AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier
Physics Paper 1H

Time allowed: 1 hour 15 minutes

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

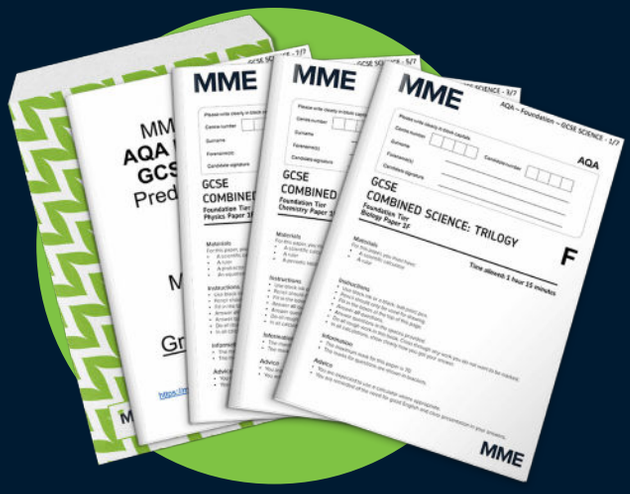
Materials

For this paper you must have:
- a ruler
- a scientific calculator
- the Physics Equations Sheet (enclosed).

Instructions
- Use black ink or black ball-point pen.
- Pencil should be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- 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 work out your answer.

Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

MME. Revision Products - GCSE Science



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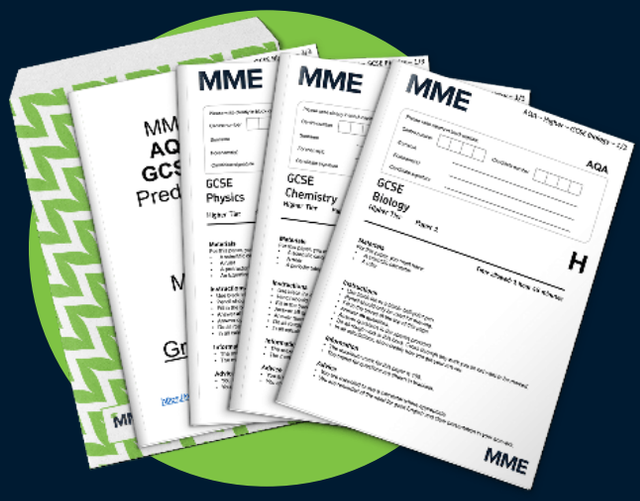

AQA GCSE Triple Science
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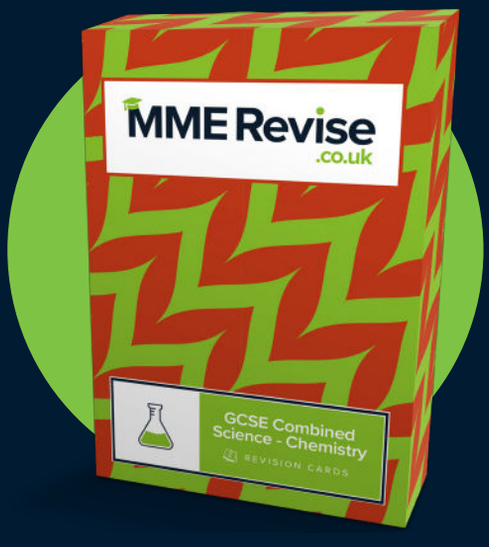

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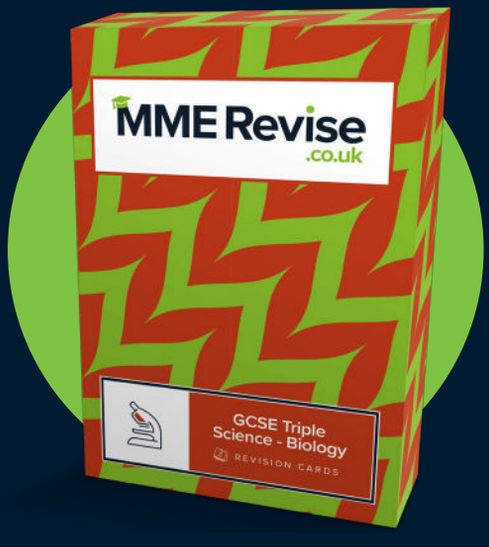

GCSE Triple Science
Revision Cards

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mmerevise.co.uk

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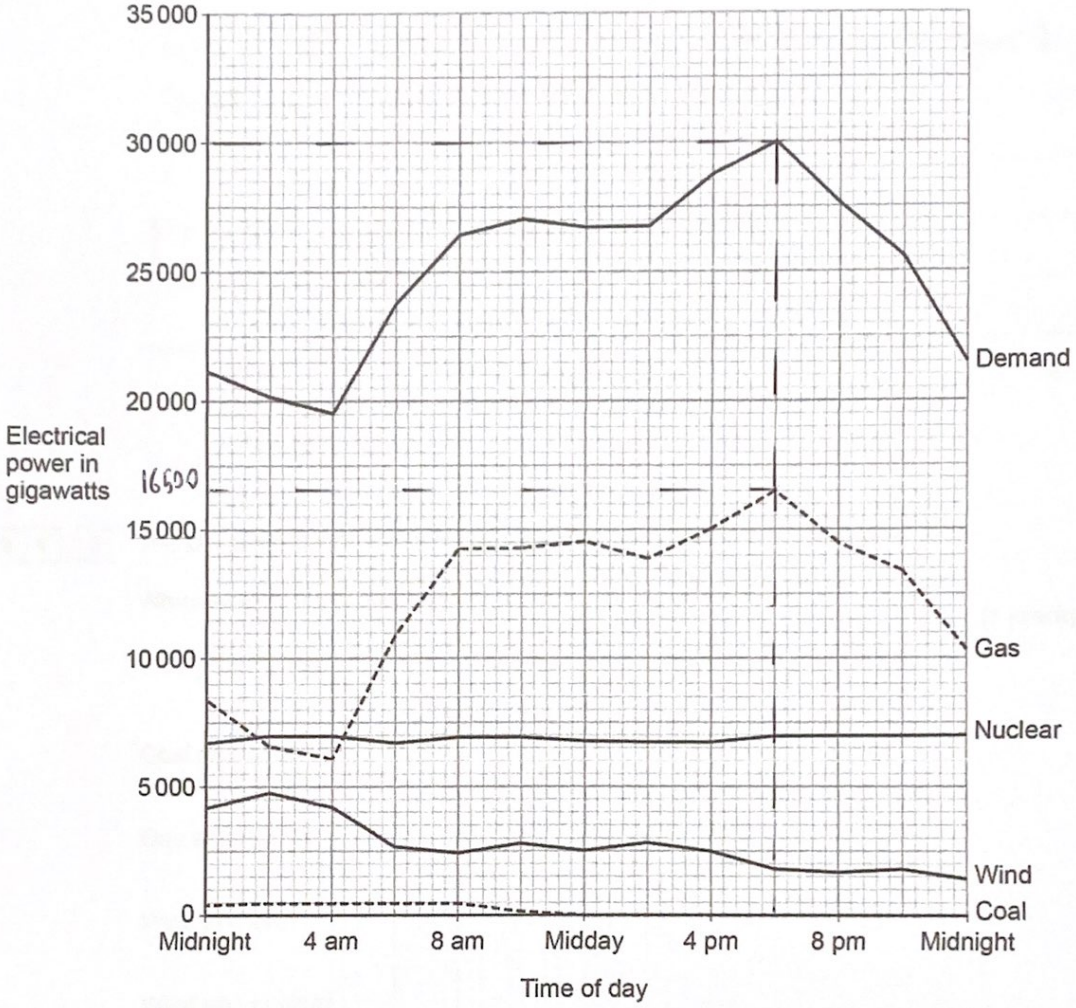
0 1 **Figure 1** shows some of the energy resources used to meet the demand for electrical power in the UK on one day in 2020.

Figure 1



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0 1 . 1 The maximum demand for electrical power on that day was at 6 pm.

Determine the percentage of the maximum demand for electrical power that was generated using gas.

[3 marks]

Gas at 6pm : 16500 (MW) - read off figure 2
Demand at 6pm : 30000 GW

percentage = $\frac{16500}{30000} \times 100 = 55\ \%$

Percentage = 55 %

0 1 . 2 The UK government wants to reduce carbon emissions as much as possible.

Which energy resources need to be used less to achieve this?

[1 mark]

Tick (✓) **one** box.

- [x] Coal and gas
- [ ] Gas and nuclear
- [ ] Wind and coal
- [ ] Wind and nuclear

Question 1 continues on the next page

Do not write outside the box

A network of transformers and transmission cables transfers electrical power from power stations to consumers.

0 1 . 3 What is this network called?

[1 mark]

The national grid

0 1 . 4 Explain how using step-up transformers makes the network efficient.

[3 marks]

The step-up transformers increase the potential difference, meaning the current is reduced. This means there is less energy loss to the surroundings.

8

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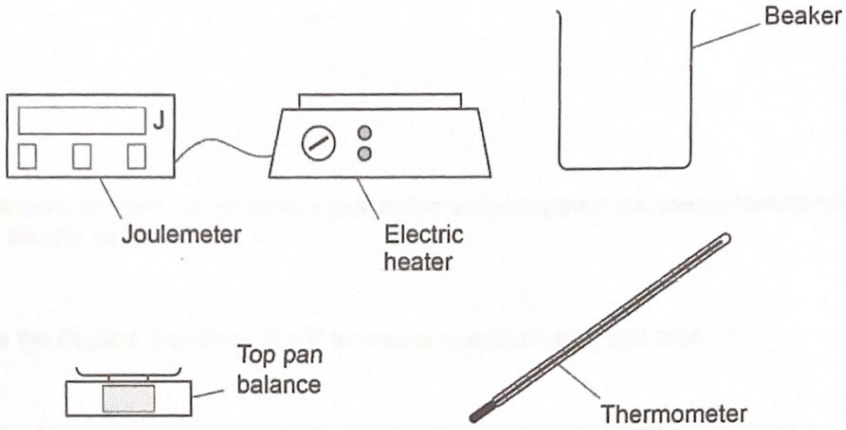
0 2 A student made measurements to determine the specific heat capacity of vegetable oil.

Figure 2 shows the equipment used.

Figure 2



0 2 . 1 Describe how the student could use the equipment shown in **Figure 2** to determine the specific heat capacity of vegetable oil.

[6 marks]

place veg oil into the beaker. Measure the mass of the veg oil using the balance and subtract the mass of the beaker. use the thermometer to measure the starting temperature of the veg oil. place the beake on the heater, so the oil heats up. After 5 minutes, record the final temperature of the oil, using a thermometer. we can also measure the energy transferred using the joulemeter connected to the heater. Subtract the first oil temperature from the start to get the temperature difference. Use $E = mc\Delta\theta$ to find c, where $\Delta\theta$ is the temperature difference and E is the energy transferred.

Do not write outside the box

0 2 . 2 Give **one** risk when using the equipment in **Figure 2**.

[1 mark]

Burns from the hot oil.

A different student did not have a joulemeter and calculated the energy transferred by the electric heater.

Use the Physics Equations Sheet to answer questions **02.3** and **02.4**.

0 2 . 3 Write down the equation linking energy transferred (E), power (P) and time (t).

[1 mark]

$P = \frac{E}{t}$

0 2 . 4 The electric heater had a power output of 50 watts.

Calculate the time taken for the electric element to transfer 4750 joules of energy to the vegetable oil.

[3 marks]

$P = \frac{E}{t}$

$50 = \frac{4750}{t}$

$t = 95$ s

Time taken = 95 s

Question 2 continues on the next page

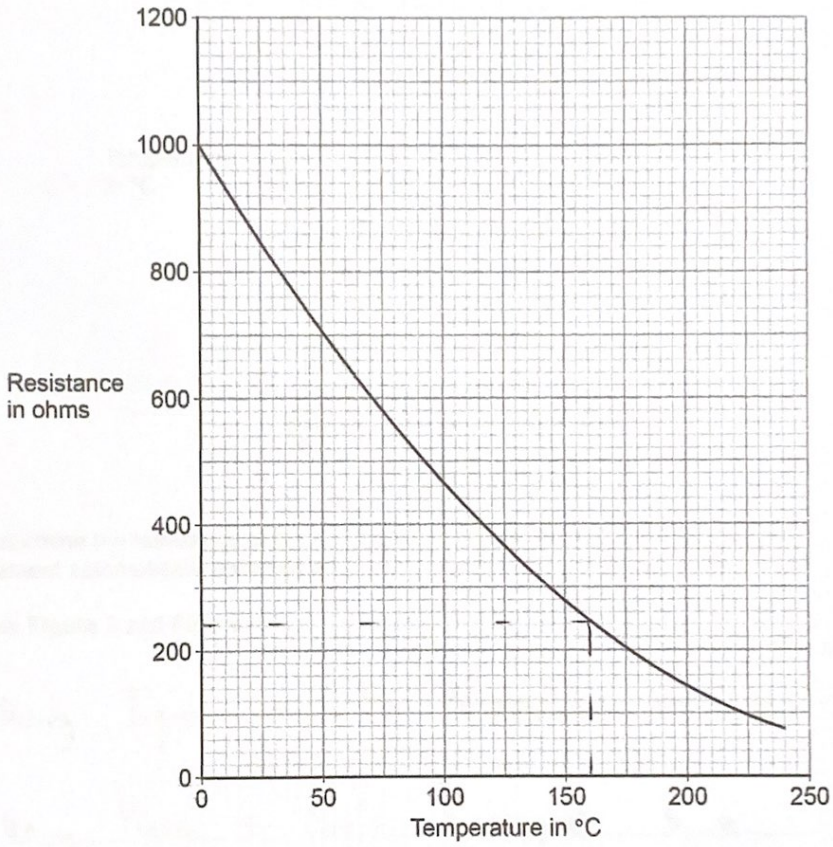
Do not write outside the box

In a deep fryer, vegetable oil is heated by an electric heating element. Food is then cooked in the hot vegetable oil.

The deep fryer contains an electrical component to monitor the temperature of the vegetable oil.

Figure 3 shows how the resistance of this electrical component changes with temperature.

Figure 3



0 2 . 5 What electrical component is used to monitor the temperature of the vegetable oil?

[1 mark]

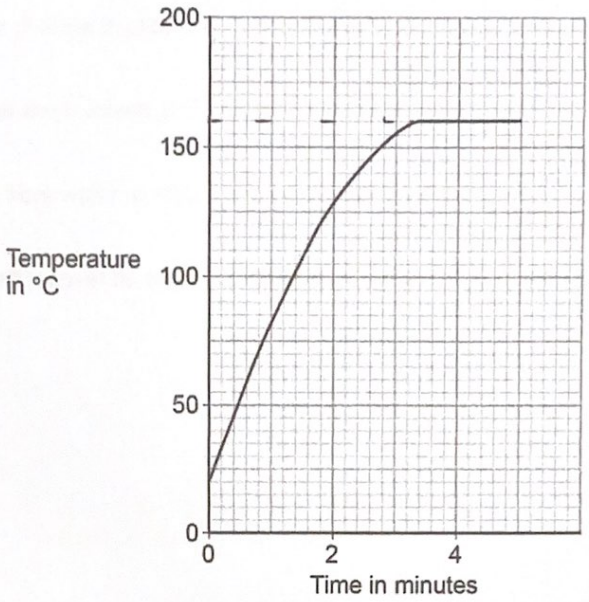
Thermistor

Do not write outside the box

0 2 . 6 The electric heating element in the deep fryer automatically switches off when the vegetable oil reaches a certain temperature.

Figure 4 shows how the temperature of the vegetable oil changed after the deep fryer was switched on.

Figure 4



Determine the resistance of the electrical component when the electric heating element automatically switched off.

Use **Figure 3** and **Figure 4**.

[2 marks]

Using Figure 4, the temperature was 160°C

Using Figure 3, 160°C corresponds to a resistance of 240 Ω

Resistance = 240 Ω

Question 2 continues on the next page

Do not write outside the box

0 2 . 7 Some chips were put in the deep fryer.

In the deep fryer, water in the chips underwent a physical change and became steam.

Why is this a physical change?

[1 mark]

Tick (✓) **one** box.

All water can change to steam. ☐

No chemicals are involved when water changes to steam. ☐

The change from water to steam can be detected visually. ☐

The water will recover its original properties if the steam is cooled ☑

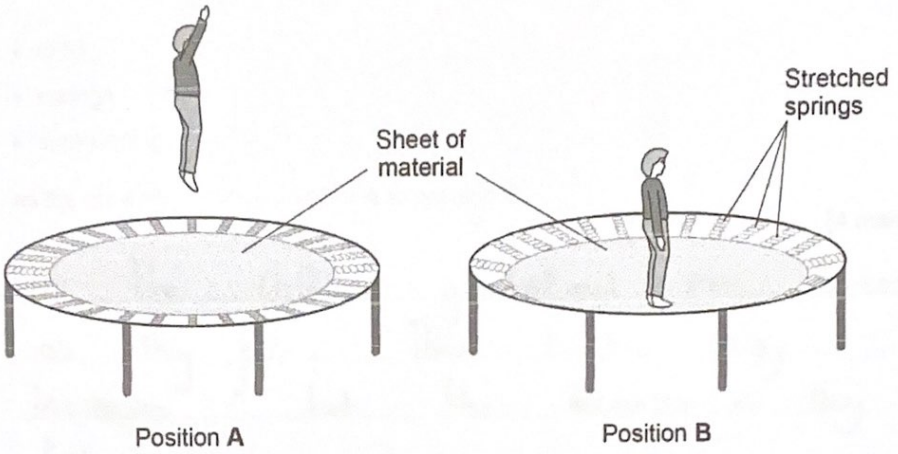
15

Do not write outside the box

0 3 A trampoline is made from a sheet of material held in place by stretched springs.

Figure 5 shows a child on a trampoline.

Figure 5



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0 3 . 1 Position **A** shows the child's maximum height above the trampoline.

Position **B** shows the lowest position reached by the child when landing on the trampoline.

Describe the changes to the stores of energy of the:

- child
- springs
- surroundings

as the child moves from position **A** to position **B**.

[4 marks]

Child The child's gravitational potential energy decreases as they fall. Their kinetic energy increases but then decreases as they land.

Springs The springs elastic potential energy increases as it stretches

Surroundings The thermal energy store ~~of energy~~ in the surroundings increases as the child moves.

Question 3 continues on the next page

Do not write outside the box

0 3 . 2 When the child is at position **A**, each trampoline spring is stretched by 0.056 m

The elastic potential energy of each spring is 4.9 J

When the child is at position **B**, the elastic potential energy of each spring increases to 8.1 J

Calculate the extension of each spring when the child is at position **B**.

Use the Physics Equations Sheet.

[5 marks]

At position A:

$E_e = \frac{1}{2} k e^2$

$4.9 = \frac{1}{2} \times k \times 0.056^2$

$k = 4.9 \div (\frac{1}{2} \times 0.056^2)$

$= 3125$ N/m

At position B:

$E_e = \frac{1}{2} k e^2$

$8.1 = 0.5 \times 3125 \times e^2 \quad e^2 = \frac{8.1}{3125 \times 0.5} \quad e = \sqrt{\frac{8.1}{3125 \times 0.5}}$

Extension = 0.072 m

0 3 . 3 As the child bounces on the trampoline the child does work.

What is the work done by the child equal to?

[1 mark]

Tick (✓) **one** box.

- The average force applied by the child ☐
- The maximum force applied by the child ☐
- The total energy store of the child ☐
- The total energy transferred by the child ☑

10

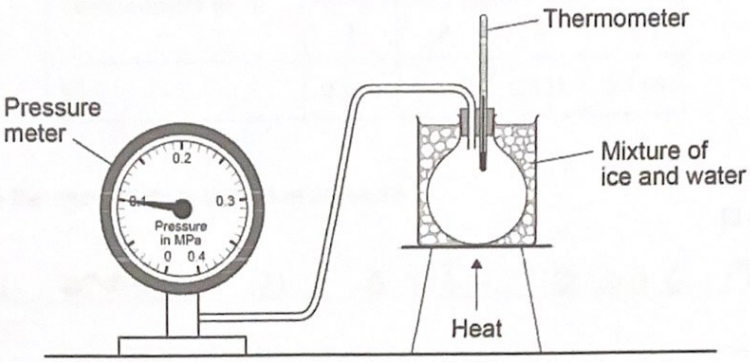
Do not write outside the box

0 4 A student investigated how the pressure of a gas depends on its temperature.

The volume of the gas did **not** change.

Figure 6 shows the equipment used.

Figure 6



0 4 . 1 Pressure is sometimes measured in units called atmospheres.

1 atmosphere is 10^5 pascals (Pa).

What is 1 atmosphere in kilopascals (kPa)?

[1 mark]

$kPa = 10^3\ Pa$

$10^5\ Pa = 10^2\ 10^3\ Pa = 10^2\ kPa$

1 atmosphere = 10^2 kPa

Do not write outside the box

0 4 . 2 The student took four pressure readings for each temperature.

Table 1 shows the pressure readings when the temperature was 50.0 °C

Table 1

Temperature in °C	Pressure in MPa			
	1	2	3	4
50.0	0.115	0.120	0.121	0.116

Calculate the uncertainty in the mean pressure.

[2 marks]

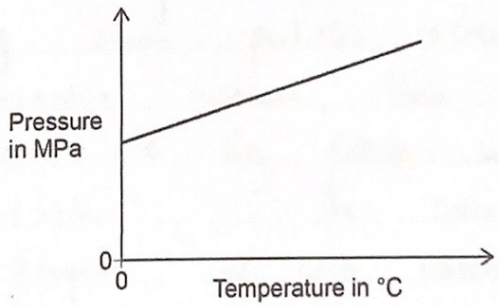
range = 0.121 − 0.115 = 0.006 MPa

uncertainty = $\frac{\text{range}}{2}$ = $\frac{0.006}{2}$ = 0.003

Uncertainty = ± 0.003 MPa

0 4 . 3 **Figure 7** shows a sketch graph of the results.

Figure 7



The student said that as the temperature increases the pressure increases.

Give a better description of the relationship between temperature and pressure.

[1 mark]

The relationship between temperature and pressure is linear

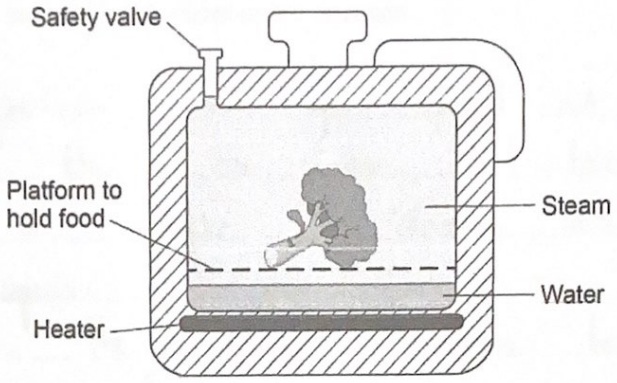
Turn over ▶

Do not write outside the box

A pressure cooker is a sealed pot that uses steam to cook food.

Figure 8 shows a pressure cooker.

Figure 8



0 4 . 4 When the water in the pressure cooker starts to boil:

- the amount of steam in the pressure cooker increases
- the temperature of the steam increases above 100 °C

Explain why these changes make the pressure in the cooker increase.

[5 marks]

As the amount of steam increases, the number of steam particles increases. When the temperature increases, these steam particles move faster and they collide with the wall of the cooker. The collisions become more frequent, and each collision exerts more force.

Do not write outside the box

0 4 . 5 If the pressure inside the pressure cooker becomes greater than 200 kPa then some of the steam is released through the safety valve.

The released steam expands as it moves into the atmosphere.

Explain how a change in density of the steam is caused by a change in the arrangement of particles in the steam as it is released.

[3 marks]

The particles will ~~spee~~ spread out, meaning that the gas now takes up a larger volume. Density is equal to mass / volume, so therefore the density decreases because the volume has increased

12

Turn over for the next question

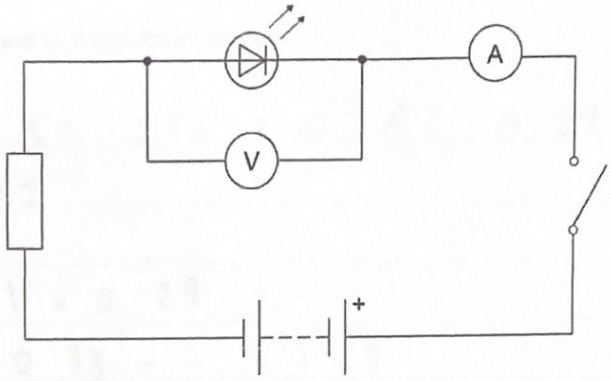
Do not write outside the box

0 5 The camera in a mobile phone uses an LED to provide light when taking a photograph.

A student investigated how the potential difference across an LED varies with the current in it.

Figure 9 shows the circuit used.

Figure 9



0 5 . 1 The student closed the switch. The voltmeter gave a reading of 5.0 V

The ammeter gave a reading of 0 mA

The LED did not emit any light.

Explain how the student should have changed the circuit to make the LED emit light.

[2 marks]

The student should have reversed the connections to the battery, because an LED only allows current through in one direction.

Do not write outside the box

0 5 . 2 The student changed the circuit so that the LED emitted light.

The current in the circuit was 290 mA

The power of the LED was 0.98 W

Calculate the potential difference across the LED.

Use the Physics Equations Sheet.

Give your answer to 2 significant figures.

[5 marks]

290 mA = 290 × 10^{-3} A = 0.29 A

P = V I

$0.98 = V \times 0.29$

$V = \frac{0.98}{0.29} = 3.379...$

V = 3.4 V (to 2 sig figs)

Potential difference (2 significant figures) = 3.4 V

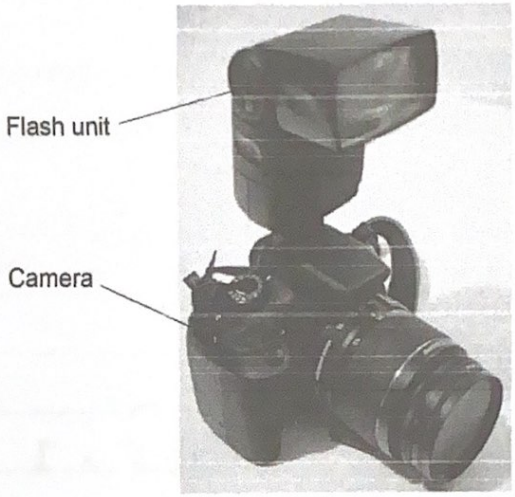
Question 5 continues on the next page

Do not write outside the box

A traditional camera uses a flash unit to provide light.

Figure 10 shows a flash unit on a traditional camera.

Figure 10



0 5 . 3 The flash unit emits light from xenon gas in a fluorescent tube.

What happens when a xenon atom emits light?

[1 mark]

Tick (✓) **one** box.

- Electrons in the atom fall to a lower energy level. ✓
- Electrons in the atom move to a higher energy level.
- Electrons leave the atom, causing ionisation.
- Electrons transfer to the atom from the electrical circuit.

Do not write outside the box

0 5 . 4 When the flash unit is used there is a mean potential difference of 200 V across the fluorescent tube.

The flash of light lasts for 2.8×10^{-4} s

1.4 J of energy is transferred.

Calculate the mean current.

Use the Physics Equations Sheet.

[6 marks]

$E = QV$

$1.4 = Q \times 200$ $\quad Q = \frac{1.4}{200} = 0.0070$ C

$Q = It$ $\quad t$

$0.0070 = I \times 2.8 \times 10^{-4}$

$I = \frac{0.0070}{2.8 \times 10^{-4}} = 25$ A

Mean current = 25 A

14

Turn over for the next question

Do not write outside the box

0 6 A smoke detector contains a source of alpha radiation in a plastic case.

0 6 . 1 A source of beta radiation in a smoke detector would be more hazardous than a source of alpha radiation.

Explain why.

[2 marks]

Beta is more penetrating than alpha radiation, meaning that beta radiation could irradiate people passing near the smoke detector.

0 6 . 2 Actinium (Ac) is one source of alpha radiation.

An actinium (Ac) nucleus emits an alpha particle (α) and turns into a francium (Fr) nucleus.

This can be represented as:

$$^{A}_{Z}Ac \longrightarrow {}^{223}_{87}Fr + \alpha$$

Determine the values of **A** and **Z**.

[2 marks]

alpha is $^{4}_{2}\alpha$

So $^{A}_{Z}Ac \rightarrow {}^{223}_{87}Fr + {}^{4}_{2}\alpha$

A = 227

Z = 89

A = 223 + 4 = 227

Z = 87 + 2 = 89

Do not write outside the box

0 6 . 3 A teacher wanted to find out what nuclear radiation is emitted from a source.

The teacher placed different barriers between the source and a detector.

The teacher recorded the count for 30 seconds after each barrier was put in place.

Table 2 shows the results.

Table 2

Barrier	Thickness in millimetres	Count after 30 seconds
None		985
Paper	0.1	149
Aluminium	5.0	0
Lead	20.0	0

Explain what nuclear radiation was emitted by the source.

[4 marks]

Some radiation is stopped by the paper. As alpha radiation is absorbed by paper, this means the source emits alphas radiation. Some radiation passes thrugh the paper but is stopped by alminain. Beta is stopped by aluminain, therfore the source emits beta radiation.

Question 6 continues on the next page

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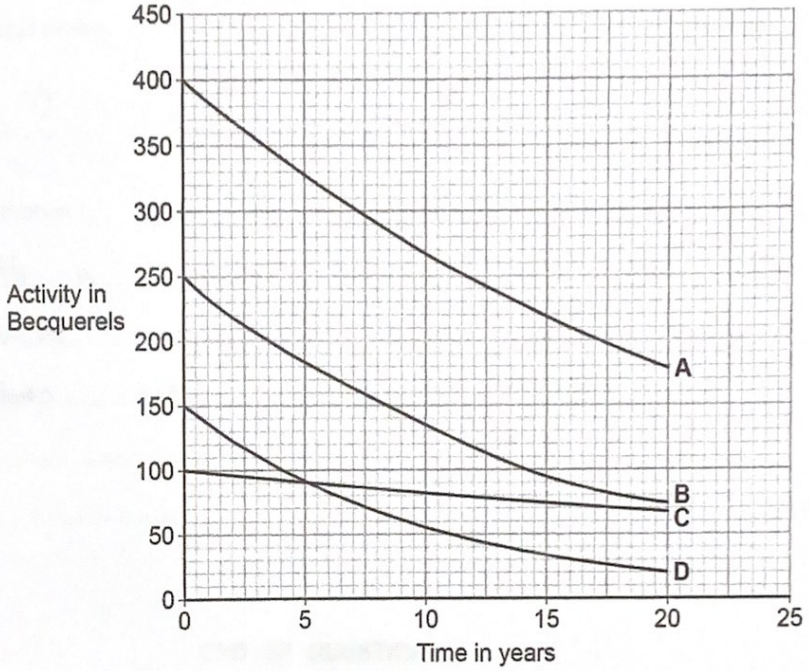
0 6 . 4 **Figure 11** shows how the activity of four different radioactive isotopes, **A**, **B**, **C** and **D**, changes over time.

Figure 11



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Write the isotopes **A**, **B**, **C** and **D** in order of increasing stability of their nuclei.

Explain your answer.

[3 marks]

Least stable **Most stable**

D B A C

Explanation This is because a substance with a longer half-life has more stable nuclei. So I have ordered the answers with increasing half-life.

11

END OF QUESTIONS