A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Physics Paper 1F

8464/P/1F

Wednesday 20 May 2020 Afternoon

Time allowed: 1 hour 15 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

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 only be used for drawing.**
- **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

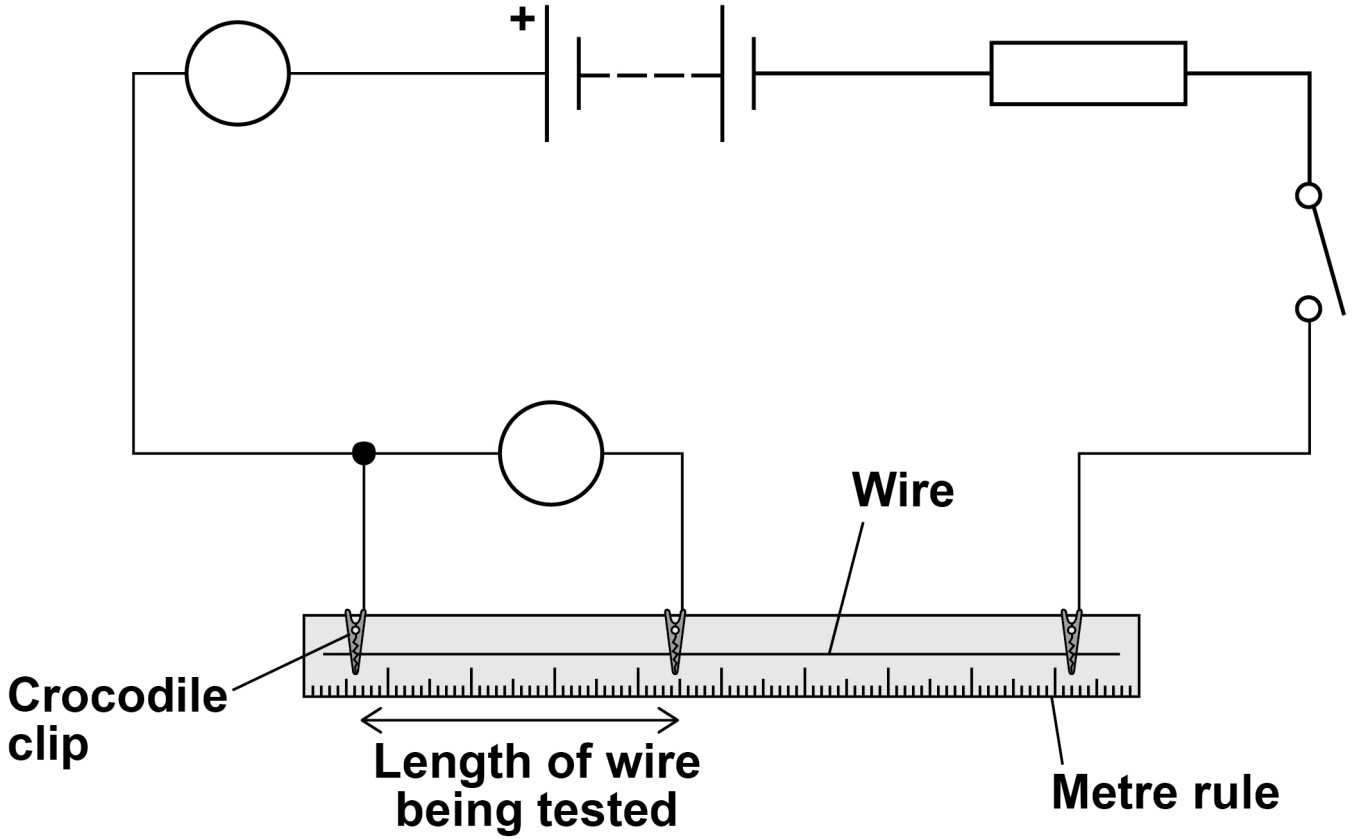
- **The maximum mark for this paper is 70.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

0 1 **A student investigated how the resistance of a wire varies with the length of the wire.**

FIGURE 1 shows the circuit used.

FIGURE 1



0 1 . 1 **The symbols for the voltmeter and ammeter in FIGURE 1 are NOT complete.**

Complete the symbols for the voltmeter and ammeter in FIGURE 1. [1 mark]

0 1 . 2 **Which variable is the independent variable? [1 mark]**

Tick (✓) ONE box.

- ☐ **The current in the wire**
- ☐ **The length of the wire being tested**
- ☐ **The resistance of the wire**
- ☐ **The thickness of the wire**

[Turn over]

0 1 . 3 **Which variable is the dependent variable?**
[1 mark]

Tick (✓) ONE box.

- ☐ **The current in the wire**
- ☐ **The length of the wire being tested**
- ☐ **The resistance of the wire**
- ☐ **The thickness of the wire**

0 1 . 4 **The student took repeat readings of potential difference for a 30 cm length of the wire.**

The readings were:

0.16 V 0.17 V 0.15 V

Calculate the mean potential difference.
[2 marks]

Mean potential difference = _____ V

[Turn over]

The length of the wire was increased to 60 cm

The current in the wire was 0.50 A

The mean potential difference across the wire was 0.32 V

0 1 . 5 Calculate the resistance of the 60 cm length of wire.

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

[2 marks]

Resistance = _____ Ω

0 1 . 6 **Calculate the power dissipated in the 60 cm length of wire.**

Use the equation:

power = potential difference × current

[2 marks]

Power = _____ W

0 1 . 7 **Calculate the charge flow when there is a current of 0.50 A in the wire for 17 s**

Use the equation:

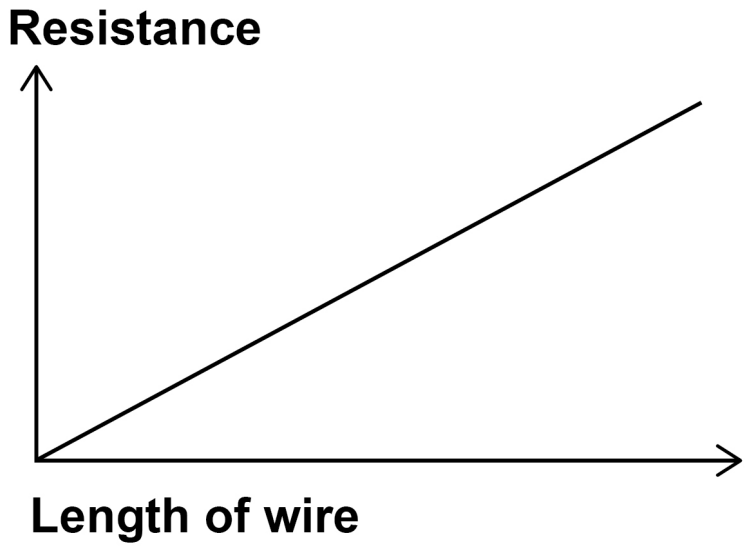
charge flow = current × time

[2 marks]

Charge flow = _____ C

0 1 . 8 **FIGURE 2 is a sketch graph of the results.**

FIGURE 2



The student repeated the investigation using a thicker wire made from the same metal. For the same length, the thicker wire has a lower resistance.

Draw a line on FIGURE 2 to show how the resistance of the thicker wire varies with length. [1 mark]

[Turn over]

12

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0 2 **Between 1951 and 1992 the USA tested nuclear weapons in a desert.**

0 2 . 1 **Complete the sentence.**

Choose the answer from the list. [1 mark]

- **contamination**
- **irradiation**
- **ionisation**
- **decay**

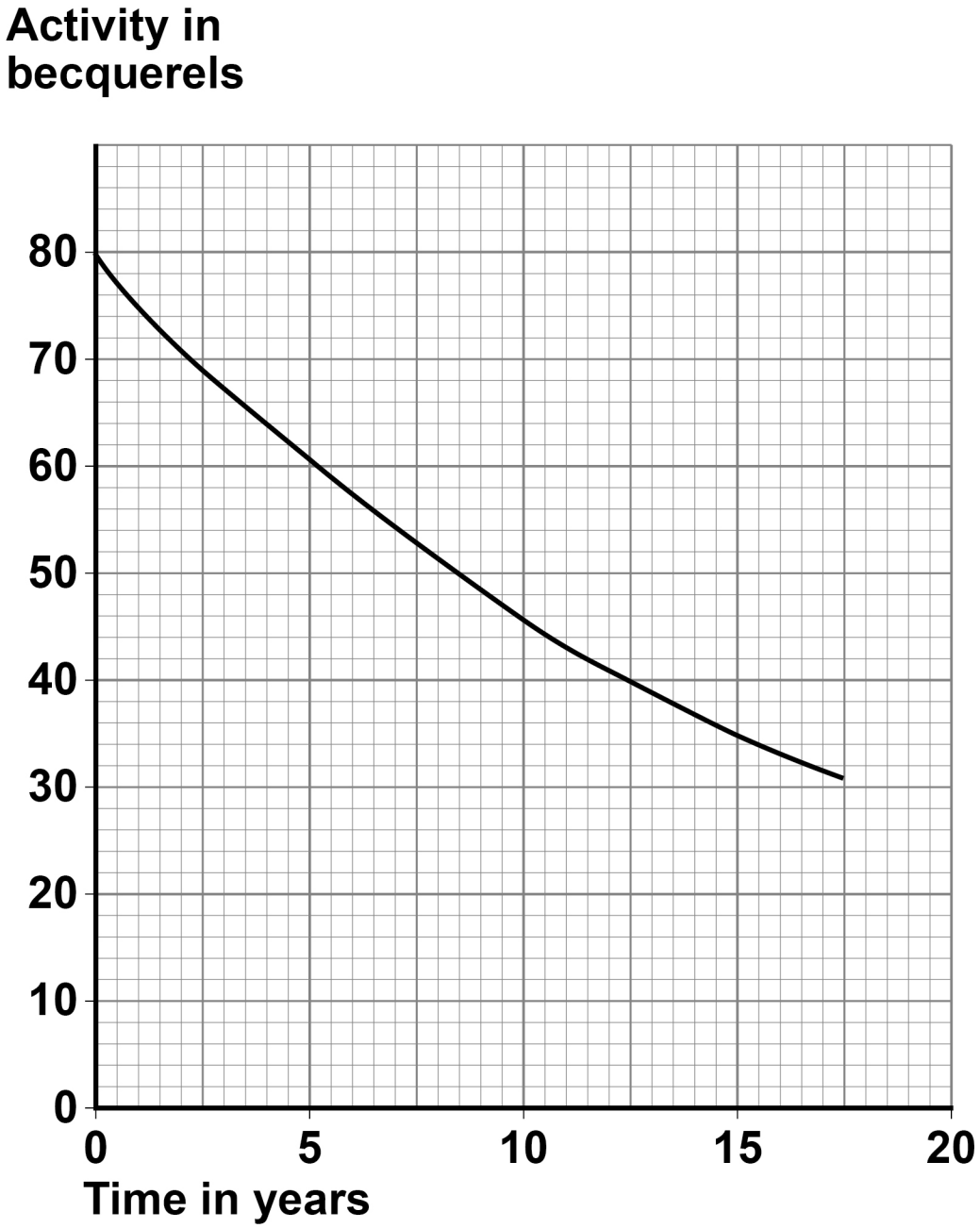
Radioactive dust from the nuclear weapons testing settled on the desert. This is called radioactive _____ .

[Turn over]

The desert now contains radioactive tritium.

FIGURE 3 shows how the activity of the tritium in a sample taken from the desert changed with time.

FIGURE 3



0 2 . 2 **The sample was collected from the desert in 1992.**

Determine the activity of the tritium in the sample in 2007. [2 marks]

Activity = _____ Bq

0 2 . 3 **How much time did it take for the activity of the tritium in the sample to decrease from 80 Bq to 40 Bq? [1 mark]**

Time = _____ years

[Turn over]

0 2 . 4 **What is the half-life of tritium? [1 mark]**

Half-life = _____ years

0 2 . 5 **The sample started with 45 billion atoms of tritium.**

After 4 years the sample had 36 billion atoms of tritium.

Calculate the percentage of the tritium in the sample that remained after 4 years. [2 marks]

_____

_____

_____

_____

_____

_____

Percentage of tritium remaining = _____ %

0 2 . 6 **A scientist determined the activity of a sample of tritium every minute for 3 minutes.**

TABLE 1 shows the results.

TABLE 1

Time in minutes	Activity in Bq
0	149
1	151
2	148
3	152

Why do the activity readings in TABLE 1 vary? [1 mark]

Tick (✓) ONE box.

☐ **Radioactive decay is a random process.**

☐ **Temperature changes affect the radioactive decay.**

☐ **The number of radioactive nuclei keeps increasing and decreasing.**

0 2 . 7 **What safety precaution should scientists take when working with radioactive materials in a laboratory? [1 mark]**

Tick (✓) ONE box.

- ☐ **Tie long hair back before handling the materials.**
- ☐ **Use long tongs to handle the materials.**
- ☐ **Wear safety goggles when handling the materials.**

0 2 . 8 **Studies show that children born near the area of the desert containing tritium were more likely to develop cancer.**

It is important that the results from these studies are checked by other scientists.

What is this process called? [1 mark]

Tick (✓) ONE box.

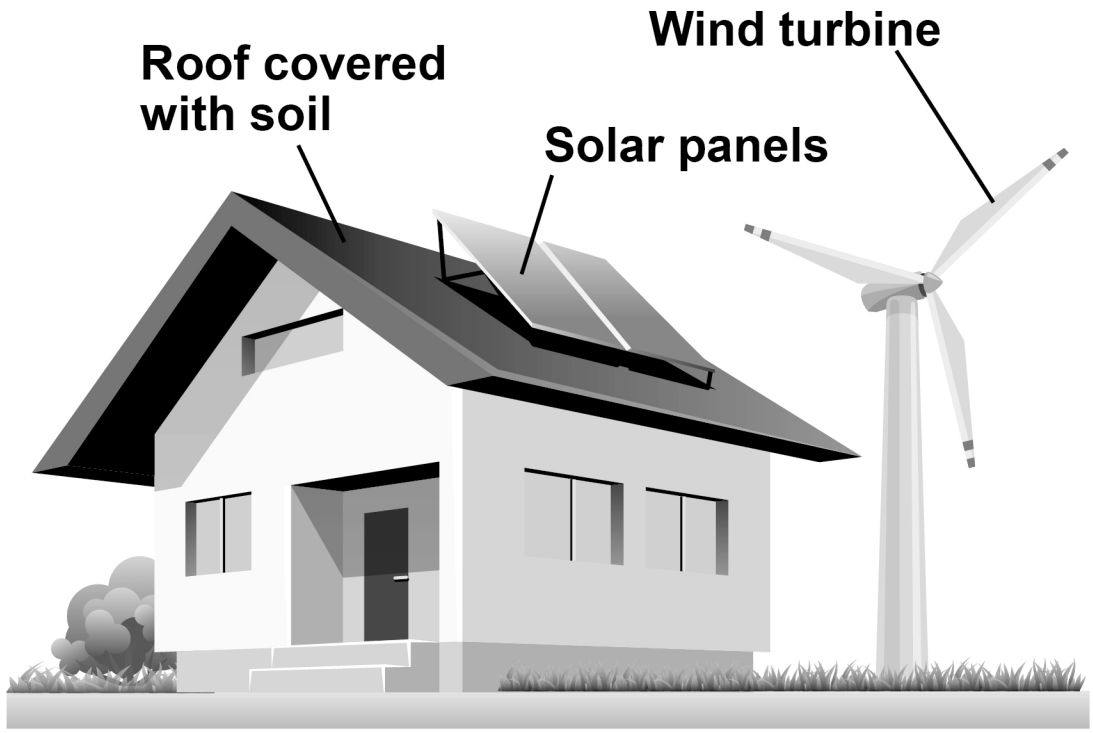
- ☐ **Experiment review**
- ☐ **Peer review**
- ☐ **Results review**
- ☐ **Test review**

10

0 3 **An eco-house is designed to be environmentally friendly.**

FIGURE 4 shows a picture of an eco-house.

FIGURE 4



0 3 . 1 **The solar panels and a wind turbine are used to generate electricity for the eco-house.**

Solar and wind are both renewable energy resources.

What does renewable energy resource mean? [1 mark]

Tick (✓) ONE box.

- ☐ **It can be replenished as it is used.**
- ☐ **It is unreliable.**
- ☐ **It has no fuel costs.**
- ☐ **It produces no greenhouse gases.**

0 3 . 2 **Biomass, nuclear and natural gas are three other energy resources.**

Complete the table to show whether each energy resource is renewable or non-renewable. [2 marks]

Tick (✓) ONE box for EACH energy resource.

Energy resource	Renewable	Non-renewable
Biomass		
Nuclear		
Natural gas		

0 3 . 3 Moving air makes the wind turbine spin.

The wind turbine generates electricity which is used to charge a battery.

Complete the sentences.

Choose answers from the list. [2 marks]

- **chemical**
- **electrical**
- **gravitational**
- **kinetic**

When the wind turbine spins faster there is an increase in its _____ energy.

Charging the battery increases the _____ store of energy of the battery.

[Turn over]

0 3 . 4 **The roof of the eco-house is covered with soil.**

Covering the roof with soil decreases the thermal conductivity of the roof.

What are the advantages of having a roof with a lower thermal conductivity?
[2 marks]

Tick (✓) TWO boxes.

- ☐ **Less energy is needed to heat the house.**
- ☐ **The rate of energy transfer by conduction is greater.**
- ☐ **The roof is a better insulator.**
- ☐ **The roof is less likely to leak.**
- ☐ **Weather will have a greater effect on the temperature of the house.**

0 3 . 5 **The average power transferred to the solar panels by sunlight is 26 000 W**

Calculate the average energy transferred to the solar panels in 30 seconds.

Use the equation:

energy transferred = power × time

[2 marks]

Average energy transferred to solar panels =

_____ **J**

[Turn over]

0 3 . 6 **Write down the equation that links efficiency, total power input and useful power output. [1 mark]**

0 3 . 7 **The solar panels on the roof of the eco-house have an efficiency of 0.15**

The average power input to the solar panels is 26 000 W

Calculate the average useful power output from the solar panels. [3 marks]

Average useful power output =

_____ **W**

[Turn over]

0 3 . 8 **Explain why it is a good idea for the eco-house to have both a wind turbine and solar panels. [2 marks]**

_____

_____

_____

_____

_____

_____

15

0 4 **A scientist had a balloon which was filled with air.**

0 4 . 1 **Which statement describes how air particles move? [1 mark]**

Tick (✓) ONE box.

- ☐ **At random speeds in random directions**
- ☐ **At random speeds in the same direction**
- ☐ **At the same speed in random directions**
- ☐ **At the same speed in the same direction**

[Turn over]

The temperature of the air was 19 °C

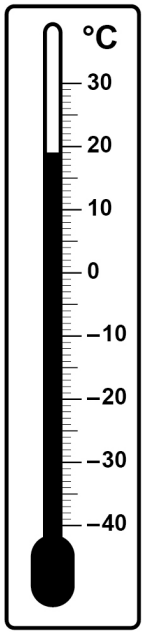
The scientist dipped the balloon into liquid nitrogen.

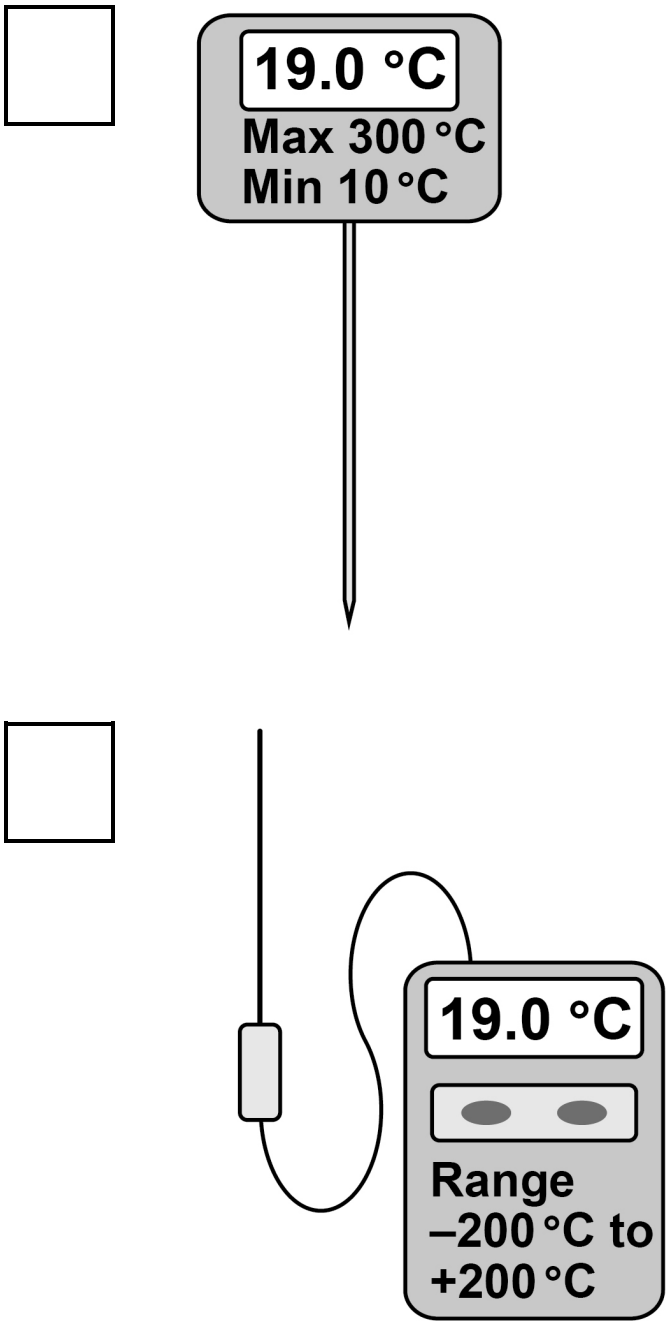
The temperature of the liquid nitrogen was −196 °C

0 4 . 2 **Which thermometer could be used to measure the temperature of the liquid nitrogen? [1 mark]**

Tick (✓) ONE box.

☐





[Turn over]

0 4 . 3 **The scientist wore special insulating gloves when putting the balloon into the liquid nitrogen.**

Suggest why. [1 mark]

0 4 . 4 **When the balloon was put into liquid nitrogen the temperature of the air in the balloon decreased.**

Complete the sentences.

Choose answers from the list below.

Each answer may be used once, more than once or not at all. [2 marks]

- **decreased**
- **stayed the same**
- **increased**

As the air in the balloon cooled down, the

speed of the particles _____ .

This is because the kinetic energy of the

particles _____ .

[Turn over]

0 4 . 5 **The air in the balloon had a mass of 0.00320 kg**

The temperature of the air in the balloon decreased by 215 °C

The change in thermal energy of the air in the balloon was 860 J

Calculate the specific heat capacity of the air in the balloon.

Use the Physics Equations Sheet. [3 marks]

Specific heat capacity = _____ J/kg°C

0 4 . 6 **The liquid nitrogen boiled.**

What happens to the temperature of nitrogen as it boils? [1 mark]

Tick (✓) ONE box.

☐ **Temperature decreases**

☐ **Temperature increases**

☐ **Temperature stays the same**

[Turn over]

The scientist recorded measurements to calculate the specific latent heat of vaporisation of nitrogen.

0 4 . 7 What is meant by vaporisation? [1 box]

Tick (✓) ONE box.

- ☐ **A change of state from liquid to gas**
- ☐ **A change of state from solid to gas**
- ☐ **A change of state from solid to liquid**

0 4 . 8 **The mass of nitrogen that vaporised was 0.0072 kg**

1440 J of energy was transferred to the nitrogen as it vaporised.

Calculate the specific latent heat of vaporisation of nitrogen.

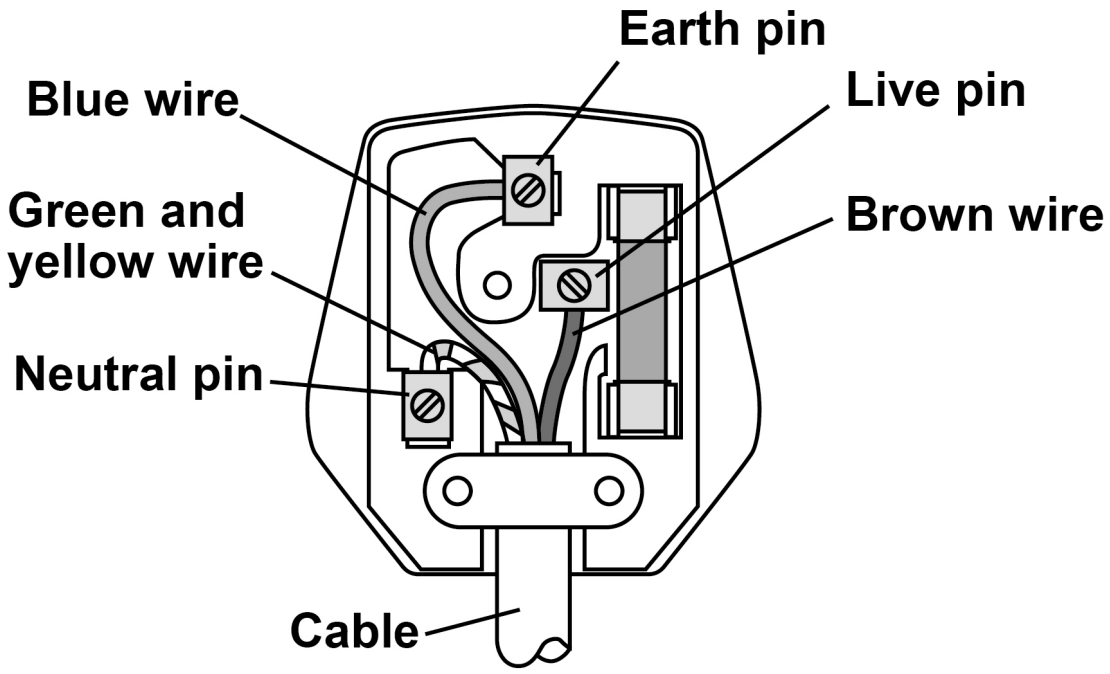
Use the Physics Equations Sheet. [3 marks]

Specific latent heat of vaporisation =

_____ **J/kg**

0 5 **FIGURE 5 shows the inside of a plug.**

FIGURE 5



0 5 . 1 **The plug is NOT wired correctly.**

What should be done to connect the wires in the plug correctly? [1 mark]

The correctly wired plug and cable connects a washing machine to the mains electricity supply.

0 5 . 2 Give the potential difference and frequency of the mains electricity supply in the UK.
[2 marks]

The potential difference is _____ V

The frequency is _____ Hz

0 5 . 3 The washing machine is switched on.

What is the potential difference between the neutral wire and the earth wire? [1 mark]

Potential difference = _____ V

[Turn over]

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0 5 . 4 **The plug has a fuse.**

Draw the circuit symbol for a fuse in the space below. [1 mark]

[Turn over]

The washing machine has a metal case.

A fault causes the live wire to make an electrical connection with the metal case of the washing machine.

0 5 . 5 **The earth wire is NOT connected to the metal case of the washing machine.**

Explain why it would not be safe for a person to touch the metal case. [2 marks]

0 5 . 6 **The earth wire is now connected to the metal case of the washing machine.**

Explain why it would now be safe for a person to touch the metal case, even if the live wire touches the metal case. [2 marks]

9

0 6 **Different radioactive isotopes emit different types of nuclear radiation.**

A polonium-210 (Po) nucleus emits an alpha particle (α) and turns into a lead (Pb) nucleus.

This can be represented by the equation:

$$^{210}_{84}\mathrm{Po} \longrightarrow {}^{A}_{Z}\mathrm{Pb} + \alpha$$

0 6 . 1 **What is the value of A in the equation? [1 mark]**

Tick (✓) ONE box.

- ☐ **A = 206**
- ☐ **A = 208**
- ☐ **A = 210**
- ☐ **A = 211**

0 6 . 2 **What is the value of Z in the equation?**
[1 mark]

Tick (✓) ONE box.

☐ **Z = 80**

☐ **Z = 82**

☐ **Z = 85**

☐ **Z = 86**

[Turn over]

0 6 . 3 **A strontium-89 nucleus (Sr) emits a beta particle (β) and turns into an yttrium nucleus (Y).**

This can be represented by the equation:

$$^{89}_{38}\mathrm{Sr} \longrightarrow {}^{A}_{Z}\mathrm{Y} + \beta$$

What are the values of A and Z in the equation? [2 marks]

A = _____

Z = _____

0 6 . 4 **Gamma radiation is another type of nuclear radiation.**

What does gamma radiation consist of?
[1 mark]

Tick (✓) ONE box.

- ☐ **High energy neutrons**
- ☐ **Electromagnetic waves**
- ☐ **Particles with no charge**
- ☐ **Positively charged ions**

[Turn over]

0 6 . 5 **Explain the differences between the properties of alpha, beta and gamma radiations. [6 marks]**

END OF QUESTIONS

11

Additional page, if required.
Write the question numbers in the left-hand margin.

Additional page, if required.
Write the question numbers in the left-hand margin.

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For Examiner's Use	
Question	Mark
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