

Please write clearly in block capitals.

Centre number

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Candidate number

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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	



J U N 1 8 8 4 6 3 1 F 0 1

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



0 1 . 3

When the cyclist uses the brakes, the bicycle slows down.

This causes the temperature of the brake pads to increase by $50\text{ }^{\circ}\text{C}$.

The mass of the brake pads is 0.040 kg .

The specific heat capacity of the material of the brake pads is $480\text{ J/kg }^{\circ}\text{C}$.

Calculate the change in thermal energy of the brake pads.

Use the equation:

change in thermal energy = mass $\times$ specific heat capacity $\times$ 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

Turn over ►

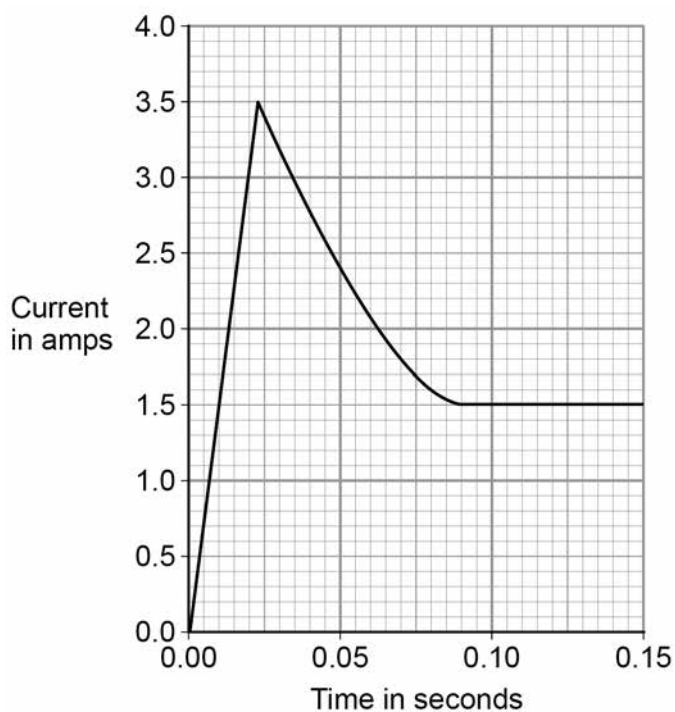


0 2

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

Do not write
outside the
box

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

☐


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:

$$\text{power} = \text{potential difference} \times \text{current}$$

[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.

☐


0 3 . 1

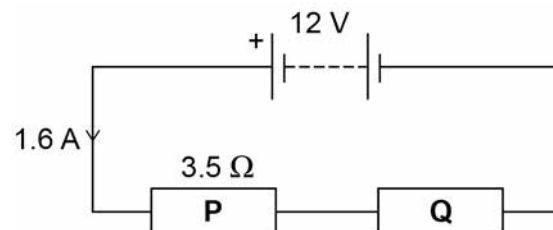
Draw a diagram to show how 1.5 V cells should be connected together to give a potential difference of 4.5 V.

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



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

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]

Turn over for the next question

Turn over ►



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:

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

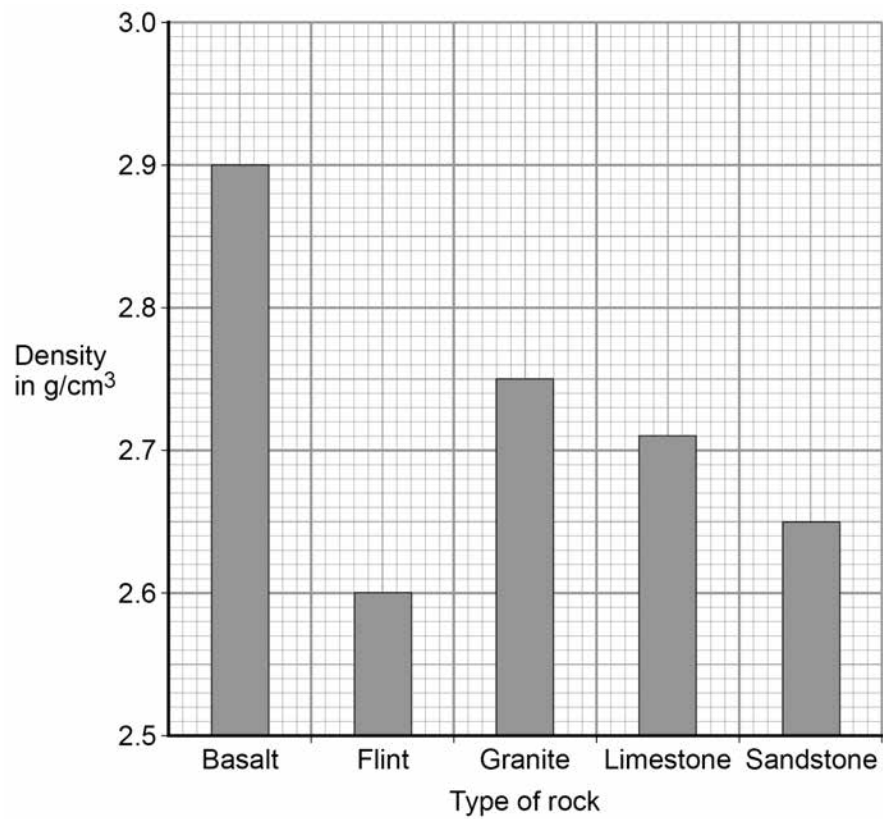
[2 marks]

Density = _____ g/cm^3



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	☐

Turn over ►



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

0 5Americium-241 ($^{241}_{95}\text{Am}$) 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

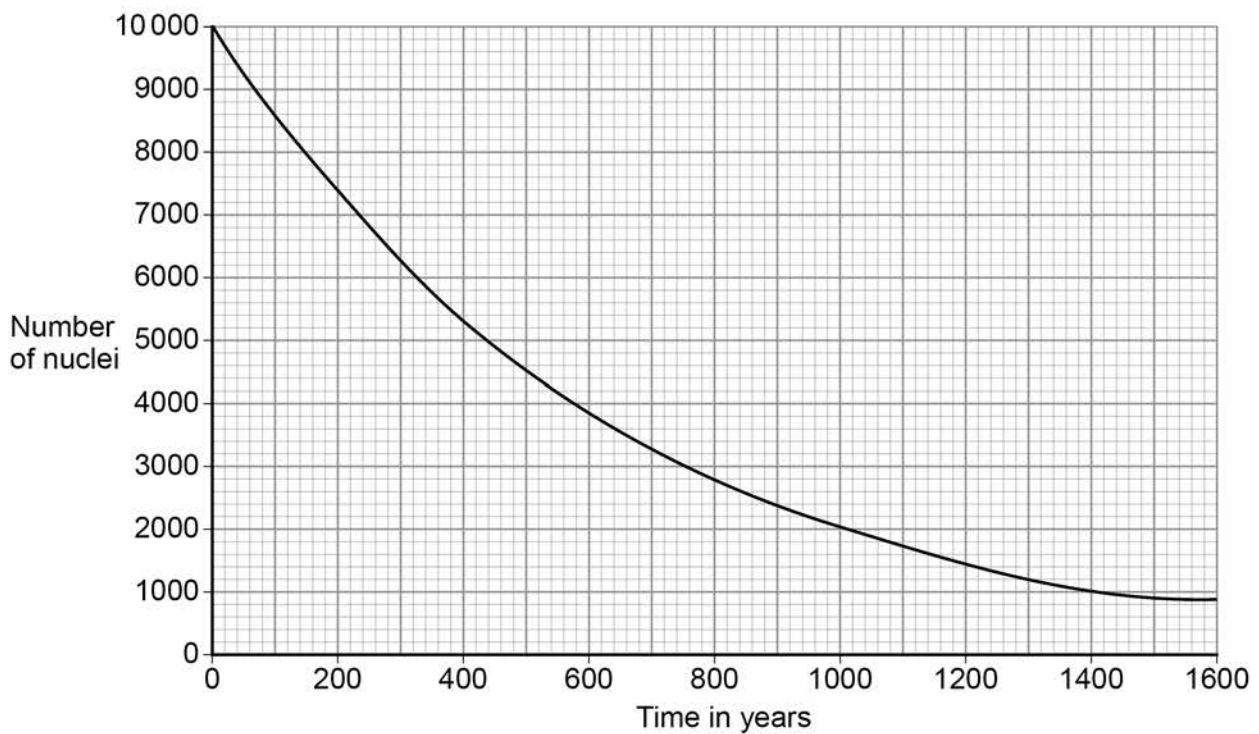
Isotope _____

Give a reason for your answer.

Question 5 continues on the next page**Turn over ►**

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

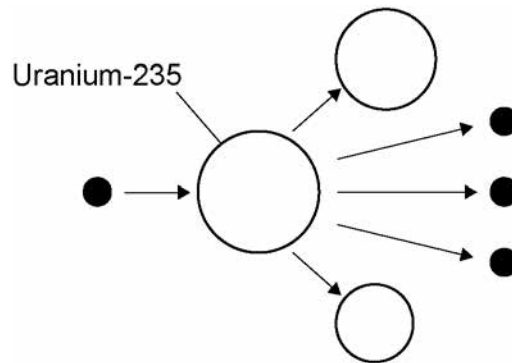


0 6

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 ►



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

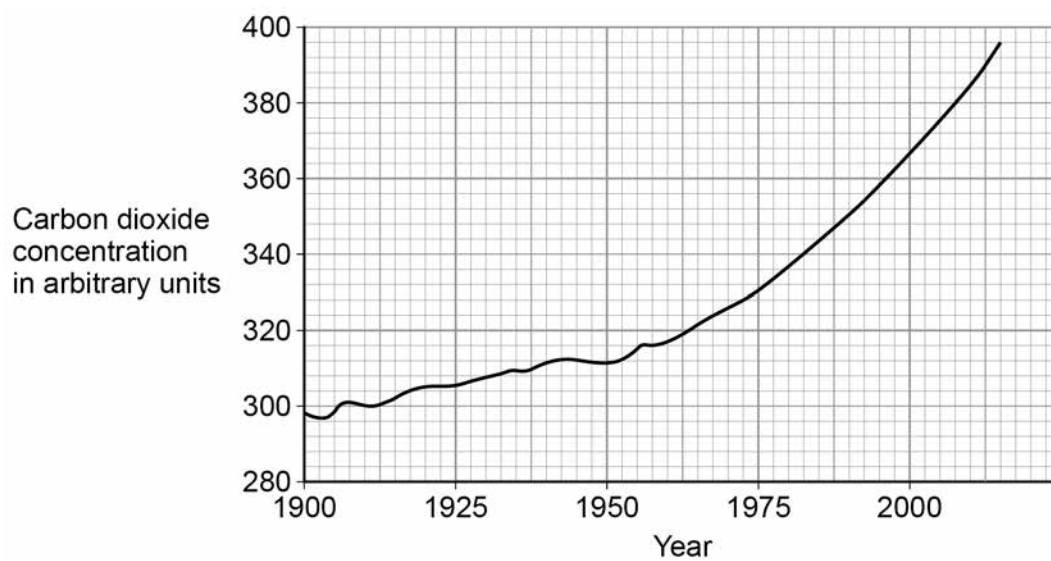
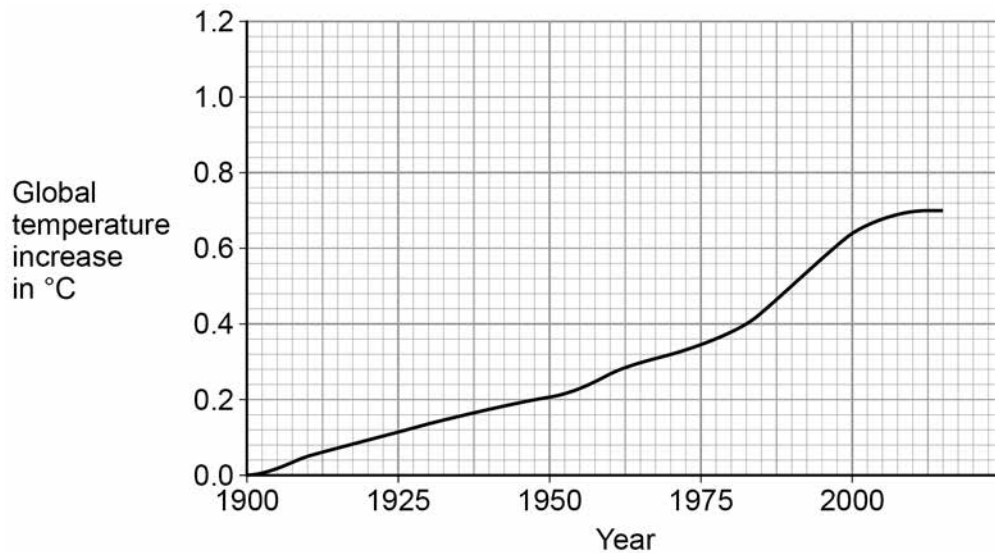


Figure 8 shows how the global temperature has changed over the past 115 years.

Figure 8



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

[2 marks]

Similarity _____

Difference _____

Turn over for the next question

Turn over ►



07

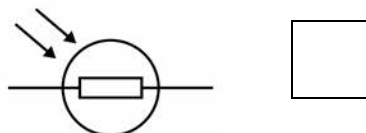
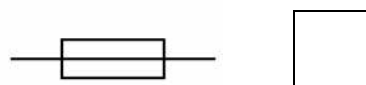
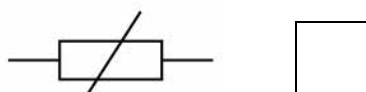
The plug of an electrical appliance contains a fuse.

07.1

What is the correct circuit symbol for a fuse?

Tick **one** box.

[1 mark]



07.2

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:

$$\text{energy transferred} = \text{charge flow} \times \text{potential difference}$$

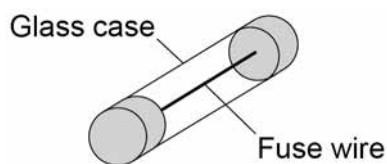
[2 marks]

Energy transferred = _____ J



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]

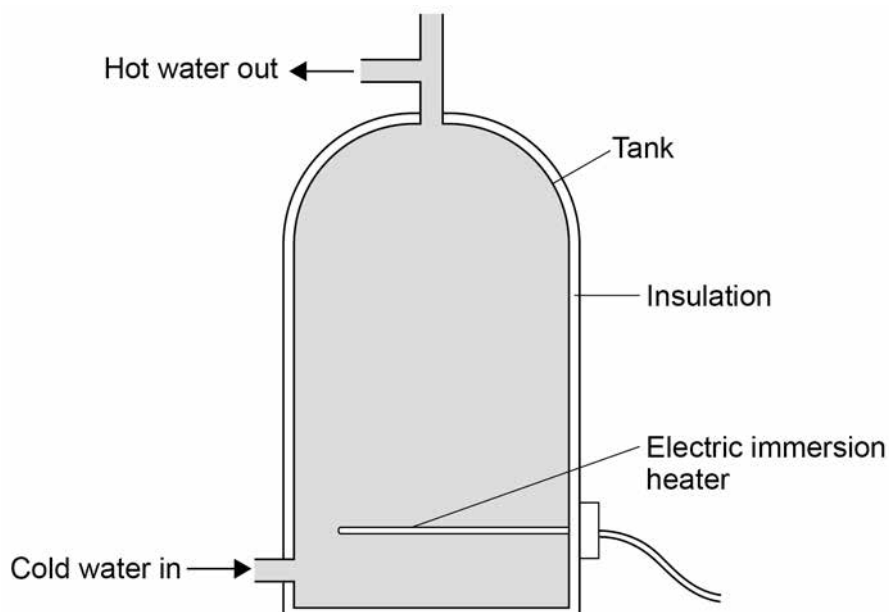
Energy = _____ J



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

☐

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

Turn over ►



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

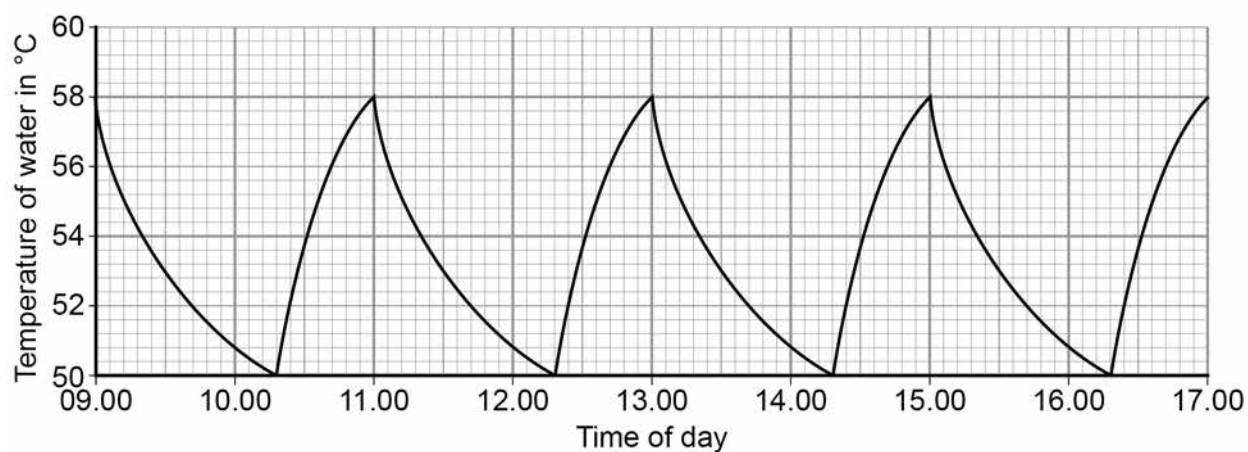
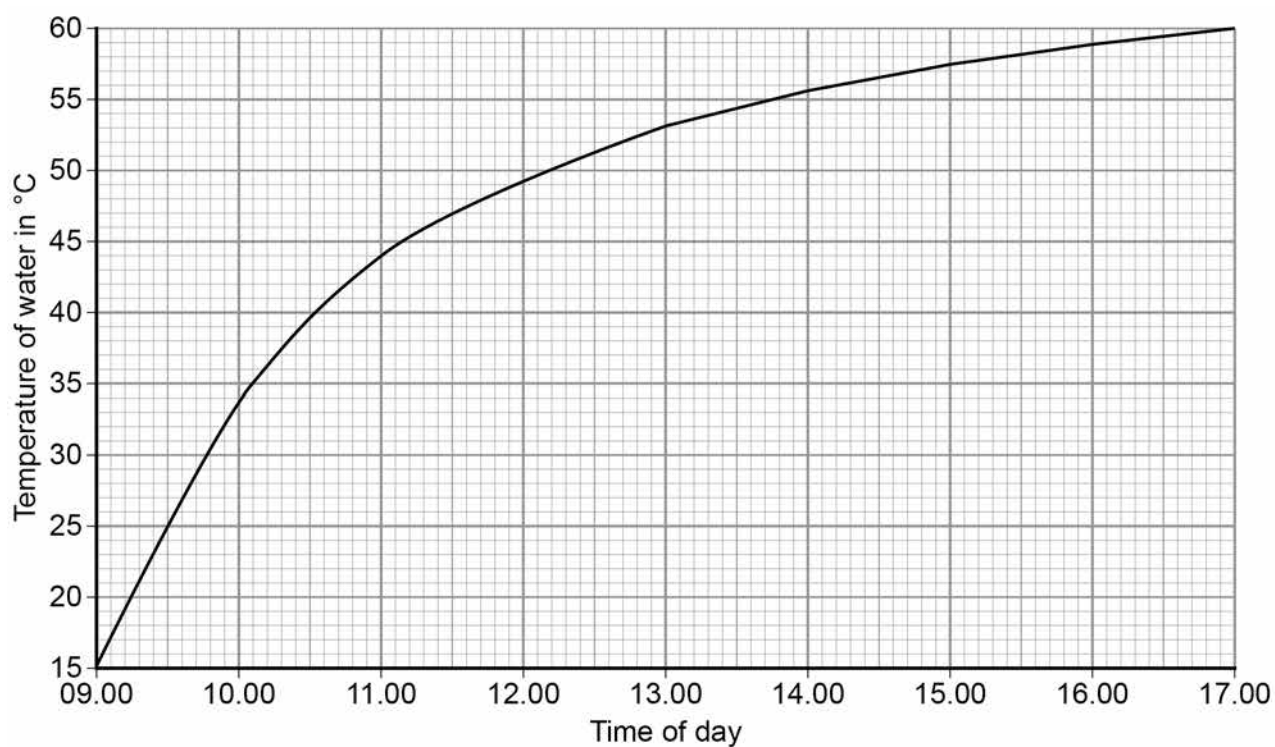


Figure 12



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

Turn over ►



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



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

Turn over ►



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.

☐

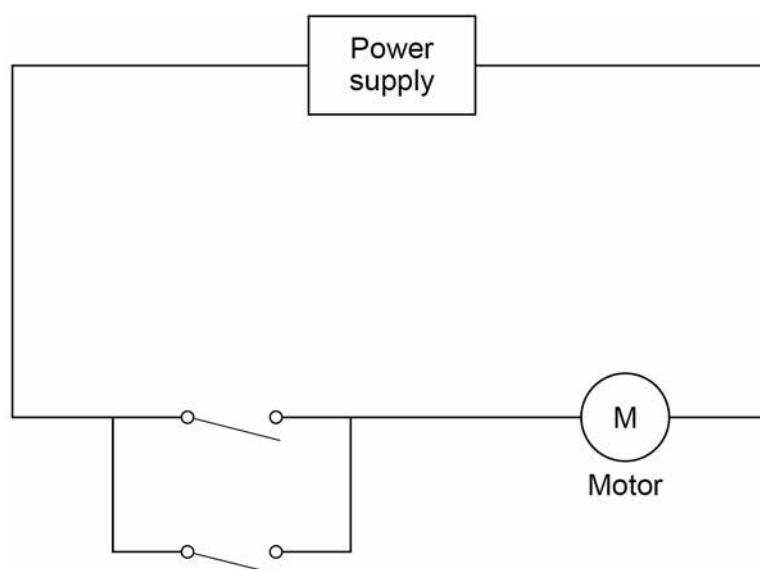
There are only four people in the lift.

☐

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]



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

Turn over ►



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]



1 0 . 2

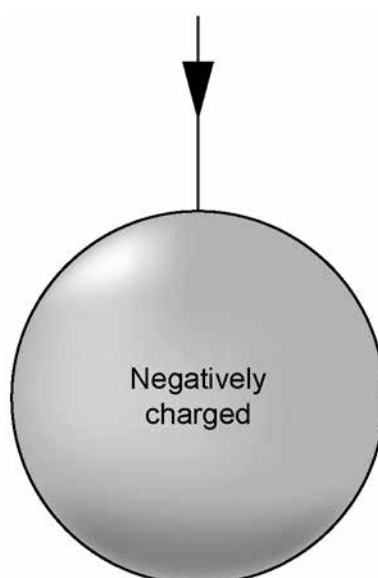
The student's head is represented by the sphere in **Figure 16**.

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]

Turn over ►



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



Turn over for the next question

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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



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]

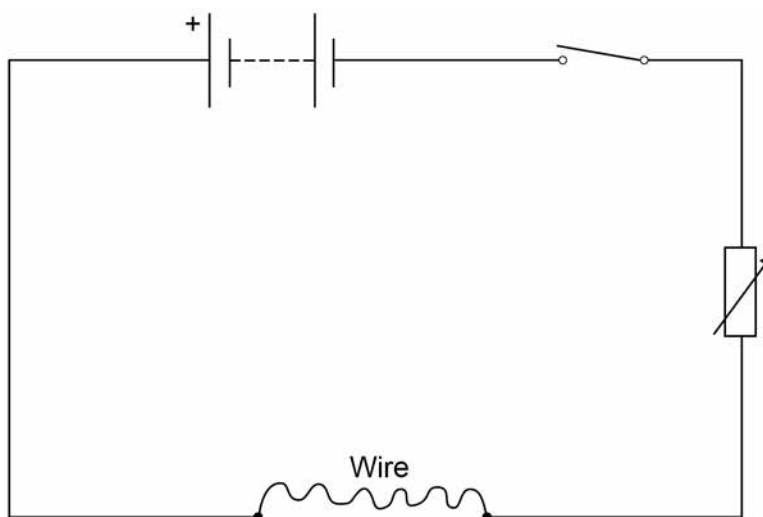


1	2
---	---

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]



[6 marks]

[illegible]

[1 mark]

7

11

10

10

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

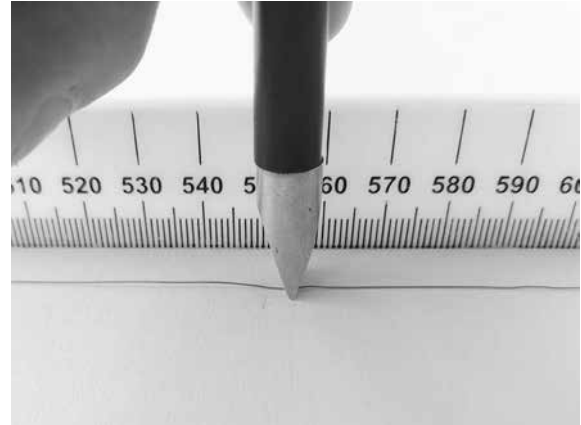
They could have used a piece of equipment called a 'jockey'.

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.

☐

END OF QUESTIONS



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3 5

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