AQA Style

GCSE

PHYSICS

H

Higher Tier Physics Paper 1

Time allowed: 1 hour 45 minutes

Materials

- A ruler
- A pen and pencil
- A calculator
- Physics Equation Sheet

Instructions

- Answer all the questions using a black pen.
- Answer the questions in the space available and cross out any work you do not want to be marked.
- In any calculations make sure you show your working out.
- The marks for each question are shown in brackets.
- The maximum mark for the paper is 100.
- You must make your work as neat as possible and use good English in your answers.

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

Name _____

Date _____

0 1 A chef wants to melt 0.5kg of chocolate.

0 1 . 1 The chef heats the chocolate over a pan of boiling water. The temperature of the chocolate increases by 9°C.

The energy transferred to the chocolate was 9450J.

Calculate the specific heat capacity of the chocolate.

Use the correct equation from the Physics Equation Sheet.

[3 marks]

specific heat capacity = _____ J/kg °C

0 1 . 2 When the chocolate reaches 30°C, it starts to melt.

The energy required for all of the chocolate to melt can be calculated using the equation:

thermal energy for a change of state = mass × specific latent heat

What is the difference between specific heat capacity and specific latent heat?

[2 marks]

0 1 . 3 Describe what happens to the temperature of the chocolate as it melts.

[1 mark]

0 1 . 4 Explain what will happen to the mass of the chocolate when it has all melted.

[2 marks]

0 1 . 5 Melting is an example of a physical change.

Explain why melting is a physical change rather than a chemical change.

[1 mark]

_____

_____

9

Turn over for the next question

0 2 **Figure 1** shows a person's hair becoming electrostatically charged when taking off a hat.

Figure 1

0 2 . 1 Explain what causes the person's hair to become charged.

[2 marks]

0 2 . 2 Explain why the person's hair stands on end.

[2 marks]

0 2 . 3 A group of scientists investigated whether the type of material a hat is made from affects the build-up of charge.

Table 1 shows the results of the investigation.

Table 1

Material	Charge (millicoulombs)		
	Repeat 1	Repeat 2	Mean
nylon	3.1	3.4	3.3
cotton	1.5	1.5	1.5
wool	2.4	2.6	2.5

Which material created the strongest electric field around the person's head?

[1 mark]

0 2 . 4 Suggest how the scientists could reduce the effect of random errors in the investigation.

[2 marks]

0 2 . 5 A different group of scientists repeated the experiment using the same method and got similar results.

Complete the sentence. Choose the answer from the box.

accurate	precise	repeatable	reproducible	valid

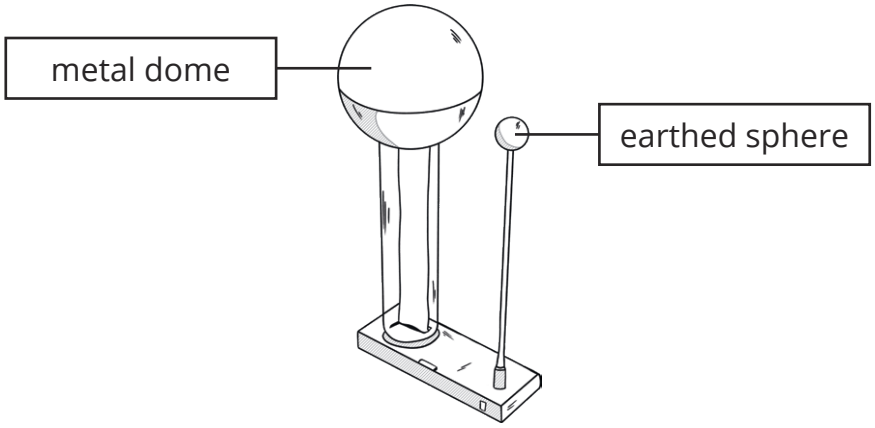
[1 mark]

The measurements were _____.

Question 2 continues on the next page.

0 2 . 6 **Figure 2** shows a Van de Graaff generator that is used to investigate static electricity.

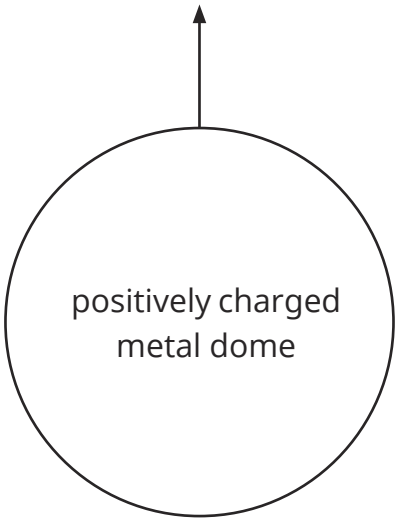
Figure 2



The dome of the Van de Graaff generator is represented by the circle in **Figure 3.**

The dome is positively charged. The arrow shows part of the electric field around the dome.

Figure 3



Draw **three** more arrows on **Figure 3** to complete the electric field pattern.

[1 mark]

0 2 . 7 The longer the Van de Graaff generator is kept on, the more charge is stored on the dome.

When the earthed sphere is moved into the electric field around the dome, a spark jumps between the two.

Explain why.

[2 marks]

11

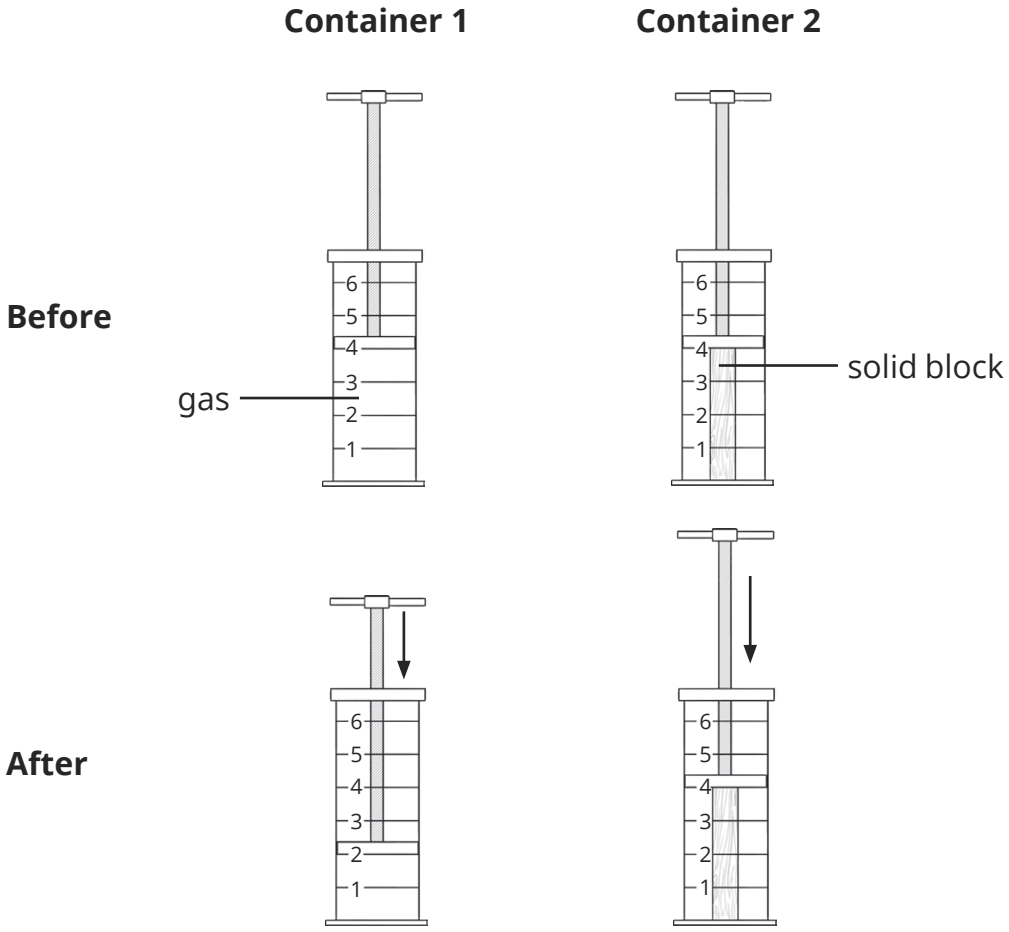
Turn over for the next question

0 3 A group of students are investigating the properties of solids and gases.

The students use two containers with lids that can be used as plungers. They fill the first container with gas and place a solid block into the second container.

Figure 4 shows the appearance of the two containers before and after pushing the plunger.

Figure 4



The students make two observations.

Observation 1: The gas fills the space in the container but the solid block does not.

Observation 2: The gas can be compressed (squashed) but the solid cannot.

0 3 . 1 Explain the students' observations.

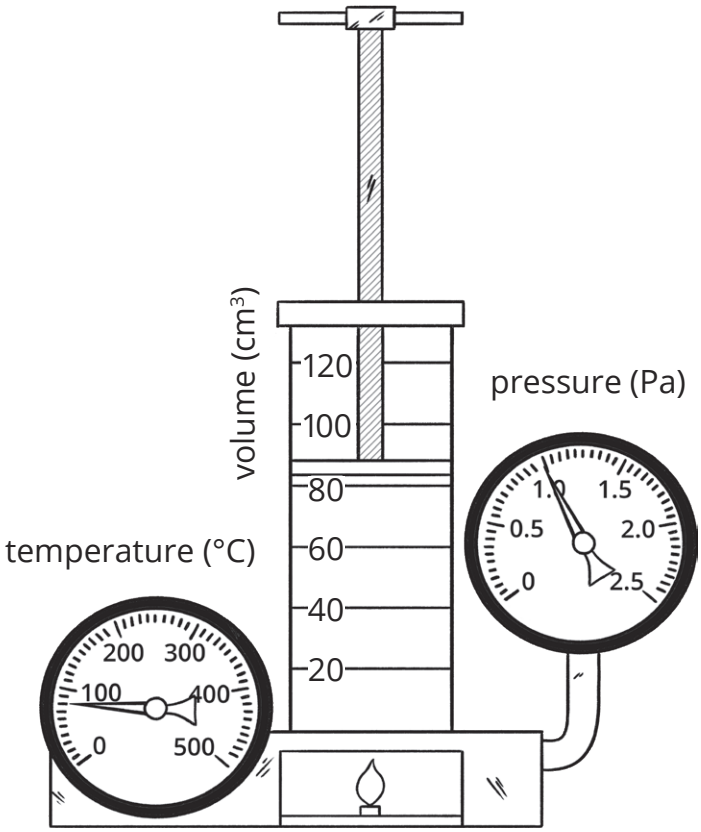
You should include your knowledge of:

- the spacing between particles;
- the movement of individual particles.

[6 marks]

0 3 . 2 **Figure 5** shows the container being used to measure the temperature and pressure of a gas.

Figure 5



Use information from **Figure 5** to determine the temperature of the gas.

[1 mark]

temperature = _____ °C

0 3 . 3 The lid of the container is secured so that the volume is kept constant.

The students increase the temperature of the gas.

Explain how increasing the temperature would change the pressure exerted by the gas.

[3 marks]

_____

_____

_____

_____

0 3 . 4 In a second investigation, the temperature of the gas is kept constant.

When the volume of the gas is 80cm^3, the pressure exerted by the gas is 1.2Pa.

The volume of the gas increases from 80cm^3 to 120cm^3.

Calculate the pressure of the gas when the volume is 120cm^3.

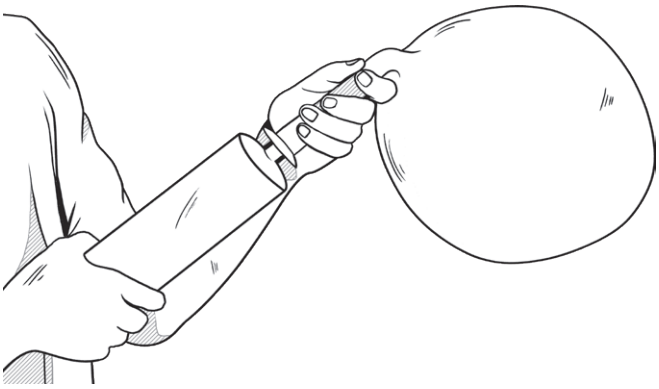
Use the correct equation from the Physics Equation Sheet.

[3 marks]

pressure = _____ Pa

0 3 . 5 **Figure 6** shows a balloon pump being used to fill a balloon with air.

Figure 6



The internal energy of the air increases as the balloon is inflated.

Explain why.

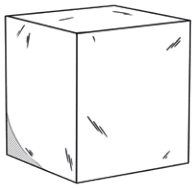
[2 marks]

15

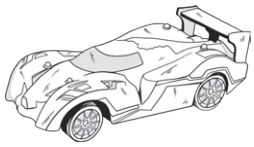
0 4 A group of students wanted to find out the density of the objects shown in **Figure 7.**

Figure 7

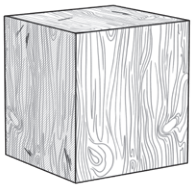
key



regular aluminium block



toy car



regular wooden block

0 4 . 1 Describe a method that could be used to calculate the density of the objects in **Figure 7.**

You should include:

- the equipment required;
- what would be measured;
- any calculations needed.

[6 marks]

0 4 . 2 A second group of students carried out a different investigation.

They put a small plastic ball in a beaker of water at room temperature. The ball sank.

They then put the same ball in a beaker of water cooled to 5°C. The ball floated.

Explain the students' observations.

[4 marks]

10

Turn over for the next question

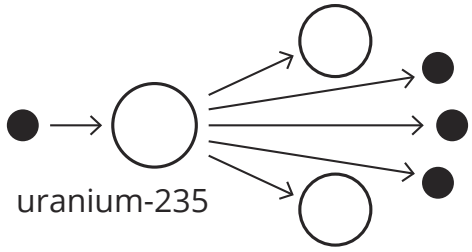
DO NOT WRITE ON THIS PAGE.

ANSWER IN THE SPACES PROVIDED.

0 5 The energy released from the nuclear fission of uranium-235 is used in nuclear power stations to generate electricity.

Figure 8 shows the process of nuclear fission.

Figure 8



0 5 . 1 The black dots in **Figure 8** represent particle **X**.

Name particle **X.**

[1 mark]

0 5 . 2 Explain how nuclear fission leads to a chain reaction.

[1 mark]

0 5 . 3 The nuclear fission of uranium also releases a gamma wave.

What happens to the mass of the uranium nucleus when a gamma wave is released?

[1 mark]

0 5 . 4 Some atomic nuclei decay spontaneously.

Figure 9 shows the nuclear equation for the decay of carbon-14 to nitrogen.

Figure 9

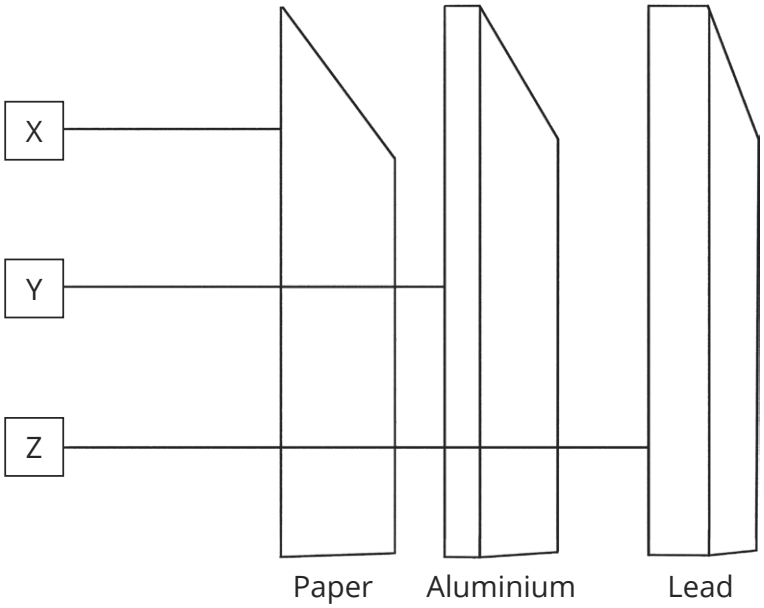
$$^{14}_{6}\mathbf{C} \longrightarrow {}^{0}_{-1}e + {}^{\square}_{\square}\mathbf{N}$$

Complete **Figure 9** to give the mass number and atomic number of nitrogen.

[1 mark]

0 5 . 5 **Figure 10** shows the penetration of three types of nuclear radiation through different materials.

Figure 10



Which letter represents the type of radiation emitted when carbon-14 decays?

[1 mark]

Tick **one** box.

X ☐

Y ☐

Z ☐

0 5 . 6 Carbon-12 and carbon-14 are isotopes of carbon. **Figure 11** shows a representation of each isotope of carbon.

Figure 11

$^{12}_{6}C$ $^{14}_{6}C$

What is an isotope?

[2 marks]

0 5 . 7 The half-life of carbon-14 is 5730 years.

What does 'half-life' mean?

[1 mark]

Question 5 continues on the next page.

0 5 . 8 Radiation can be measured by a Geiger-Müller tube and counter.

Table 2 shows the count-rate for a radioactive source over 8 hours.

Table 2

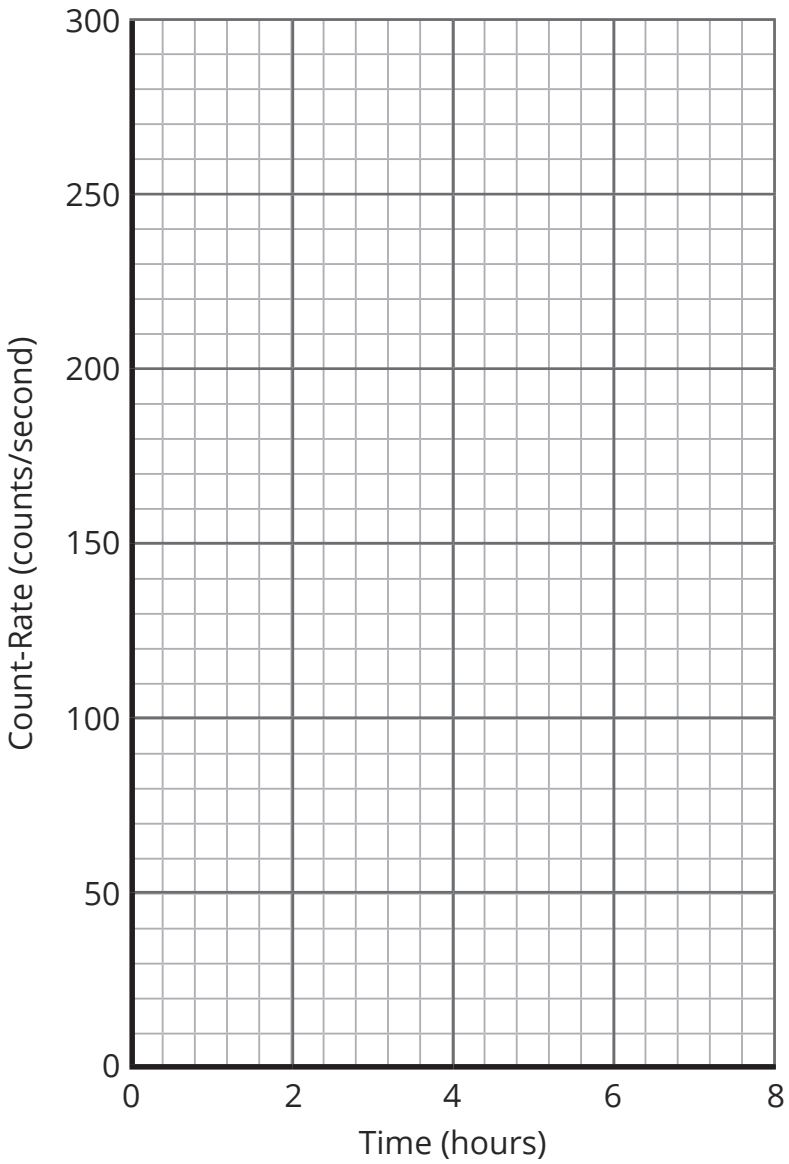
Time (hours)	Count Rate (counts/second)
0	280
2	190
4	140
6	100
8	70

Complete **Figure 12** using the results in **Table 2.**

Draw a line of best fit.

[3 marks]

Figure 12



0 5 . 9 Use your completed graph to determine the half-life of the radioactive isotope.

Show clearly on **Figure 12** how you obtain your answer.

[2 marks]

half-life = _____ hours

0 5 . 1 0 **Table 3** shows the count-rate for a second radioactive source. The source has a half-life of 2 days.

Table 3

Time (days)	Count Rate (counts/second)
0	8400
2	4200
4	2100
6	1050
8	525

Calculate the net decline in radioactive emissions after 3 half-lives.

Give your answer as a ratio.

[1 mark]

net decline = _____

14

0 6 **Figure 13** shows a toy helicopter. The helicopter is powered by a battery. When it is switched on, a motor causes the blades to spin. This lifts the helicopter into the air and it flies around the room.

Figure 13

Energy is transferred between different stores when the toy is used.

0 6 . 1 Complete the sentences. Choose answers from the box.

thermal	chemical	gravitational potential
electrical	kinetic	

[3 marks]

As the toy is used, the _____ energy store of the battery decreases.

This energy is transferred to the motor, then to a _____ energy store in the spinning blades.

As the toy accelerates upwards its _____ energy store increases.

0 6 . 2 Write down the equation that links energy transferred, power and time.

[1 mark]

_____

0 6 . 3 The toy can fly for 15 minutes before it needs to be recharged.

The power output of the battery is 4.8W.

Calculate the maximum energy stored by the battery.

[3 marks]

energy = _____ J

0 6 . 4 Some energy is wasted as heat or sound.

What happens to the wasted energy?

[1 mark]

0 6 . 5 A child used the toy when the battery was not fully charged.

The battery supplied 3200J of energy to the toy.

1920J of energy was usefully transferred.

Calculate the efficiency of the toy.

[2 marks]

efficiency = _____

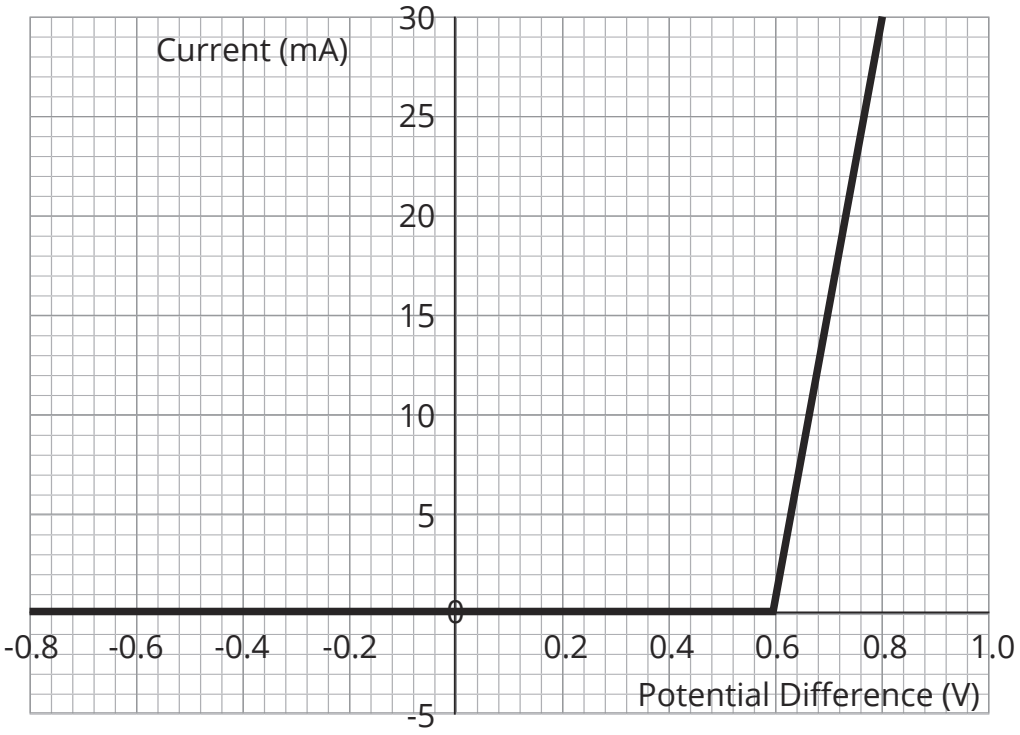
0 6 . 6 Suggest **one** way the efficiency of the toy could be increased.

[1 mark]

11

0 7 **Figure 14** shows the graph of the current through a component, Y, for different values of potential difference.

Figure 14



0 7 . 1 Draw the circuit symbol for component **Y.**

[1 mark]

0 7 . 2 Use information from **Figure 14** to calculate the current through component **Y** when the potential difference is 0.7V.

Give your answer in amps.

[2 marks]

current = _____ A

0 7 . 3 Calculate the resistance of component **Y** when the potential difference is 0.7V.

[3 marks]

resistance = _____ Ω

0 7 . 4 Component **Y** is connected in series with a lamp.

The total potential difference of the power supply is 0.5V.

What is the current through the lamp?

Explain your answer.

[3 marks]

current = _____ A

explanation _____

0 7 . 5 A second lamp is added to the circuit.

Suggest how the second lamp could be connected so that the total resistance of the lamps is as low as possible.

[2 marks]

11

0 8 The mains electricity supply in UK homes uses an alternating current.

0 8 . 1 What is an alternating current?

[1 mark]

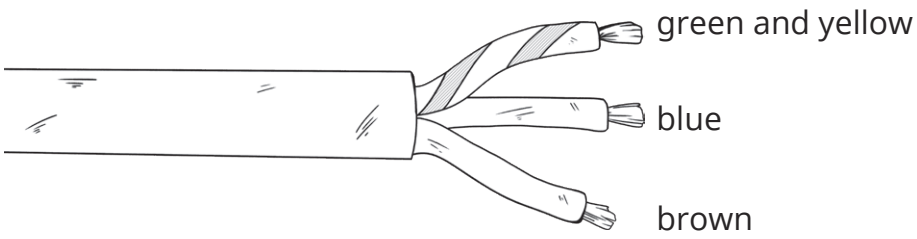
0 8 . 2 What is the potential difference of the domestic electricity supply in the UK?

Give the unit.

[1 mark]

0 8 . 3 **Figure 15** shows the wires inside a cable. There are three different coloured wires.

Figure 15



The cable is connected to a games console. The games console has a metal case.

Explain why it would be dangerous for the brown wire to touch the metal case.

[2 marks]

0 8 . 4 The National Grid is a system of cables and transformers linking power stations to consumers.

Explain why **step-up** transformers are used in the National Grid.

[3 marks]

7

Turn over for the next question

0 9 Between July and September 2019, renewable energy sources were used to generate more electricity than fossil fuels for the first time in the UK.

0 9 . 1 What does 'renewable energy source' mean?

[1 mark]

0 9 . 2 Half of the electricity that was generated from renewable energy sources came from wind turbines.

The remaining electricity (excluding renewable sources and fossil fuels) was generated from nuclear fuels.

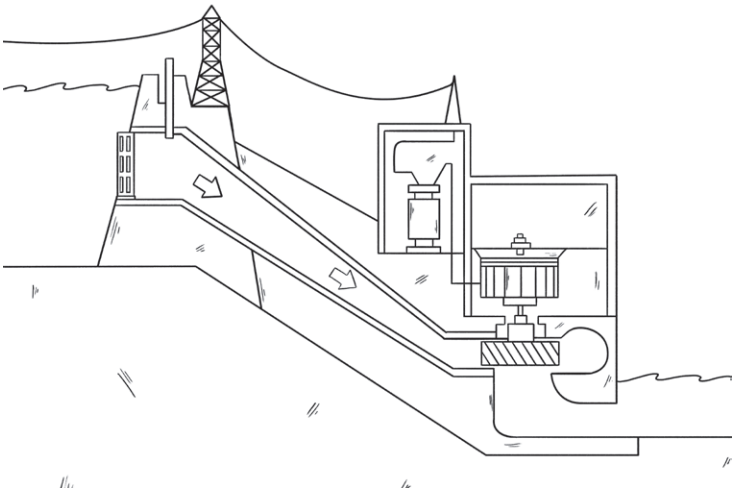
Evaluate the use of wind turbines and nuclear power stations for generating electricity.

[6 marks]

0 9 . 3 Some of the electricity generated from renewable sources came from hydroelectric power stations.

Figure 16 shows an example of a hydroelectric power station. Electricity is generated when the water flows at speed from the reservoir at the top to the reservoir at the bottom. The flowing water turns turbines that are attached to generators to produce electricity.

Figure 16



1000kg of water is released from the reservoir.

It travels down the slope at 20m/s.

Gravitational field strength on Earth = 9.8N/kg

Calculate the height of the top reservoir, assuming that no energy is transferred to the surroundings.

[5 marks]

height = _____ m

12

END OF QUESTIONS