AQA

Please write clearly in block capitals.

Centre number | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE

COMBINED SCIENCE: TRILOGY

H

Higher Tier

Physics Paper 1H

Time allowed: 1 hour 15 minutes

Materials

For this paper, you must have:

- A scientific calculator
- A ruler
- A protractor
- An equations sheet

Instructions

- Use black ink or a black- ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you got your answer.

Information

- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.

Advice

- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

0 1 Alpha, beta and gamma are all types of ionising radiation.

0 1.1 Draw **one** line from each type of radiation to what the radiation is made of.

[3 marks]

Alpha	Electromagnetic radiation
Beta	Fast-moving electron
Gamma	Two neutrons and two electrons
	Two neutrons and two protons
	Neutron from the nucleus

0 1.2 What type of radiation is the least ionising?

Tick **one** box.

[1 mark]

- Alpha ☐
- Beta ☐
- Gamma ☐

Question continues on next page

4

0 1.3 A scientist demonstrates the penetration of alpha, beta and gamma radiation through various materials.

This demonstration is shown in Figure 1.

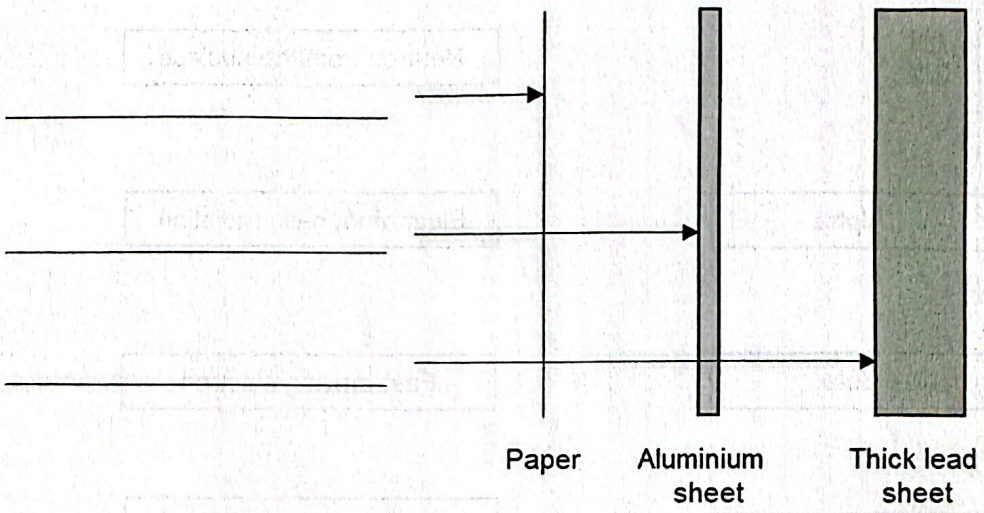


Figure 1

Complete Figure 1 by writing the name of the correct radiation on the missing labels.

[2 marks]

0 1.4 Give **one** safety precaution the scientist should have taken in the demonstration.

[1 mark]

_____

_____

0 1.5 Figure 2 shows how the count rate of a radioactive source changes over time.

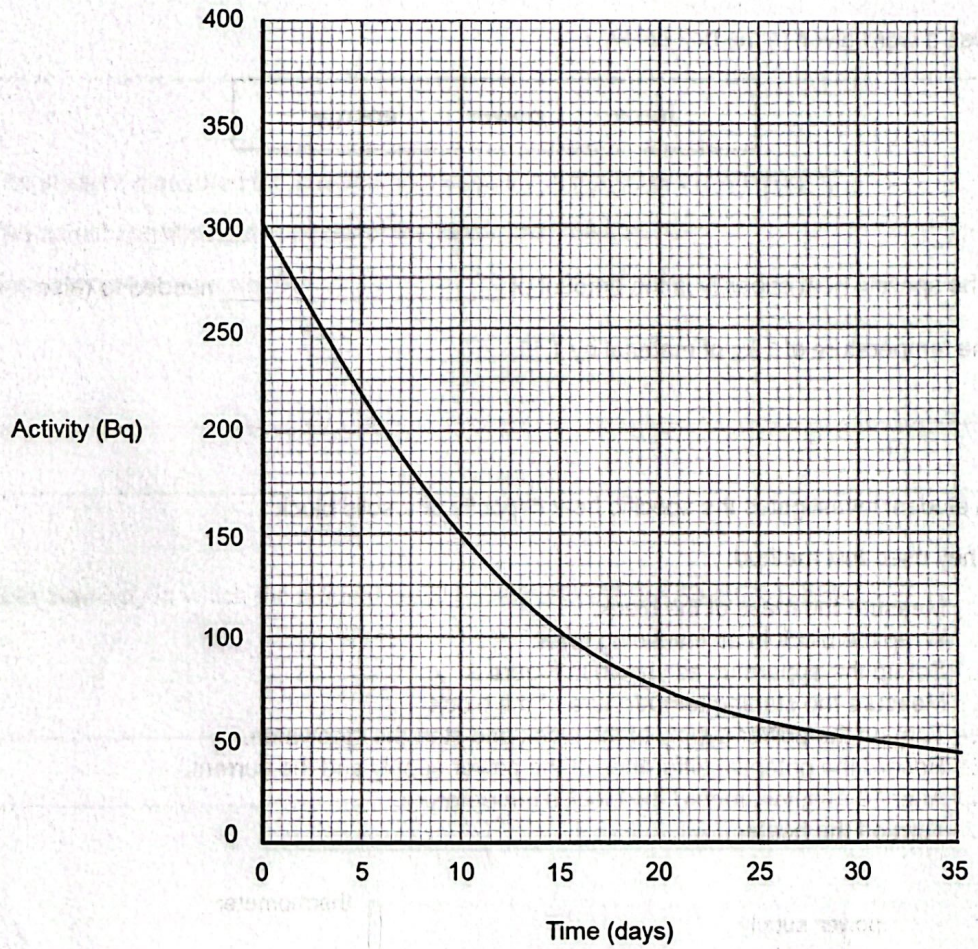


Figure 2

Use Figure 2 to find the half-life of this source.

Show clearly how you used Figure 2 to obtain your answer.

[2 marks]

Half-life = _____ days

Turn over for next question

2

0 2 This question is about specific heat capacity.

0 2.1 Complete the sentence.

Use a word given in the box below.

force	power	energy

[1 mark]

The specific heat capacity is the amount of _____ needed to raise the temperature of 1 kg of material by 1 °C.

A student investigates the specific heat capacity of a solid block.

They used this method:

1. Measure the mass of the block.
2. Wrap the block in an insulating layer.
3. Set up the apparatus as shown in Figure 3.
4. Measure the starting temperature of the block.
5. Turn on the power supply of the block and start the stopwatch.
6. Record the potential difference of the power supply and the current.
7. After 10 minutes, record the block's temperature.
8. Turn off the heater.

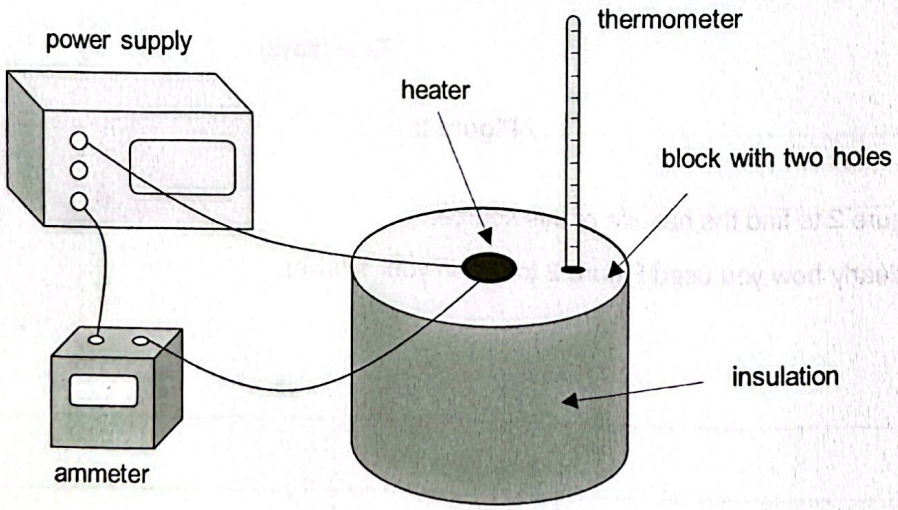


Figure 3

0 2.2 Suggest something the student may have used as an insulating layer for the block.

[1 mark]

_____

0 2.3 The student measured the specific heat capacity of the block as 920 J/kg °C

The actual specific heat capacity of the block was 700 J/kg °C

Suggest **one** reason why.

[1 mark]

_____

_____

0 2.4 Give **one** way in which the student could have made the results more reliable.

[1 mark]

_____

_____

Question continues on next page

3

0 2.5 Another student repeats the experiment with a different material block.

The student heats a 2.5 kg block of material using a 12 V power supply.

The starting temperature of the block is 25°C.

The current through the heater is recorded as 10 A.

After 100 seconds, the final temperature of the block is 31°C.

Calculate the specific heat capacity of the block.

Use the equation:

change in thermal energy = mass × specific heat capacity × temperature change

[5 marks]

Specific heat capacity = _____ J/kg °C

5

0 3 Figure 4 shows the nuclear model of the atom.

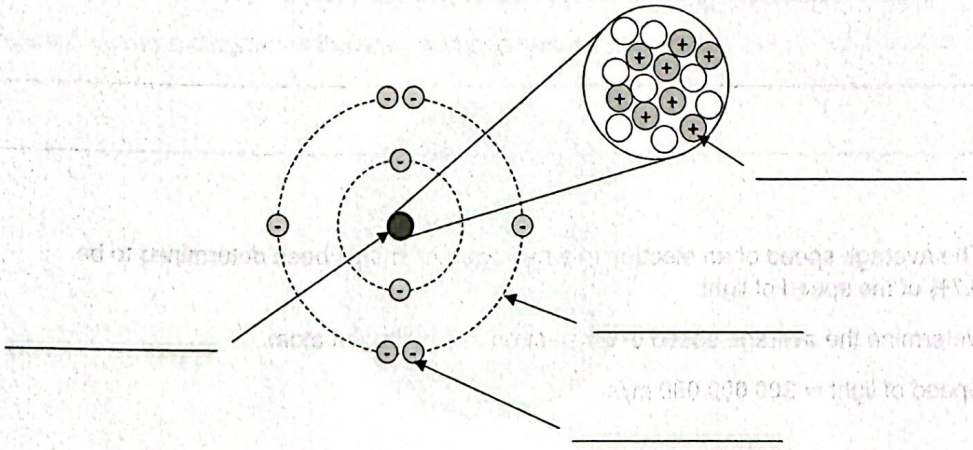


Figure 4

0 3.1 Complete the labels on Figure 4.

Use the words from the box below.

electron	**atom**	**neutron**	**nucleus**
ion	**proton**	**orbit**	**isotope**

[4 marks]

0 3.2 What is the approximate radius of an atom?

Tick **one** box.

[1 mark]

- 1×10^{-5} m ☐
- 1×10^{-10} m ☐
- 10000 m ☐
- 1×10^{-4} m ☐

Question continues on next page

5

0 3.3 Explain why atoms have no overall charge.

[1 mark]

0 3.4 The average speed of an electron in a hydrogen atom has been determined to be 0.7% of the speed of light.

Determine the average speed of an electron in a hydrogen atom.

Speed of light = 300 000 000 m/s

[2 marks]

Speed = _____ m/s

3

0 3.5 Models of the atom have changed over time.

In the early 20th century the plum pudding model was replaced by the nuclear model.

Figure 5 shows a diagram of the plum pudding model of the atom.

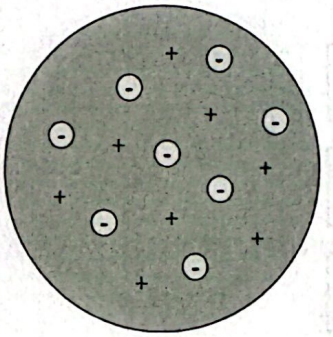


Figure 5

Explain how the alpha particle scattering experiment led to the nuclear model of the atom replacing the plum pudding model of the atom.

Include a description of the plum pudding model in your answer.

Use Figure 5 to help.

[6 marks]

Turn over for next question

0 4 This question is about changes of state and the particle model.

0 4.1 What is the name of the change of state when a solid turns into a gas?

Tick **one** box.

[1 mark]

- Condensation ☐
- Freezing ☐
- Melting ☐
- Sublimation ☐

0 4.2 Which statement is true about the forces of attraction between particles in a gas?

Tick **one** box.

[1 mark]

- There are no forces of attraction between the particles ☐
- There are almost no forces of attraction between the particles ☐
- There are strong forces of attraction between the particles ☐

2

0 4.3 Table 1 shows the conditions of a gas in a container at two different stages, A and B.

Stage	Volume (m^3)	Temperature (°C)
A	5	200
B	5	300

Table 1

Calculate the percentage change in temperature from stage A to stage B.

[3 marks]

Percentage change = _____ %

0 4.4 Explain how the pressure of the gas would change from stage A to stage B.

[4 marks]

Turn over for next question

7

0 5 A man holds a ball over a cliff edge.

The man drops the ball.

0 5.1 Describe the energy transfers that take place when the ball is dropped.

[2 marks]

0 5.2 The ball is dropped from a height of 25 m.

The ball weighs 300 g.

Calculate the speed of the ball as it hits the ground.

Give your answer to three significant figures.

State any equations that you use.

Use $g = 9.8$ N/kg.

[6 marks]

Speed = _____ m/s^2

8

0 5.3 Explain why your answer to **0 5.2** relies on the assumption of no air resistance.

[2 marks]

Turn over for next question

0 6 A student investigates the I-V characteristics of different circuit components.

They use the following method:

1. Set up a test circuit.
2. Vary the variable resistor.
3. Take several pairs of readings from an ammeter and a voltmeter.
4. Plot a graph of current against voltage for the component.
5. Repeat for different components.

The student records their results for one of the components in Table 2.

Potential difference (V)	Current (A)
0	0
1.00	0.21
2.00	0.40
3.00	0.59
4.00	0.80
5.00	1.02
6.00	1.38
7.00	1.40
8.00	1.61

Table 2

0 6.1 Calculate the resistance across the component when the voltage was 2.0 V.

Give the units.

[3 marks]

Resistance = _____ Units _____

3

0 6.2 Plot the data from Table 2 on Figure 6.

You should:

- Write a suitable scale on the y-axis
- Plot the data points
- Draw a line of best fit, ignoring the anomalous result.

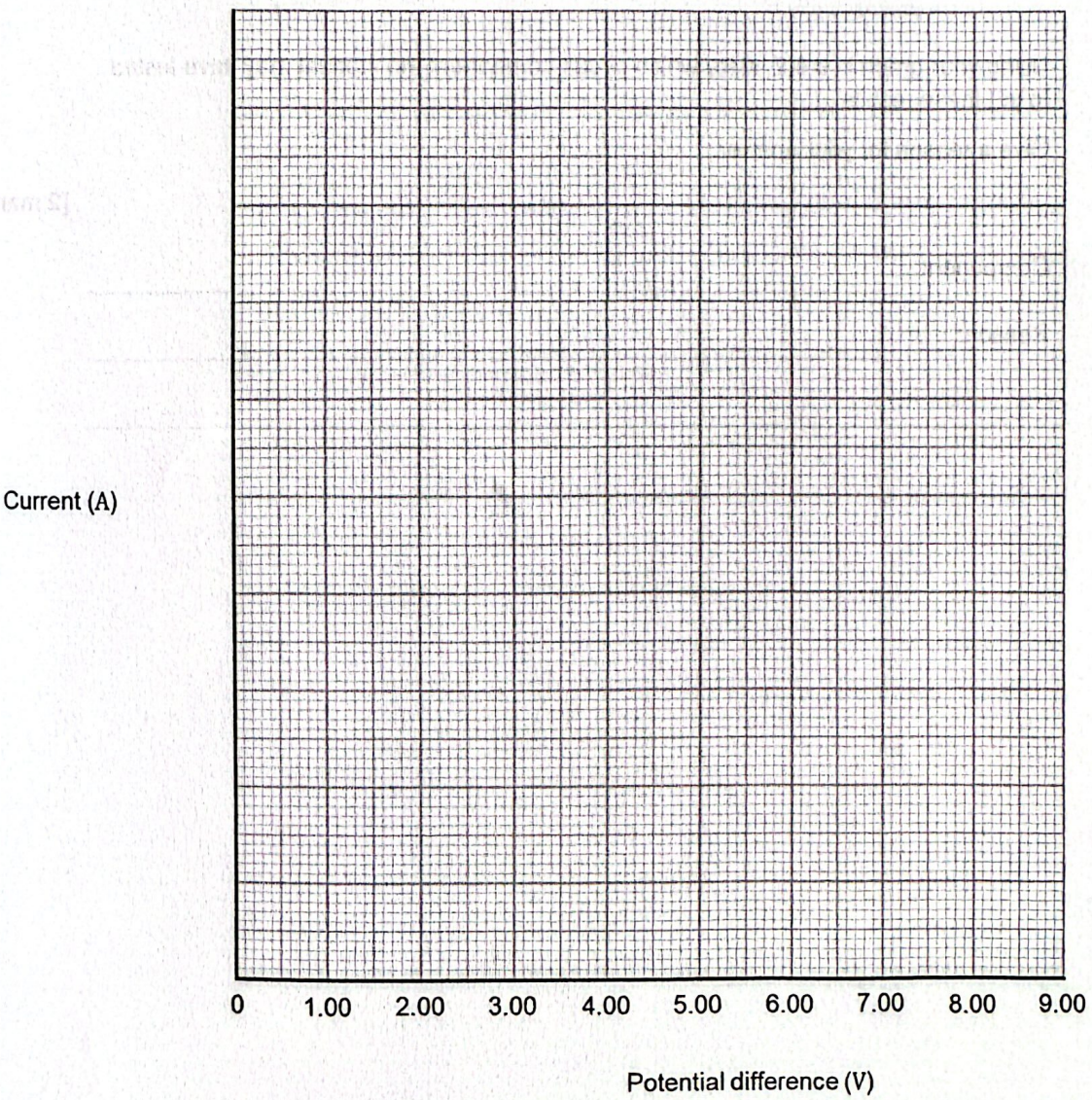


Figure 6

[4 marks]

Question continues on next page

4

0 6.3 Suggest **one** cause of the anomalous result.

[1 mark]

_____

_____

0 6.4 Using your graph in **0 6.2**, state which circuit component the student may have tested to get these results.

Give a reason for your answer.

[2 marks]

Component: _____

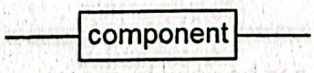
Reason: _____

_____

0 6.5 Draw a diagram of a suitable test circuit the student may have used for this experiment in the space provided below.

The diagram has been started for you.

[3 marks]



Question continues on next page

3

0 6.6 A different student investigates sensing circuits.

They build the circuit shown in Figure 7.

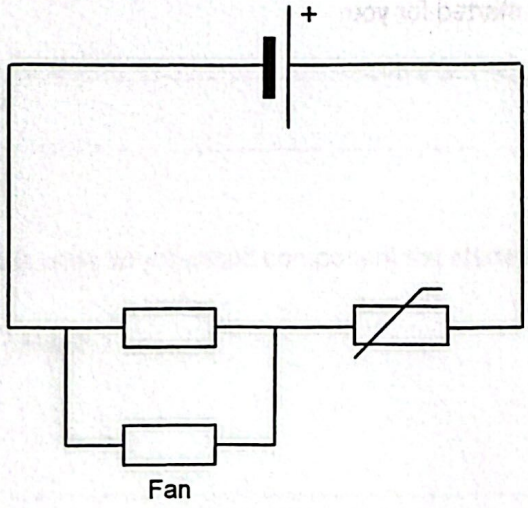


Figure 7

Explain how the circuit in Figure 7 can be used to operate a fan in a room, depending on the temperature of the room.

Include the changes in resistance and potential difference across each component in your answer.

[6 marks]

End of Questions

6

END