AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
PHYSICS

F

Foundation Tier Paper 1

Wednesday 23 May 2018 Afternoon Time allowed: 1 hour 45 minutes

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.
- Fill in the box at the top of this page.
- Answer **all** 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 work out your answer.

Information
- The maximum mark for this paper is 100.
- 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
TOTAL	

Do not write outside the box

0 1 **Figure 1** shows a cyclist riding along a flat road.

Figure 1



0 1 . 1 Complete the sentence.

Choose answers from the box.

[2 marks]

chemical	**elastic potential**	**gravitational potential**	**kinetic**

As the cyclist accelerates, the _____ energy store in the cyclist's body decreases and the _____ energy of the cyclist increases.

0 1 . 2 The mass of the cyclist is 80 kg. The speed of the cyclist is 12 m/s.

Calculate the kinetic energy of the cyclist.

Use the equation:

$$\text{kinetic energy} = 0.5 \times \text{mass} \times (\text{speed})^2$$

[2 marks]

_____

_____

_____

_____

Kinetic energy = _____ J

Do not write outside the box

0 1 . 3 When the cyclist uses the brakes, the bicycle slows down.

This causes the temperature of the brake pads to increase by 50 °C.
The mass of the brake pads is 0.040 kg.
The specific heat capacity of the material of the brake pads is 480 J/kg °C.

Calculate the change in thermal energy of the brake pads.

Use the equation:

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

[2 marks]

Change in thermal energy = _____ J

0 1 . 4 How is the internal energy of the particles in the brake pads affected by the increase in temperature?

Tick **one** box.

[1 mark]

Decreased ☐

Increased ☐

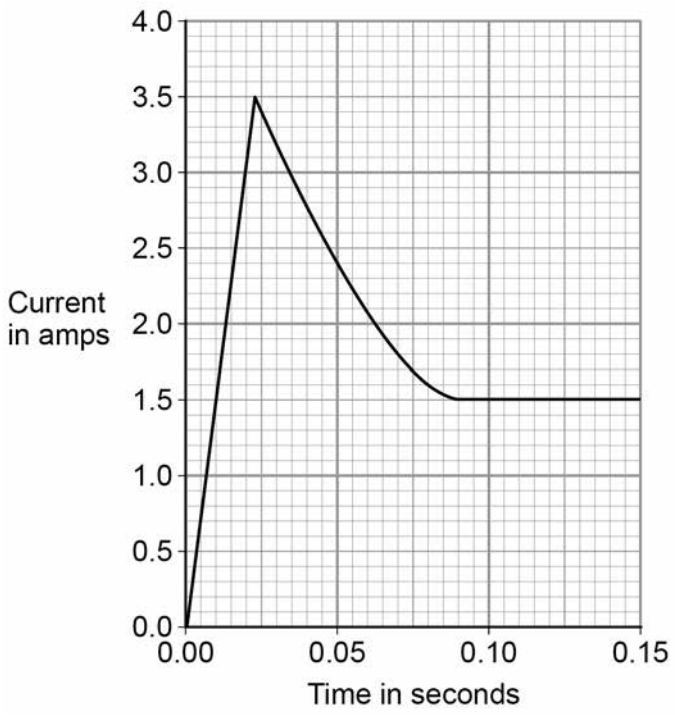
Not affected ☐

7

Do not write outside the box

0 2 **Figure 2** shows how the current through a filament lamp changes after the lamp is switched on.

Figure 2



0 2 . 1 The normal current through the filament lamp is 1.5 A.

For how many seconds is the current through the filament lamp greater than 1.5 A?

Tick **one** box.

[1 mark]

0.01 s ☐

0.08 s ☐

0.09 s ☐

0.14 s ☐

Do not write outside the box

0 2 . 2 Why might the filament inside a lamp melt when the lamp is first switched on?

[1 mark]

0 2 . 3 The lamp is connected to a 24 V power supply. The current through the lamp is 1.5 A.

Calculate the power of the lamp.

Use the equation:

power = potential difference × current

[2 marks]

Power = _____ W

0 2 . 4 LED lamps are much more efficient than filament lamps.

What does this statement mean?

Tick **one** box.

[1 mark]

- LED lamps have a similar power output to filament lamps. ☐
- LED lamps waste a smaller proportion of the input energy than filament lamps. ☐
- LED lamps have a higher power input than filament lamps. ☐
- LED lamps waste a larger proportion of the input energy than filament lamps. ☐

5

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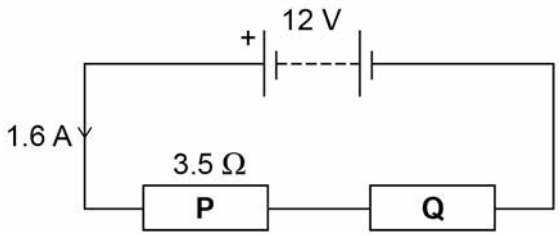
0 3 . 1 Draw a diagram to show how 1.5 V cells should be connected together to give a potential difference of 4.5 V.

Use the correct circuit symbol for a cell.

[2 marks]

A student built the circuit shown in **Figure 3**.

Figure 3



0 3 . 2 Calculate the total resistance of the circuit in **Figure 3**.

Use the equation:

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

[2 marks]

Total resistance = _____ Ω

Do not write outside the box

0 3 . 3 The resistance of **P** is 3.5 Ω.

Calculate the resistance of **Q**.

[1 mark]

Resistance of **Q** = _____ Ω

0 3 . 4 The student connects the two resistors in **Figure 3** in parallel.

What happens to the total resistance of the circuit?

Tick **one** box.

[1 mark]

- It decreases ☐
- It increases ☐
- It does not change ☐

Give a reason for your answer.

[1 mark]

7

Turn over for the next question

Do not write outside the box

0 4 A student wanted to determine the density of a small piece of rock.

0 4 . 1 Describe how the student could measure the volume of the piece of rock.

[4 marks]

0 4 . 2 The volume of the piece of rock was 18.0 cm^3.

The student measured the mass of the piece of rock as 48.6 g.

Calculate the density of the rock in g/cm^3.

Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

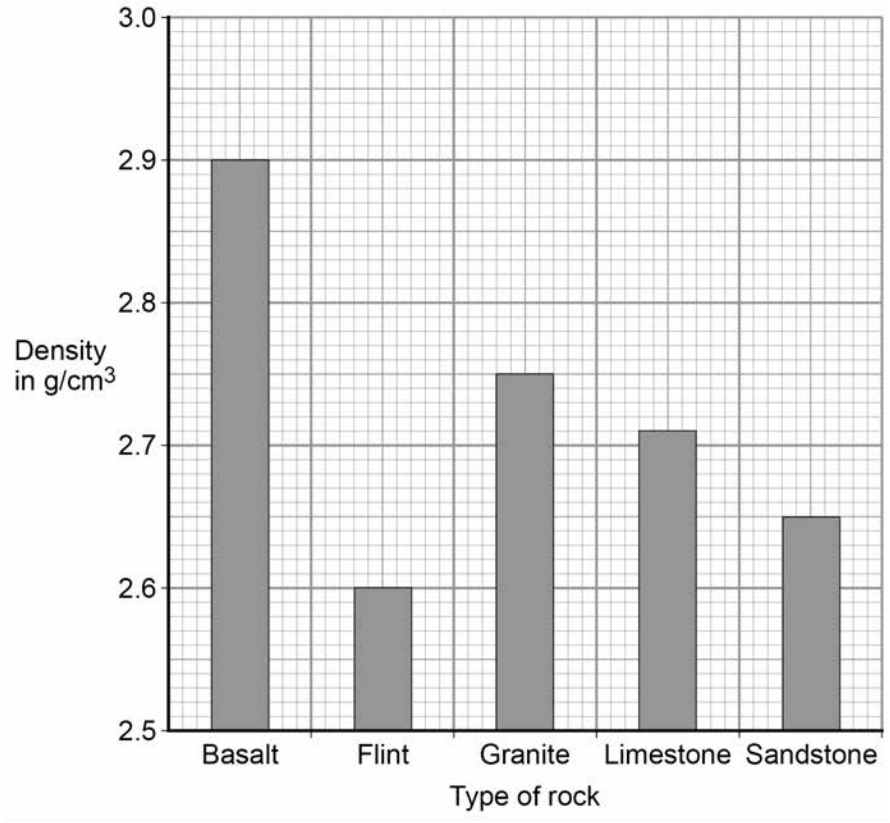
[2 marks]

Density = _____ g/cm^3

Do not write outside the box

Figure 4 shows the densities of different types of rock.

Figure 4



0 4 . 3 What is the most likely type of rock that the student had?

Tick **one** box.

[1 mark]

- Basalt ☐
- Flint ☐
- Granite ☐
- Limestone ☐
- Sandstone ☐

Do not write outside the box

0 4 . 4 Give **one** source of error that may have occurred when the student measured the volume of the rock.

[1 mark]

0 4 . 5 How would the error you described in question **04.4** affect the measured volume of the rock?

[1 mark]

9

Do not write outside the box

0 5 Americium-241 ($^{241}_{95}Am$) is an isotope of americium.

0 5 . 1 Which of the isotopes given in **Table 1** is **not** an isotope of americium?

[2 marks]

Table 1

Isotope	Mass number	Atomic number
A	243	95
B	243	94
C	242	95

Isotope _____

Give a reason for your answer.

_____

_____

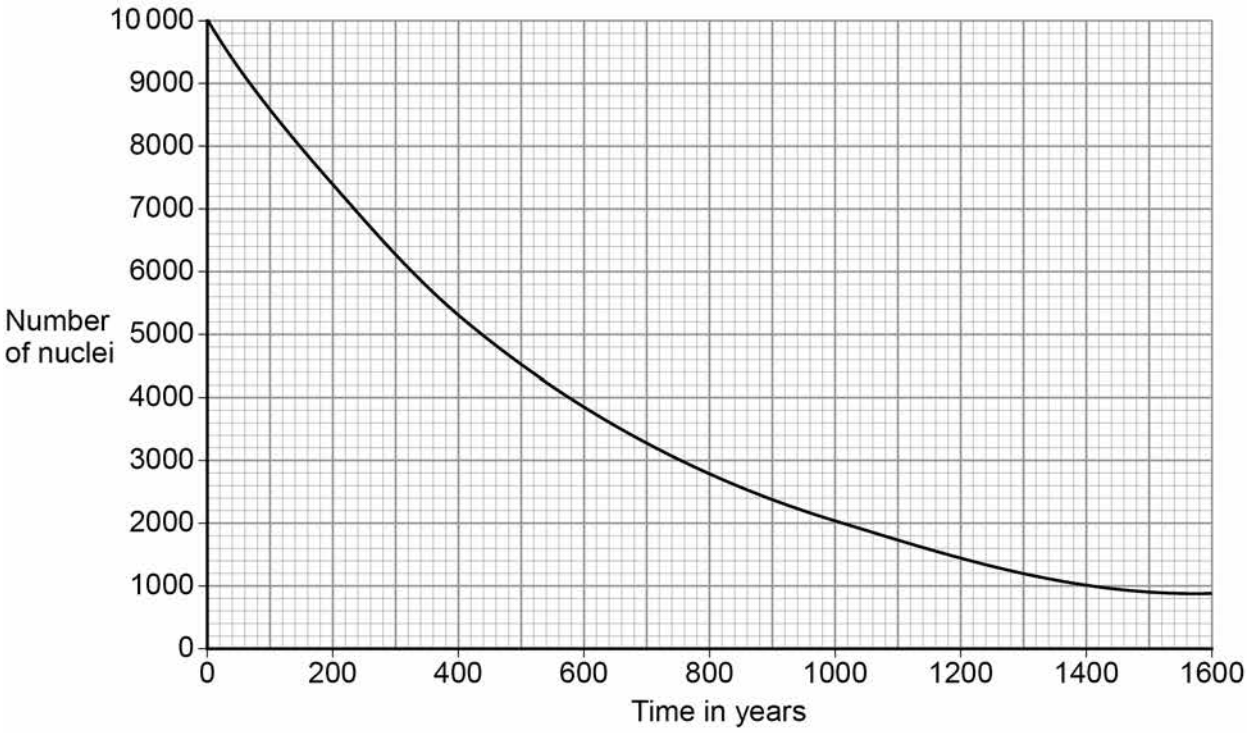
_____

Question 5 continues on the next page

Do not write outside the box

Figure 5 shows how the number of americium-241 nuclei in a sample changes with time.

Figure 5



0 5 . 2 How many years does it take for the number of americium-241 nuclei to decrease from 10 000 to 5000?

[1 mark]

Time = _____ years

0 5 . 3 What is the half-life of americium-241?

[1 mark]

Half-life = _____ years

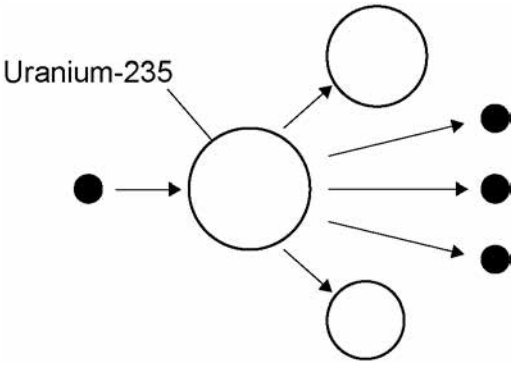
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0 6 Nuclear power can be used to generate electricity through nuclear fission.

Figure 6 shows the process of nuclear fission.

Figure 6



0 6 . 1 Complete the sentences.

Choose answers from the box.

[3 marks]

gamma rays	**light rays**	**proton**	**neutron**	**nucleus**	**X-rays**

During the process of nuclear fission a uranium _____

absorbs a _____ .

Electromagnetic radiation is released in the form of _____ .

0 6 . 2 The UK needs at least 25 000 000 kW of electrical power at any time.

A nuclear power station has an electrical power output of 2 400 000 kW

Calculate how many nuclear power stations are needed to provide 25 000 000 kW of electrical power.

[2 marks]

_____

_____

_____

_____

Number of nuclear power stations = _____

Turn over ►

Do not write outside the box

0 6 . 3 State **two** environmental issues caused by generating electricity using nuclear power stations.

[2 marks]

1 _____

_____

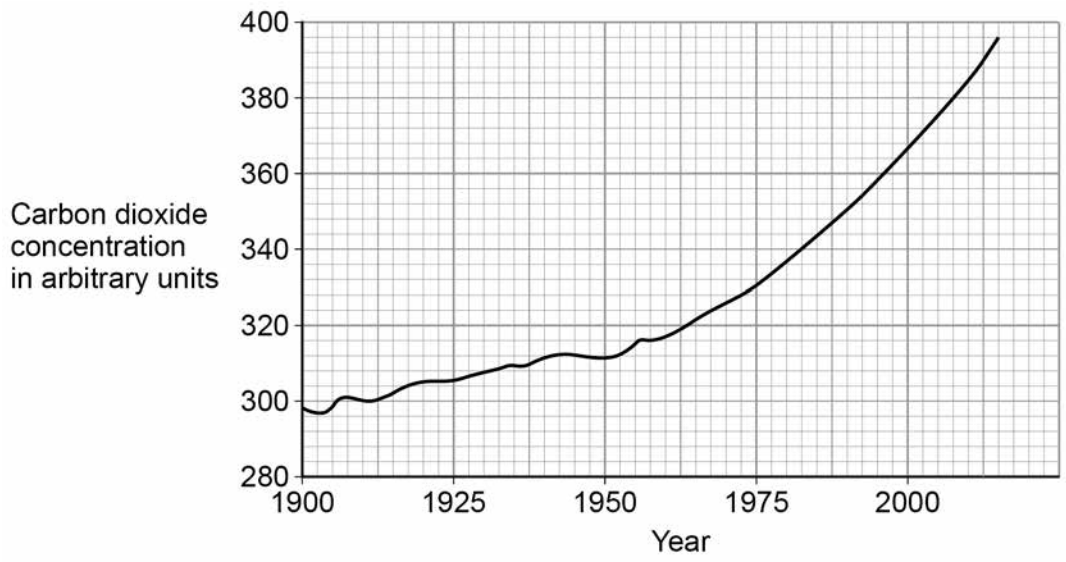
2 _____

_____

0 6 . 4 The UK currently generates a lot of electricity by burning natural gas. This process releases carbon dioxide into the atmosphere.

Figure 7 shows how the concentration of carbon dioxide in the atmosphere has changed over the past 115 years.

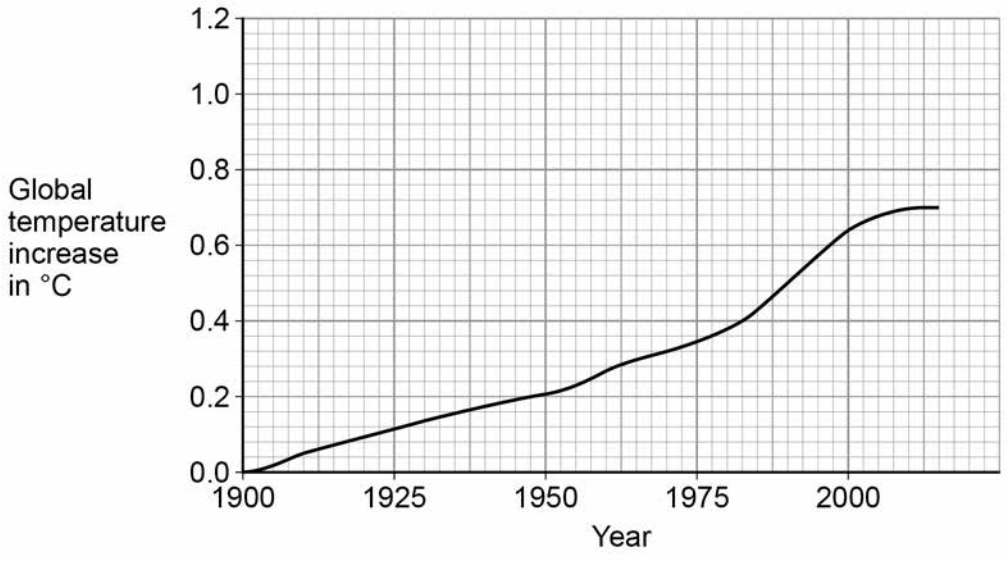
Figure 7



Do not write outside the box

Figure 8 shows how the global temperature has changed over the past 115 years.

Figure 8



Give **one** similarity and **one** difference between the data in **Figure 7** and **Figure 8**.

[2 marks]

Similarity _____

_____

_____

Difference _____

_____

_____

9

Turn over for the next question

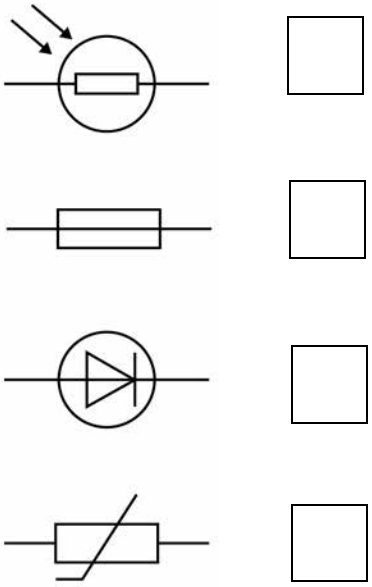
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0 7 The plug of an electrical appliance contains a fuse.

0 7 . 1 What is the correct circuit symbol for a fuse?

Tick **one** box.

[1 mark]



0 7 . 2 The appliance is connected to the mains electrical supply. The mains potential difference is 230 V.

Calculate the energy transferred when 13 C of charge flows through the appliance.

Use the equation:

energy transferred = charge flow × potential difference

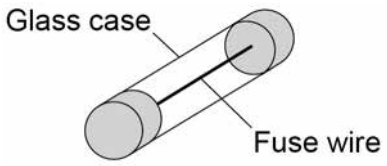
[2 marks]

Energy transferred = _____ J

Do not write outside the box

Figure 9 shows the structure of a fuse.

Figure 9



0 7 . 3 Write down the equation that links charge flow, current and time.

[1 mark]

0 7 . 4 The fuse wire melts when 1.52 coulombs of charge flows through the fuse in 0.40 seconds.

Calculate the current at which the fuse wire melts.

[3 marks]

Current = _____ A

0 7 . 5 The mass of the fuse wire is 0.00175 kg. The specific latent heat of fusion of the fuse wire is 205 000 J/kg.

Calculate the energy needed to melt the fuse wire.

Use the Physics Equations Sheet.

[2 marks]

Energy = _____ J

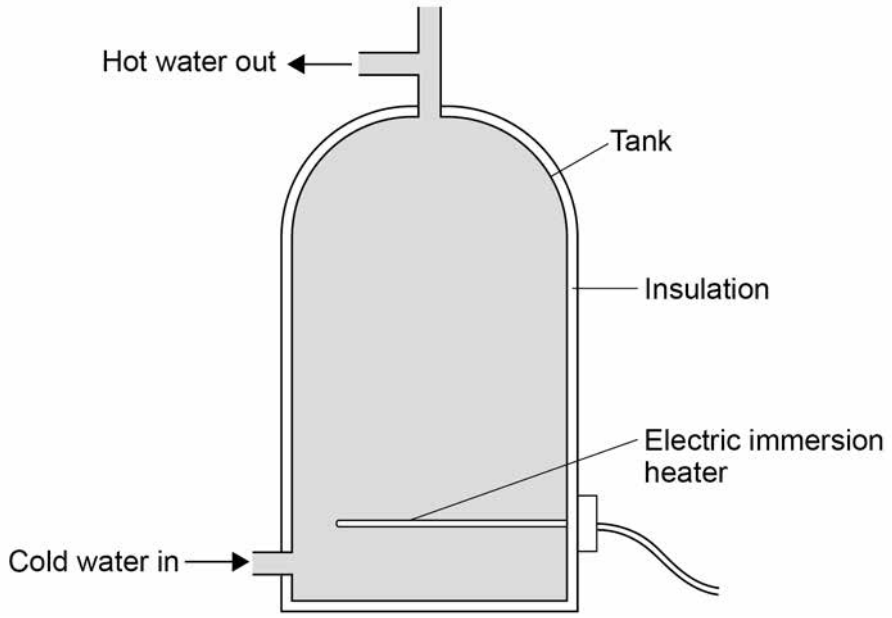
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Turn over ►

Do not write outside the box

0 8 **Figure 10** shows a hot water tank made of copper.

Figure 10



0 8 . 1 Copper has a higher thermal conductivity than most metals.

How does the rate of energy transfer through copper compare with the rate of energy transfer through most metals?

Tick **one** box.

[1 mark]

Higher ☐

Lower ☐

The same ☐

Do not write outside the box

0 8 . 2 The tank is insulated. When the water is hot, the immersion heater switches off.

Complete the sentences.

[2 marks]

Compared to a tank with no insulation, the rate of energy transfer from the water in an insulated tank is _____ .

This means that the water in the insulated tank stays _____ for longer.

Question 8 continues on the next page

Do not write outside the box

Figure 11 shows how temperature varies with time for water in a tank heated with an immersion heater.

Figure 12 shows how temperature varies with time for water in a tank heated with a solar panel.

Figure 11

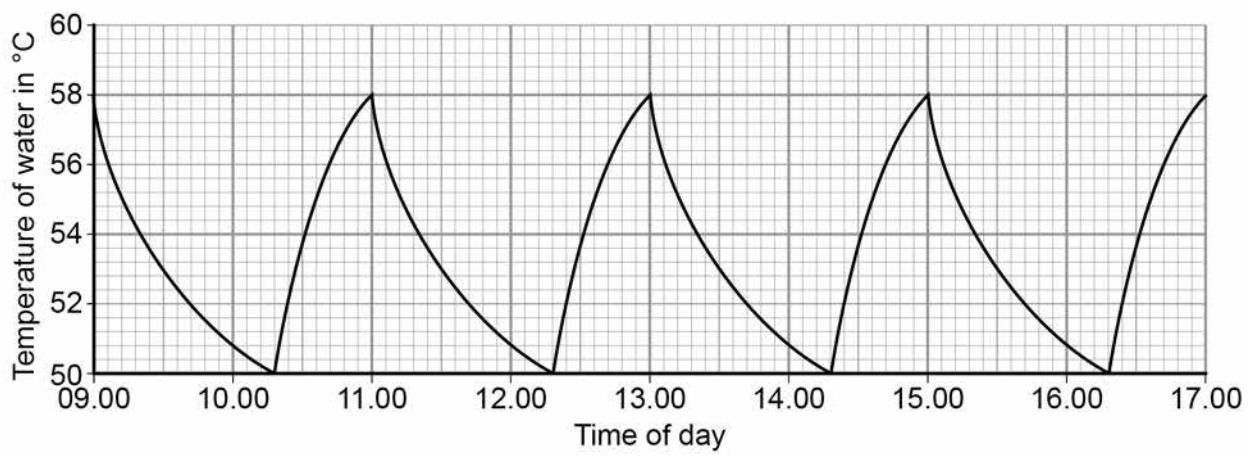
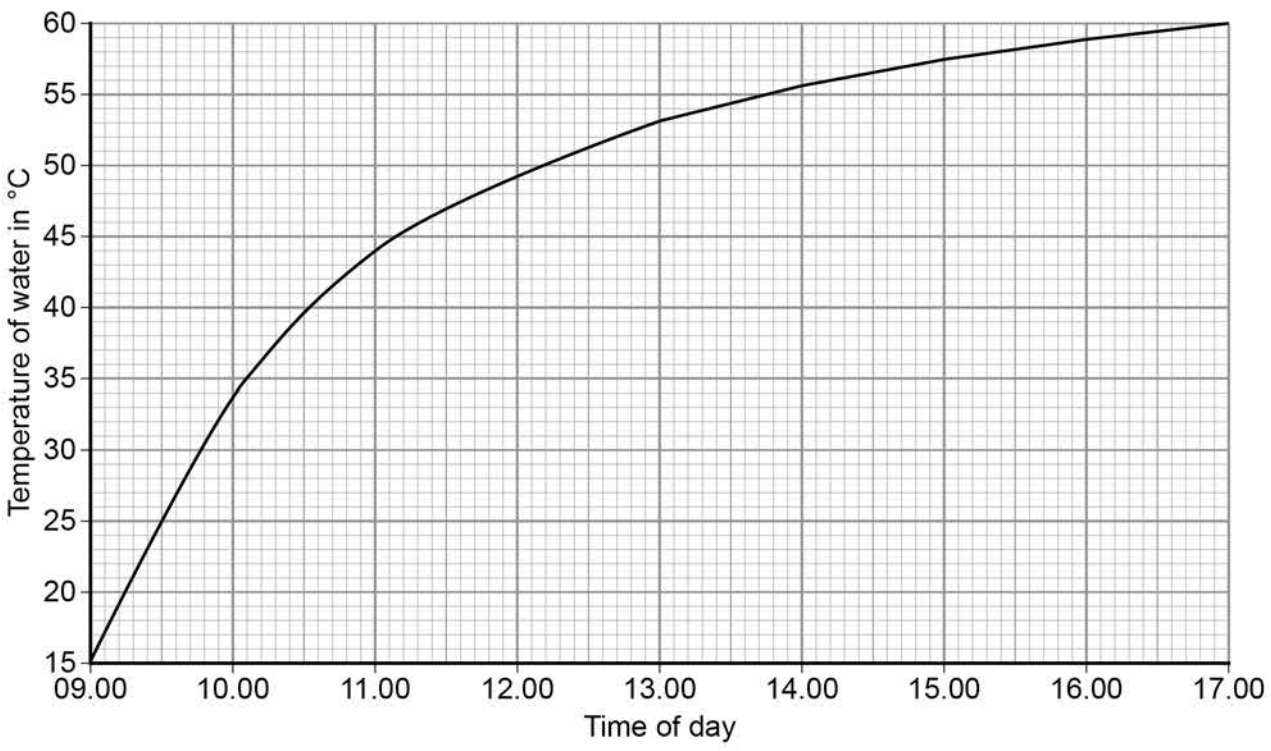


Figure 12



Do not write outside the box

0 8 . 3 Give **one** advantage and **one** disadvantage of heating the water using solar panels rather than an immersion heater.

Use only information from **Figure 11** and **Figure 12**.

[2 marks]

Advantage of solar panels _____

_____

_____

Disadvantage of solar panels _____

_____

_____

0 8 . 4 During one morning, a total of 4 070 000 J of energy is transferred from the electric immersion heater.

4 030 000 J of energy are transferred to the water.

Calculate the proportion of the total energy transferred to the water.

[2 marks]

_____

_____

_____

_____

Proportion of total energy = _____

Question 8 continues on the next page

Do not write outside the box

0 8 . 5 Write down the equation that links energy transferred, power and time.

[1 mark]

0 8 . 6 The power output of the immersion heater is 5000 W.

Calculate the time taken for the immersion heater to transfer 4 070 000 J of energy.

Give the unit.

[4 marks]

Time = _____ Unit _____

12

Do not write outside the box

0 9 **Figure 13** shows a lift inside a building.

Figure 13



0 9 . 1 The motor in the lift does 120 000 J of work in 8.0 seconds.

Calculate the power output of the motor in the lift.

Use the equation:

$$\text{Power output} = \frac{\text{work done}}{\text{time}}$$

[2 marks]

Power output = _____ W

Do not write outside the box

0 9 . 2 The power input to the motor is greater than the power output.

Tick **two** reasons why.

[2 marks]

Energy is transferred in heating the surroundings. ☐

Friction causes energy to be transferred in non-useful ways. ☐

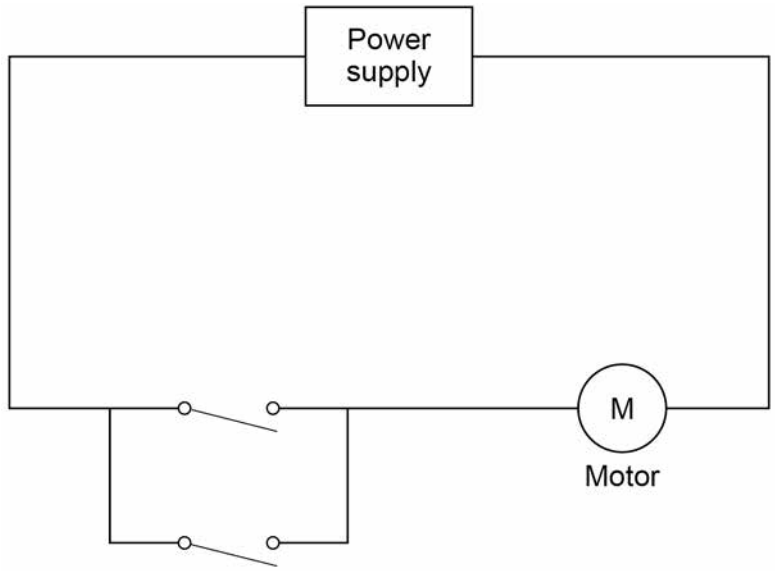
The motor is connected to the mains electricity supply. ☐

The motor is more than 100% efficient. ☐

There are only four people in the lift. ☐

0 9 . 3 **Figure 14** shows part of the circuit that operates the lift motor.

Figure 14



The lift can be operated using either of the two switches.

Explain why.

[2 marks]

Do not write outside the box

0 9 . 4 Write down the equation that links gravitational field strength, gravitational potential energy, height and mass.

[1 mark]

0 9 . 5 The lift goes up 14 m. The total mass of the people in the lift is 280 kg.

gravitational field strength = 9.8 N/kg

Calculate the increase in gravitational potential energy of the people in the lift.

Give your answer to 2 significant figures.

[3 marks]

Increase in gravitational potential energy = _____ J

10

Turn over for the next question

Do not write outside the box

1 0 **Figure 15** shows a student walking on a carpet.

Figure 15



1 0 . 1 The student becomes negatively charged because of the friction between his socks and the carpet.

Explain why the friction causes the student to become charged.

[2 marks]

Do not write outside the box

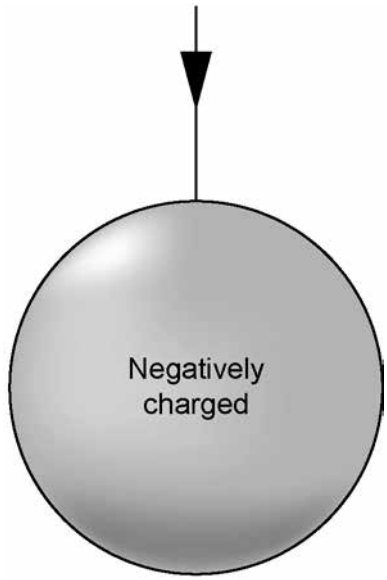
1 0 . 2 The student's head is represented by the sphere in **Figure 16.**

The student is negatively charged. The arrow shows part of the electric field around the student's head.

Draw **three** more arrows on **Figure 16** to complete the electric field pattern.

[1 mark]

Figure 16



1 0 . 3 The negatively charged student touches a metal tap and receives an electric shock.

Explain why.

[3 marks]

Do not write outside the box

1 0 . 4 Some carpets have thin copper wires running through them. The student is less likely to receive an electric shock after walking on this type of carpet.

Suggest why.

[2 marks]

8

Do not write outside the box

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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1 1 A teacher used a Geiger-Muller tube and counter to measure the number of counts in 60 seconds for a radioactive rock.

1 1 . 1 The counter recorded 819 counts in 60 seconds. The background radiation count rate was 0.30 counts per second.

Calculate the count rate for the rock.

[3 marks]

Count rate = _____ per second

1 1 . 2 A householder is worried about the radiation emitted by the granite worktop in his kitchen.

1 kg of granite has an activity of 1250 Bq. The kitchen worktop has a mass of 180 kg.

Calculate the activity of the kitchen worktop in Bq.

[2 marks]

Activity = _____ Bq

Do not write outside the box

1 1 . 3 The average total radiation dose per year in the UK is 2.0 millisieverts.

Table 2 shows the effects of radiation dose on the human body.

Table 2

Radiation dose in millisieverts	**Effects**
10 000	Immediate illness; death within a few weeks
1000	Radiation sickness; unlikely to cause death
100	Lowest dose with evidence of causing cancer

The average radiation dose from the granite worktop is 0.003 millisieverts per day.

Explain why the householder should **not** be concerned about his yearly radiation dose from the granite worktop.

One year is 365 days.

[2 marks]

1 1 . 4 Bananas are a source of background radiation. Some people think that the unit of radiation dose should be changed from sieverts to Banana Equivalent Dose.

Suggest **one** reason why the Banana Equivalent Dose may help the public be more aware of radiation risks.

[1 mark]

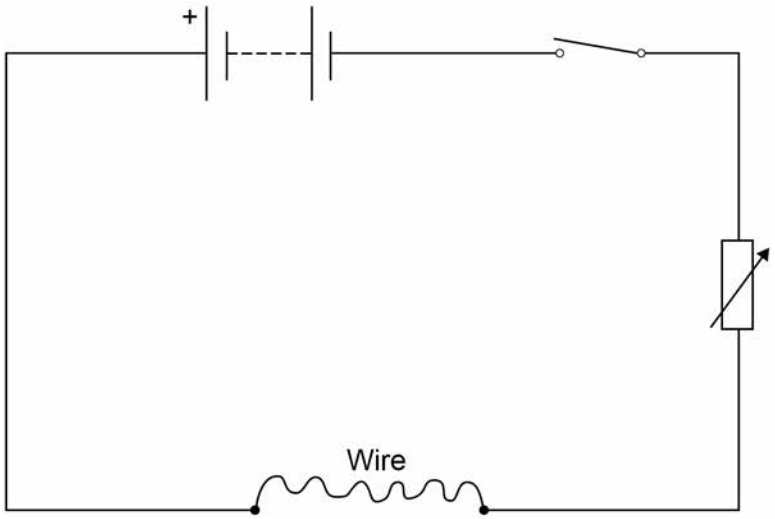
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Do not write outside the box

1 2 A student investigated how the resistance of a piece of nichrome wire varies with length.

Figure 17 shows part of the circuit the student used.

Figure 17



1 2 . 1 Complete **Figure 17** by adding an ammeter and a voltmeter.

Use the correct circuit symbols.

[3 marks]

Do not write outside the box

1 2 . 2 Describe how the student would obtain the data needed for the investigation.

Your answer should include a risk assessment for **one** hazard in the investigation.

[6 marks]

1 2 . 3 Why would switching off the circuit between readings have improved the accuracy of the student's investigation?

Tick **one** box.

[1 mark]

The charge flow through the wire would not change. ☐

The potential difference of the battery would not increase. ☐

The power output of the battery would not increase. ☐

The temperature of the wire would not change. ☐

Do not write outside the box

1 2 . 4 The student used crocodile clips to make connections to the wire.

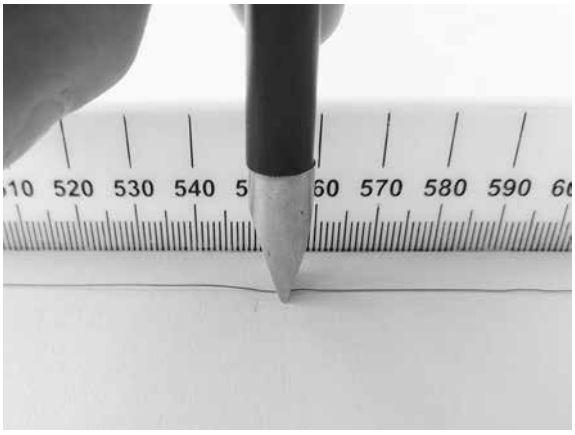
They could have used a piece of equipment called a 'jockey'.

Figure 18 shows a crocodile clip and a jockey in contact with a wire.

Figure 18



Crocodile clip



Jockey

How would using the jockey have affected the accuracy and resolution of the student's results compared to using the crocodile clip?

Tick **two** boxes.

[2 marks]

The accuracy of the student's results would be higher. ☐

The accuracy of the student's results would be lower. ☐

The accuracy of the student's results would be the same. ☐

The resolution of the length measurement would be higher. ☐

The resolution of the length measurement would be lower. ☐

The resolution of the length measurement would be the same. ☐

12

END OF QUESTIONS

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