AQA Style

GCSE

COMBINED SCIENCE: TRILOGY

H

Higher Tier Physics Paper 1

Time allowed: 1 hour 15 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 70.
- 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	
Total	

Name _____

Date _____

BEYOND SCIENCE

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

0 1 . 1 Describe the movement of particles in the chocolate before it is heated.

[1 mark]

0 1 . 2 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 . 3 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 . 4 Describe what happens to the temperature of the chocolate as it melts.

[1 mark]

0 1 . 5 Explain what will happen to the mass of the chocolate when it has all melted.

[2 marks]

0 1 . 6 Melting is an example of a physical change.

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

[1 mark]

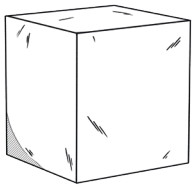
10

Turn over for the next question

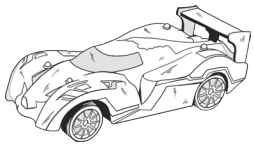
0 2 A group of students wanted to find out the density of the objects shown in **Figure 1.**

Figure 1

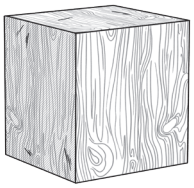
key



regular aluminium block



toy car



regular wooden block

0 2 . 1 Which unit is used to measure density?

Tick **one** box.

[1 mark]

m/cm^2 ☐

N/Kg ☐

kg/m^3 ☐

m/s^2 ☐

0 2 . 2 Describe a method that could be used to calculate the density of the objects in **Figure 1.**

You should include:

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

[6 marks]

0 2 . 3 Explain how the density of water changes when it is heated.

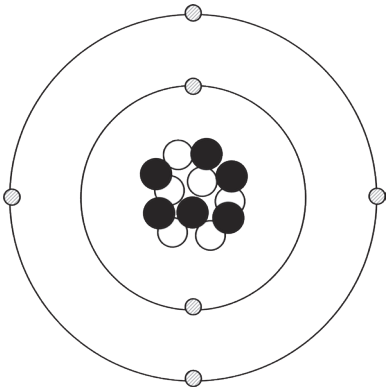
[3 marks]

10

0 3 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 3 . 1 Name the **two** subatomic particles found in the nucleus of an atom.

[1 mark]

1. _____

2. _____

0 3 . 2 Explain why an atom has no overall charge.

You should refer to the subatomic particles in your explanation.

[2 marks]

_____

_____

_____

0 3 . 3 Carbon-12 and carbon-14 are isotopes of carbon. **Figure 3** shows a representation of each isotope.

Figure 3

[1 mark]

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

What are isotopes?

_____

_____

0 3 . 4 **Figure 4** shows the nuclear equation for the decay of carbon-14 to nitrogen.

Figure 4

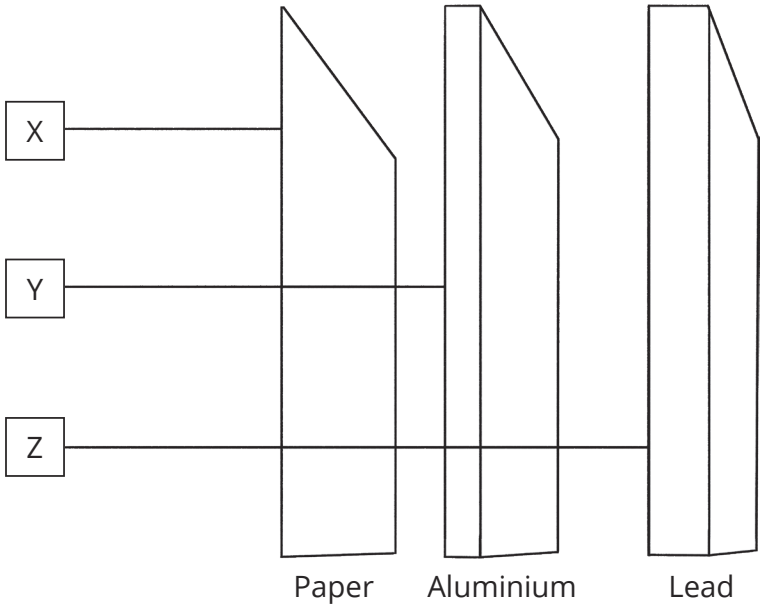
$$^{14}_{6}\mathbf{C} \longrightarrow {}^{0}_{-1}e + {}^{\square}_{\square}\mathbf{N}$$

Complete **Figure 4** to give the mass number and atomic number of nitrogen.

[1 mark]

0 3 . 5 The penetration of three types of nuclear radiation through materials is shown in **Figure 5**.

Figure 5



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

[1 mark]

Tick **one** box.

X ☐

Y ☐

Z ☐

0 3 . 6 The half-life of carbon-14 is 5730 years.

What does 'half-life' mean?

[1 mark]

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

0 3 . 7 **Table 1** shows the count-rate for a radioactive source over 8 hours.

Table 1

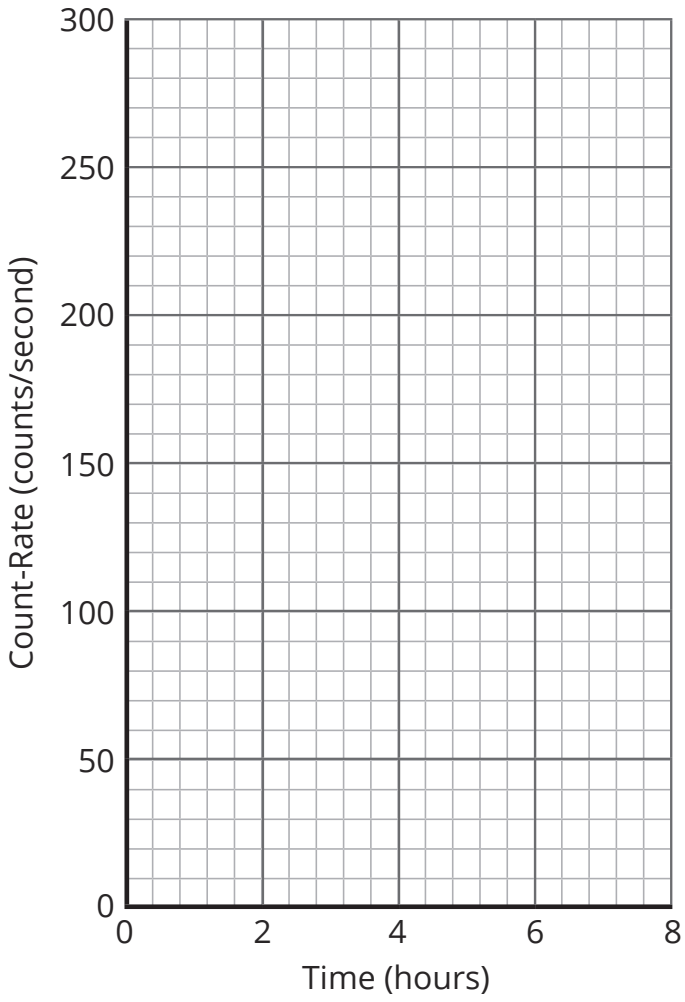
Time (hours)	Count Rate (counts/second)
0	280
2	190
4	140
6	100
8	70

Complete **Figure 6** using the results in **Table 1**.

Draw a line of best fit.

[3 marks]

Figure 6



0 3 . 8 Use your completed graph to determine the half-life of the radioactive isotope.

Show clearly on **Figure 6** how you obtain your answer.

[2 marks]

half-life = _____ hours

0 3 . 9 **Table 2** shows the count-rate for a second radioactive source. The source has a half-life of 2 days.c

Table 2

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 4 **Figure 7** 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 7

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

0 4 . 1 Use words from the box to complete the sentences.

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 4 . 2 Write down the equation that links energy transferred, power and time.

[1 mark]

_____

0 4 . 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 4 . 4 Some energy is wasted as thermal energy or sound energy.

What happens to the wasted energy?

[1 mark]

0 4 . 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 = _____

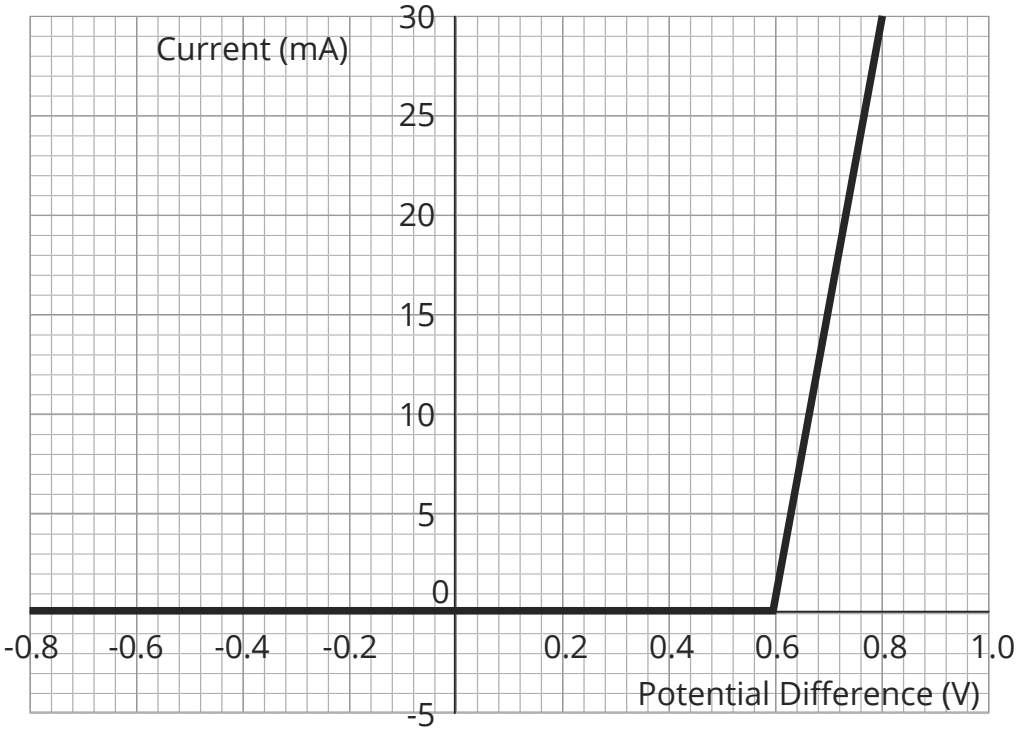
0 4 . 6 Give **one** way the efficiency of the toy could be increased.

[1 mark]

11

0 5 **Figure 8** shows the graph of the current through a component, **Y**, for different values of potential difference.

Figure 8



0 5 . 1 Draw the circuit symbol for the component.

[1 mark]

0 5 . 2 Use information from **Figure 8** to calculate the current through component **Y** when the potential difference is 0.7V.

Give your answer in amps.

[2 marks]

current = _____ A

0 5 . 3 Calculate the resistance of component **Y** when the potential difference is 0.7V.

Give your answer to 3 significant figures.

[3 marks]

resistance = _____ Ω

6

0 6 The mains electricity supply in UK homes uses an alternating current.

0 6 . 1 What is an alternating current?

[1 mark]

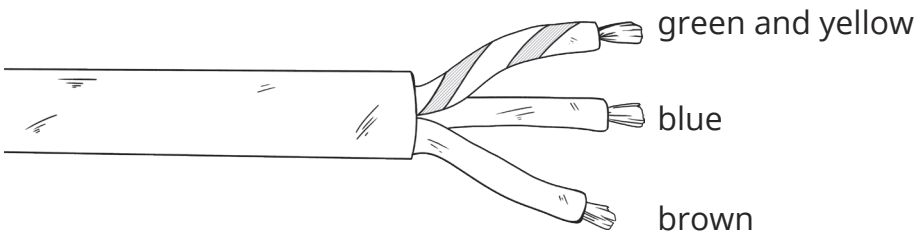
0 6 . 2 What is the potential difference of the domestic electricity supply in the UK?

Give the unit.

[1 mark]

0 6 . 3 **Figure 9** shows the wires inside a cable. There are three different coloured wires.

Figure 9



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 6 . 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 7 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 7 . 1 What does 'renewable' mean?

[1 mark]

0 7 . 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.

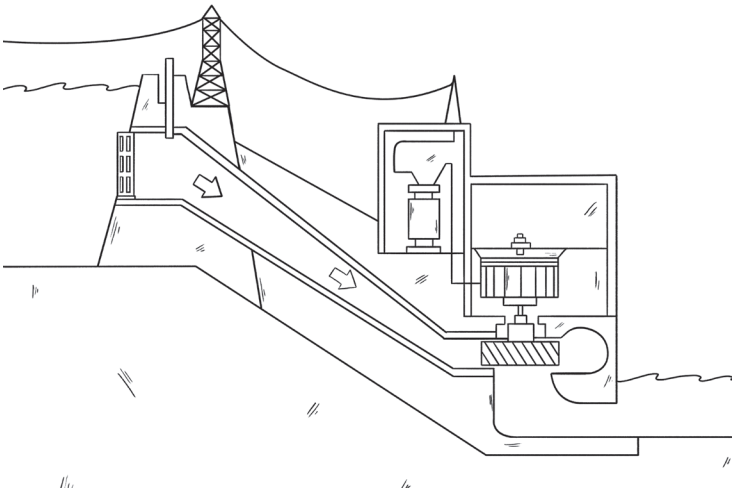
Evaluate the use of wind turbines and nuclear power stations for generating electricity.

[6 marks]

0 7 . 3 Some of the electricity generated from renewable sources came from hydroelectric power stations.

Figure 10 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 10



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.

Give your answer to 3 significant figures.

[5 marks]

height = _____ m

12

END OF QUESTIONS