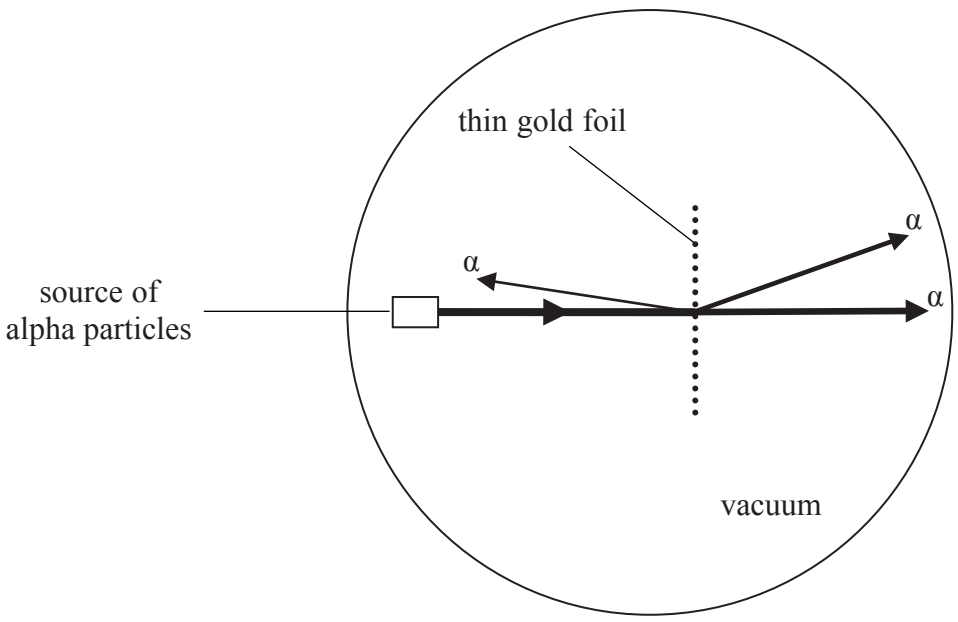
(a) An alpha particle is formed from four smaller particles.
The diagram below represents an alpha particle.
Complete the labels to show the names of the four particles.

(2)



not to scale

(b) The two scientists aimed alpha particles at a thin gold foil. Most of the alpha particles travelled straight through the thin gold foil.
Some of the alpha particles were deflected as shown in the diagram.



(i) The scientists removed all the air from the apparatus.
Give **two** reasons why this was necessary.

(2)

1 .....

.....

2 .....

.....

(ii) Describe the force that caused some alpha particles to deflect.

(2)

(iii) The experiment showed that

- most of the alpha particles went straight through the foil
- some of the alpha particles were deflected through a small angle
- a few of the alpha particles were deflected back towards the source.

Scientists concluded that each gold atom has a small, dense, positively-charged nucleus.

Explain how the results of this experiment led the scientists to this conclusion.

(5)

(Total for Question 14 = 11 marks)

TOTAL FOR PAPER = 120 MARKS

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