Write your name here

Surname	Other names

Pearson Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics

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

Thursday 11 January 2018 – Afternoon
Time: 2 hours

Paper Reference
4PH0/1P
4SC0/1P

You must have:
Ruler, calculator, 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 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.
- 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 5 2 9 8 7 A 0 1 2 8

Pearson

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 The photograph shows solar cells on the roof of a house.

(a) State the energy transfer taking place in the solar cells.

(2)

.....

.....

(b) The solar cells generate a current of 2.3 A.

(i) State the equation linking charge, current and time.

(1)

(ii) Calculate the charge transferred by the solar cells in 15 seconds.

(2)

charge transferred = ... C

(c) The solar cells are wired in parallel.

Suggest why the solar cells are not connected in series.

(1)

.....

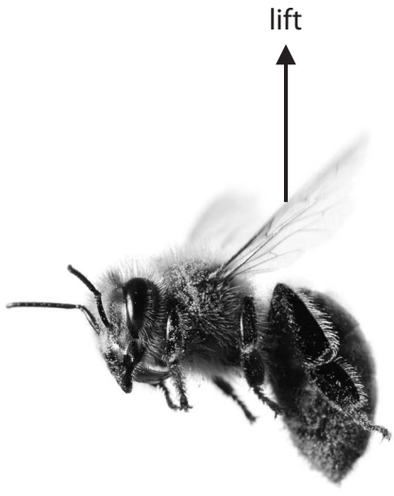
.....

.....

(Total for Question 1 = 6 marks)

2 This question is about a small flying insect called a bee.

(a) The photograph shows a bee accelerating vertically upwards.



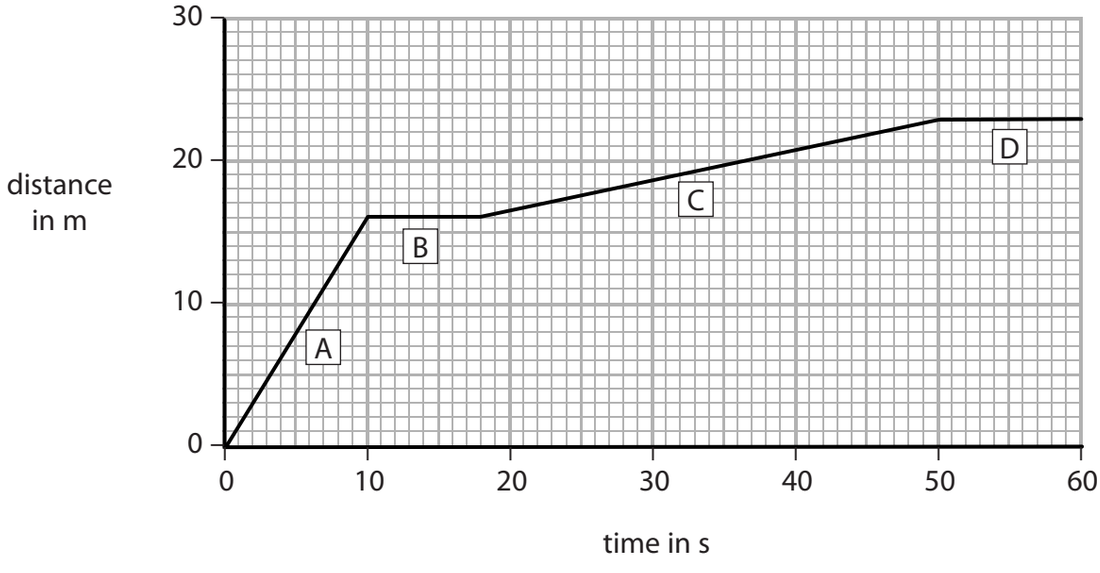
© Friends of the Honey Bee

Complete the diagram by adding another labelled force arrow.

(2)

(b) The graph shows a 60-second journey made by the bee.

During this time, the bee stops at some flowers to feed.



(i) Which stage of the graph shows the bee stopping at a flower for the shortest period of time?

(1)

☒ **A** ☒ **B** ☒ **C** ☒ **D**

(ii) Which stage of the graph shows the bee moving at the fastest speed?

(1)

☒ **A** ☒ **B** ☒ **C** ☒ **D**

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

(1)

(iv) Calculate the average speed of the bee during the first 35 seconds of its journey.

(2)

average speed = ... m/s

(c) Ultraviolet waves are used by bees to identify markings on flowers.

(i) State another use of ultraviolet waves.

(1)

.....

.....

(ii) State a similarity and a difference between ultraviolet waves and visible light waves.

(2)

similarity.....

.....

difference.....

.....

(Total for Question 2 = 10 marks)

3 The driver of a car sees an obstacle in the road and stops the car as quickly as possible.

The car stops without hitting the obstacle.

State three factors that could have affected the stopping distance of the car.

(3)

1 .....

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2 .....

.....

3 .....

.....

(Total for Question 3 = 3 marks)

4 A student needs to find the mass of a large steel bolt but does not have access to a balance.

The student knows the density of steel.

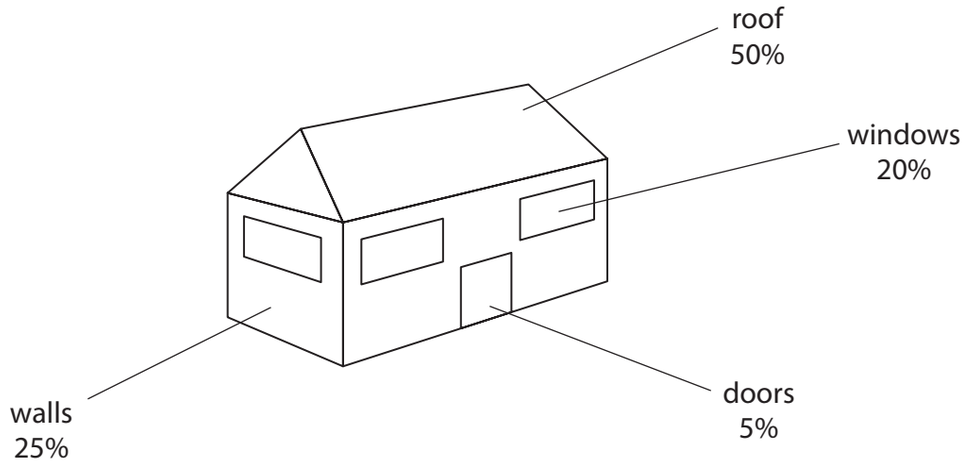
Describe how he can accurately find the mass of the bolt using its density.

You may draw a diagram to help your answer.

(5)

(Total for Question 4 = 5 marks)

5 The diagram shows the percentages of thermal energy lost from a house.



(a) The house loses a total amount of 1.2×10^7 J of thermal energy each day.

Calculate the amount of thermal energy lost through the walls in one week.

(3)

thermal energy lost through walls = ... J

(b) State how to reduce the amount of thermal energy lost through the windows.

(1)

.....

.....

(c) The roof could be insulated with fibreglass wool, which contains lots of trapped air.

Explain how this insulation reduces the amount of thermal energy lost from the roof.

(4)

(d) The house is heated with a gas boiler that is 75% efficient.

Chemical energy in the gas is transferred to thermal energy by burning.

Some of the thermal energy is useful.

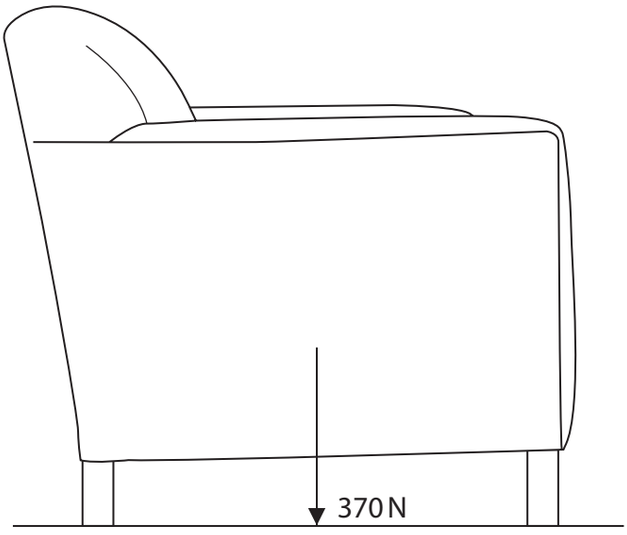
Some of the thermal energy is wasted.

Draw a Sankey diagram for this energy transfer.

(3)

(Total for Question 5 = 11 marks)

6 The diagram shows a chair with a weight of 370 N.



(a) Draw an X on the diagram to show the centre of gravity of the chair.

(1)

(b) The chair has four legs.

Each leg has an area of 5.2 cm^2 in contact with the floor.

(i) State the equation relating pressure, force and area.

(1)

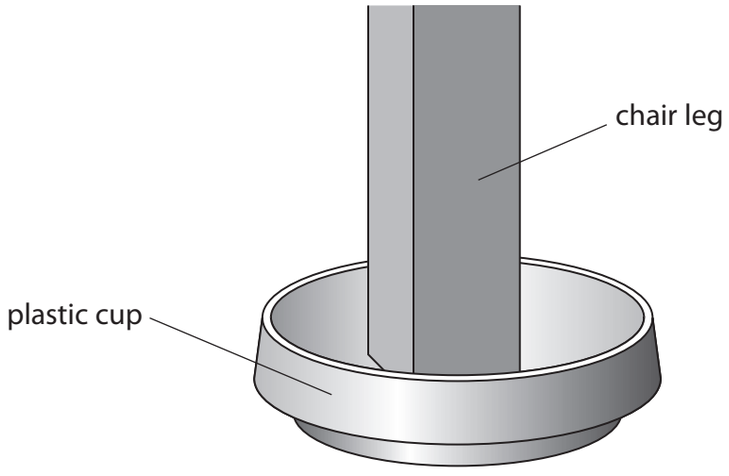
(ii) Calculate the pressure exerted on the floor by each leg.

Give a suitable unit.

(4)

pressure = ... unit .....

(c) A manufacturer supplies plastic cups that are placed under the legs of the chair.



The manufacturer claims that using the cups will reduce the risk of damage to the floor.

Evaluate the manufacturer's claim.

(3)

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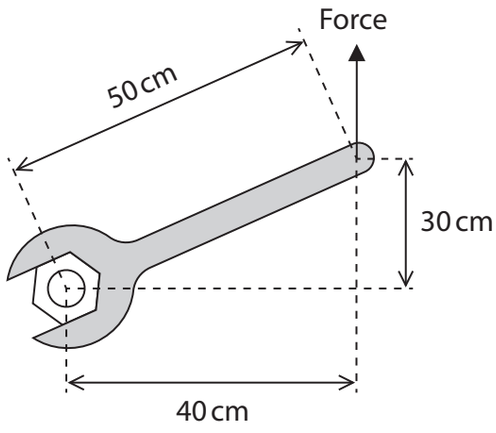
(Total for Question 6 = 9 marks)

7 (a) The diagram shows how a mechanic applies a force on a spanner to try to undo a bolt.



not to scale

(i) State the equation linking moment, force and perpendicular distance from the pivot.

(1)

(ii) Calculate the force required to produce a moment of 4.8 N m.

(4)

force = ... N

(b) The mechanic is not able to undo the bolt because a moment of 9.6 N m is needed.

Explain how the mechanic could produce a moment of 9.6 N m.

(2)

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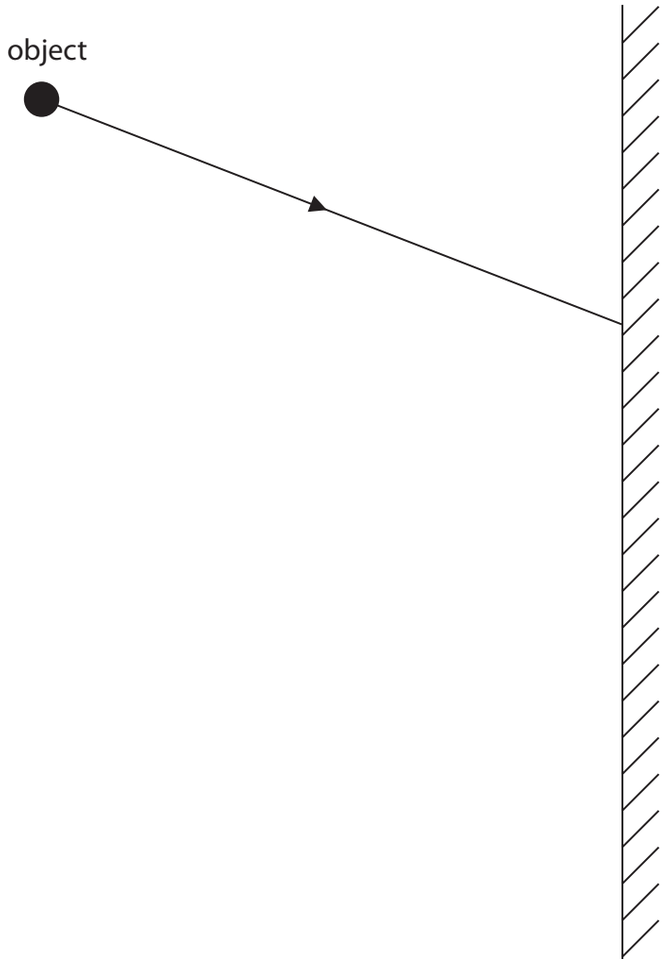
(Total for Question 7 = 7 marks)

8 The diagram shows a ray of light incident on a plane mirror.



(a) Complete the diagram to show how an image of the object is formed in the plane mirror.

(4)

(b) State the name of the type of image formed.

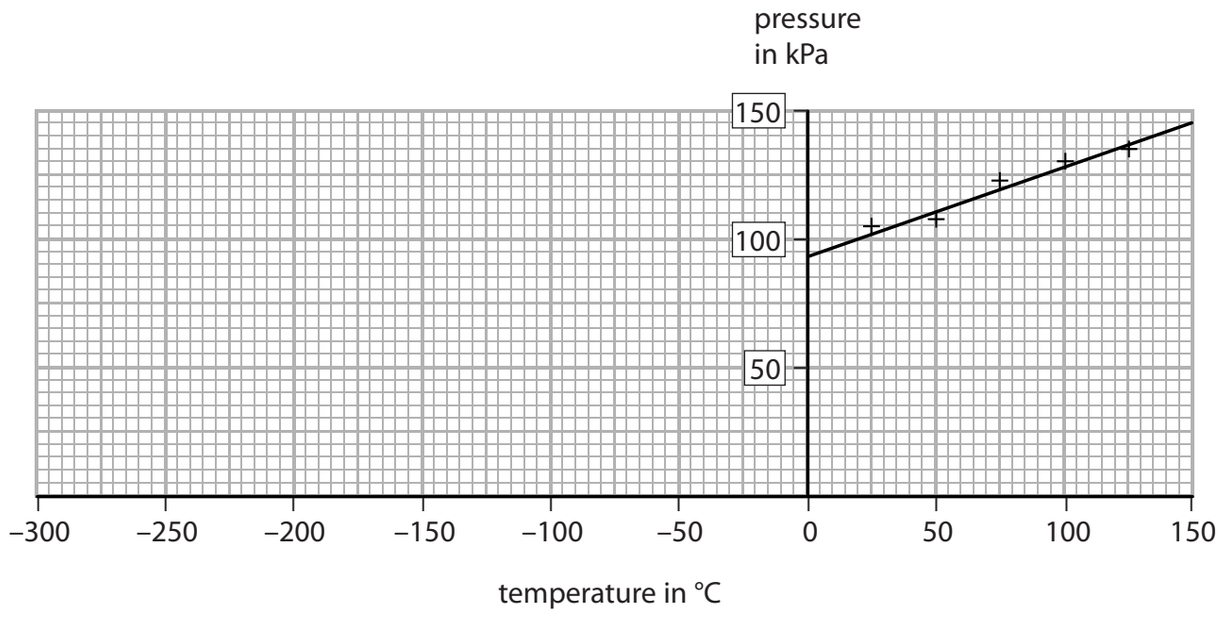
(1)

.....

(Total for Question 8 = 5 marks)

9 (a) A student investigates how the pressure of a fixed volume of gas changes with temperature.

The graph shows her results.



(i) Extend the line of best fit to find the temperature of the gas when the pressure is zero kPa.

(2)

temperature = ... °C

(ii) State what happens to the average speed of the gas molecules when the temperature of the gas is increased.

(1)

.....

.....

(b) The student then investigates how the pressure of a gas changes with volume.

(i) State two variables that she should control in this investigation.

(2)

1 .....

2 .....

(ii) Describe the relationship between the pressure of a gas and its volume.

You may sketch a graph to help your answer.

(3)

(Total for Question 9 = 8 marks)

10 (a) Describe two differences between the orbits of comets and moons.

(2)

1 .....

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2 .....

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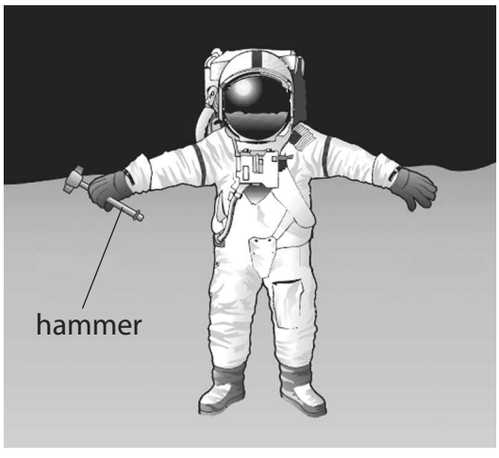
(b) An astronaut drops a hammer on the Moon.



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

(1)

(ii) The gravitational field strength (*g*) on the Moon is 1.6 N/kg.

The mass of the hammer is 750 grams. The hammer loses 2.2 J of gravitational potential energy when it falls.

Show that the hammer falls through a height of about 2 m.

(3)

(iii) The astronaut then lifts the hammer back to its original height.

State the amount of work done in lifting the hammer.

(1)

work done = ... J

(iv) Explain why the astronaut would have to do more work to lift the same hammer through the same height on Earth.

(3)

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(c) Another astronaut is stationed in the International Space Station (ISS).

The ISS orbits the Earth with an orbital radius of 6780 km and an orbital speed of 7.66 km/s.

Calculate the number of orbits the ISS makes in one day.

(4)

number of orbits = ...

(Total for Question 10 = 14 marks)

11 A student investigates the magnetic fields produced by bar magnets.

(a) Describe how the student could investigate the shape and direction of the magnetic field around a single bar magnet.

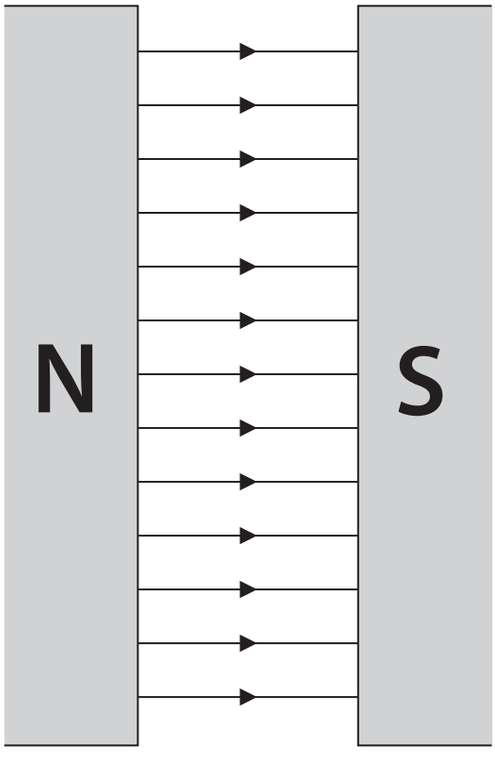
You may draw a diagram to help your answer.

(3)

(b) The student puts opposite poles of two strong bar magnets near each other.

The diagram shows part of the magnetic field produced.

Only a small part of each magnet is shown.



Explain why the diagram shows that the magnetic field is uniform.

(2)

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.....

(c) The student connects the ends of a piece of wire to a sensitive ammeter.

He then moves the piece of wire through the magnetic field between the magnets.

(i) Explain why the ammeter displays a small current when the wire is moved between the magnets.

(2)

.....

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.....

.....

(ii) State two ways that the student could increase the current using the same wire.

(2)

1 .....

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2 .....

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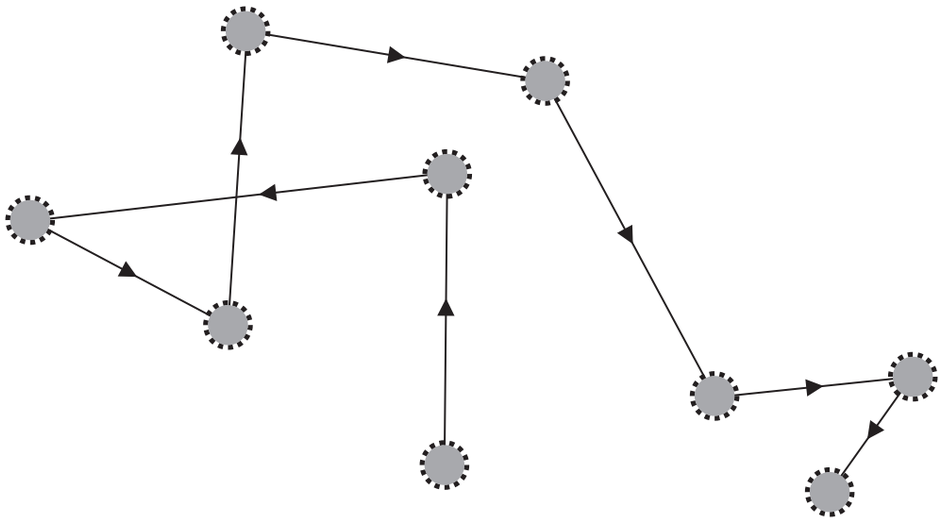
(Total for Question 11 = 9 marks)

12 The diagram shows the path of a pollen grain moving on the surface of water.



Explain why the motion of the pollen grain shows that water is made of tiny particles.

(3)

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(Total for Question 12 = 3 marks)

13 A teacher investigates the types of radiation emitted by three radioactive sources.
He does this by measuring the amount of radiation (the count) received by a detector.

He uses this method.

- place detector 4 cm from the source
- use the detector to measure the count for one minute
- repeat for all three radioactive sources

The teacher then measures the count for each source again, using paper, aluminium and lead as absorbing materials between the source and the detector.

(a) Name two pieces of equipment that the teacher would need to use in order to measure the count in this investigation.

(2)

1 .....

2 .....

(b) Table 1 shows the results of the teacher's investigation.

	Count with no absorber	Count with paper	Count with aluminium	Count with lead
Source 1	654	652	649	30
Source 2	818	820	29	31
Source 3	6980	2807	32	33

Table 1

(i) Complete Table 2 by ticking (✓) boxes to show which types of radiation are emitted by each source.

(4)

	Alpha	Beta	Gamma
Source 1			
Source 2			
Source 3			

Table 2

(ii) Suggest why there is a count for each source, even when lead is used as an absorbing material.

(1)

.....

.....

(c) Another radioactive source, X, has a half-life of 6 days.

(i) State what is meant by the term **half-life**.

(2)

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.....

(ii) The initial count for source X is 780 counts per minute.

Estimate how many days it will take for the counts per minute for source X to fall below 100.

(3)

.....days

(Total for Question 13 = 12 marks)

14 A thermistor is a device used in electric circuits.

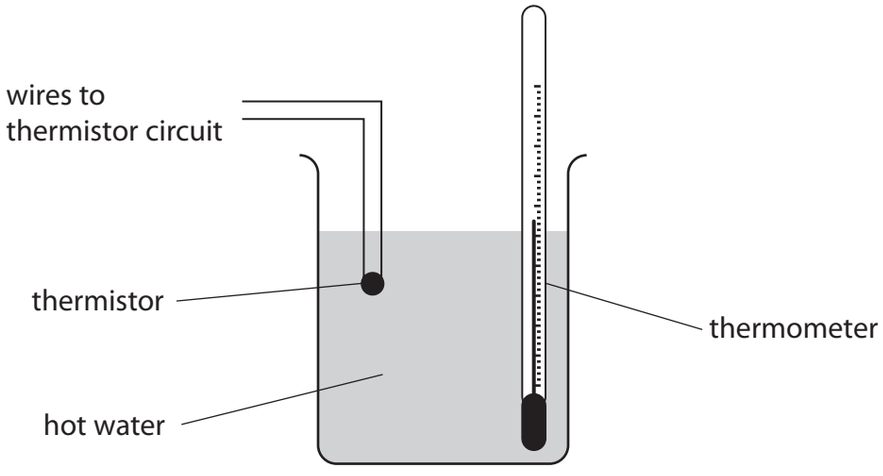
(a) Which is the correct circuit symbol for a thermistor?

(1)

☒ **A** ☒ **B** ☒ **C** ☒ **D**

(b) A student uses a thermistor as a device for measuring temperature.

The student uses this apparatus to record how the resistance of the thermistor changes with temperature.



He records the resistance of the thermistor every 5 °C as the water cools.

The table shows some of his results.

Temperature in °C	Resistance in Ω
60	150
55	200
50	280
30	690
25	840
20	1060

(i) State the independent and dependent variables in his investigation.

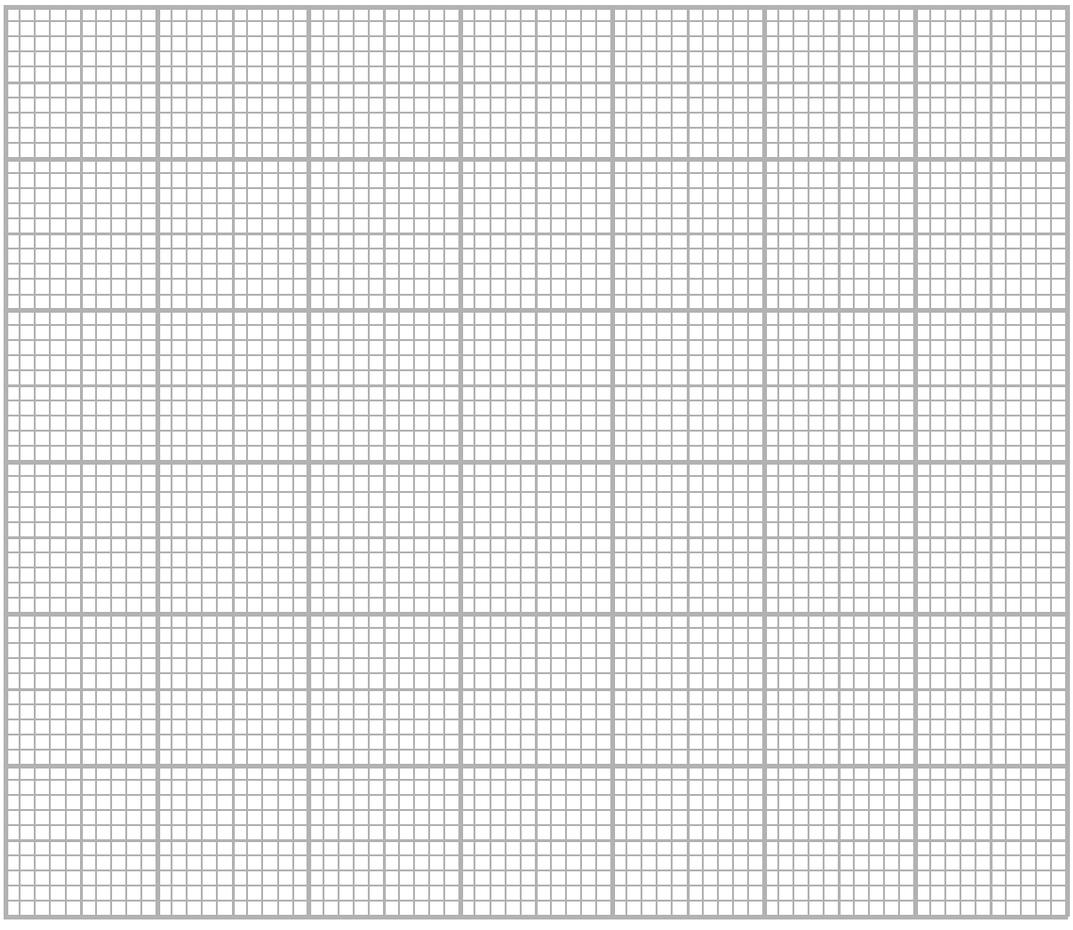
(2)

independent variable .....

dependent variable .....

(ii) Plot a graph of the student's results on the grid.

(4)



(iii) Draw a curve of best fit.

(1)

(iv) Use your graph to estimate the resistance of the thermistor when the temperature is 40 °C.

(1)

resistance = ... Ω

(v) Suggest three improvements for his investigation.

(3)

1 .....

.....

2 .....

.....

3 .....

.....

(c) The thermistor is taken out of the water and connected in a series circuit with a 6.10 V cell.

The resistance of the thermistor is 1060 Ω.

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

(1)

(ii) Calculate the current in the circuit.

(2)

current = ... A

(iii) Explain what will happen to the current in the circuit when the temperature of the thermistor increases.

(3)

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(Total for Question 14 = 18 marks)

TOTAL FOR PAPER = 120 MARKS

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