AQA

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier Paper 5: Physics 1F

Specimen 2018 Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a ruler
- a calculator
- the Physics Equation Sheet (enclosed).

Instructions
- 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.

Information
- There are 70 marks available on this paper.
- 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.
- When answering questions 05.1 and 07.5 you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.

Advice
- In all calculations, show clearly how you work out your answer.

Please write clearly, in block capitals.

Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

Surname

Forename(s)

Candidate signature _____

0 1 Most electrical appliances are connected to the mains electricity using three-core cables.

0 1 . 1 What is the approximate value of the potential difference of the UK mains electricity supply?

Tick **one** box.

[1 mark]

23 V ☐

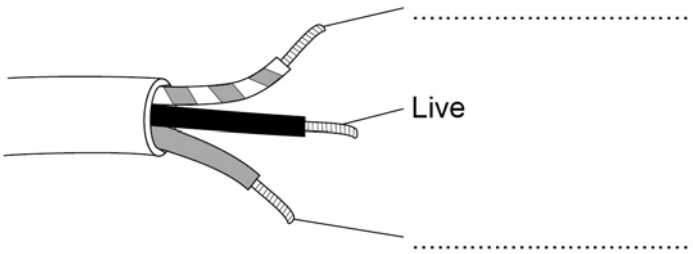
230 V ☐

300 V ☐

350 V ☐

Figure 1 shows a three-core cable.

Figure 1



0 1 . 2 Use answers from the box to label the wires and complete **Figure 1**.

[2 marks]

Earth	**Negative**	**Neutral**

0 1 . 3 In the UK the three wires in a three-core cable are always the same colours.

Why are the wires always the same colours?

Tick **one** box

[1 mark]

Each wire is made by a different company. ☐

It is easy to identify each wire. ☐

They are cheaper to manufacture. ☐

0 1 . 4 Touching the live wire is dangerous.

Use answers from the box to complete the sentences.

[2 marks]

current	**resistance**	**shock**	**force**	**voltage**

Touching the live wire causes a large potential difference to exist across the body.

This causes a _____ through the body,

which results in an electric _____

0 1 . 5 What is the approximate frequency of the UK mains electricity supply?

Tick **one** answer.

[1 mark]

50 Hz ☐

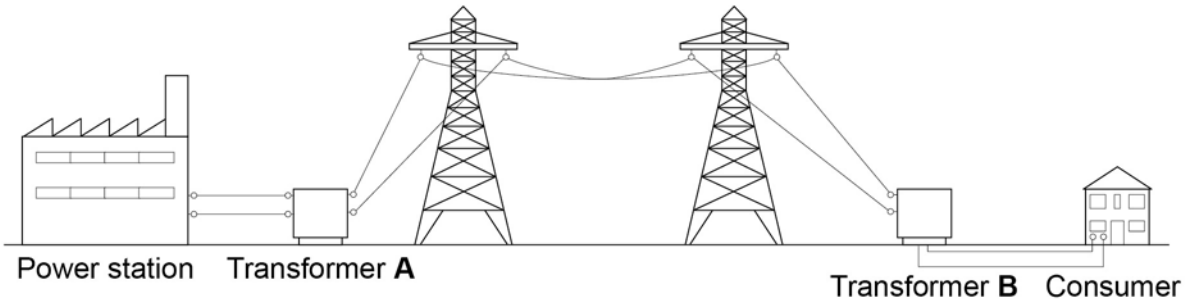
75 Hz ☐

100 Hz ☐

150 Hz ☐

Figure 2 shows how power stations transfer electrical power to consumers using the National Grid.

Figure 2



0 1 . 6 The power station generates electricity at a voltage of 25 kV.

Transformer **A** increases the voltage by a factor of 16.

What is the voltage output of transformer **A**?

[2 marks]

Output voltage = _____ kV

0 1 . 7 Why is the voltage increased by transformer **A**?

Tick **one** box.

[1 mark]

- To reduce the energy lost due to heating ☐
- To increase the power ☐
- To increase the current ☐

0 1 . 8 Why is it important that the voltage is decreased by transformer **B**?

Tick **one** box.

[1 mark]

- Less energy is used by consumers ☐
- It is safer for consumers ☐
- It reduces consumers' electricity bills ☐

Turn over for the next question

0 2 The nuclei of some isotopes are radioactive.

0 2 . 1 Which of the following statements could apply to a radioactive nucleus?

[1 mark]

Tick **one** box.

The nucleus will emit an atom. ☐

The nucleus will emit light. ☐

The nucleus will emit a neutron. ☐

The nucleus will emit sound. ☐

0 2 . 2 Potassium-40 is a radioactive isotope present in food, such as bananas.

The following equation shows how potassium-40 will decay into calcium-40

$$^{40}_{19}\text{potassium} \longrightarrow {}^{40}_{20}\text{calcium} + {}^{0}_{-1}\text{e}$$

Give one similarity and one difference between nuclei of potassium-40 and calcium-40

[2 marks]

Similarity

Difference

0 2 . 3 The activity of a sample of potassium-40 is measured 3 times.

The measurements are given below.

4906 Bq **4956 Bq** **4889 Bq**

Which of the following statements explains why the readings are different?

[1 mark]

Tick **one** box.

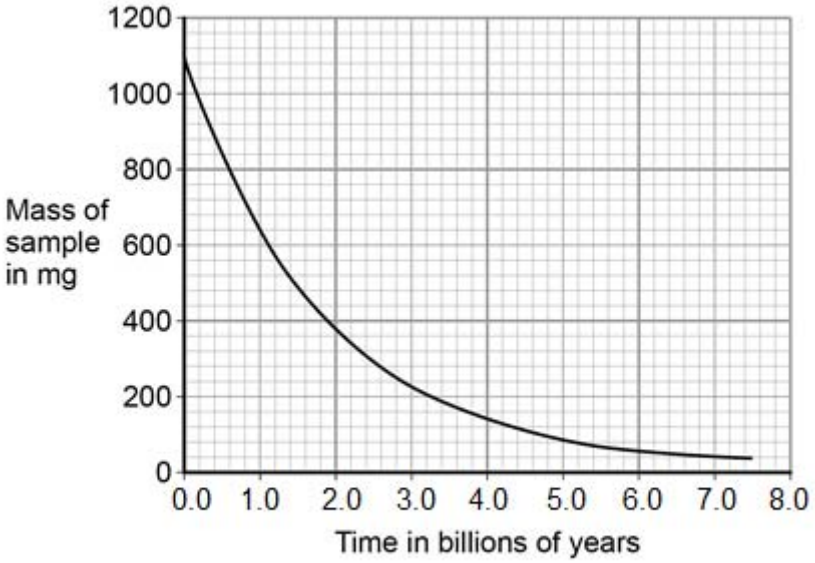
Radioactive decay is constant. ☐

Radioactive decay is hazardous. ☐

Radioactive decay is random. ☐

0 2 . 4 **Figure 3** shows how the activity of a sample of potassium-40 changes over time.

Figure 3



Use **Figure 3** to determine the half-life of potassium-40.

[2 marks]

Half-life = _____ billion years

0 2 . 5 When food is eaten, some of the radiation the food emits is detectable outside the body.

Which type of radiation would not be detectable outside the body?

Tick **one** box.

[1 mark]

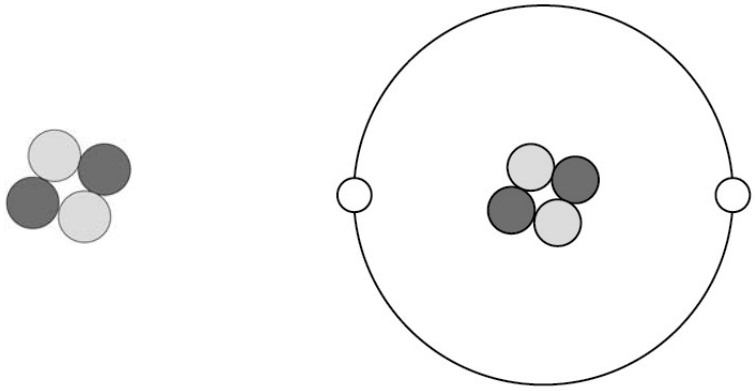
alpha ☐

beta ☐

gamma ☐

0 3 **Figure 4** is a diagram of an alpha particle and a helium atom.

Figure 4



Alpha particle Helium atom

0 3 . 1 What is the approximate size of a helium atom?

Tick **one** box.

[1 mark]

1×10^{-5} m ☐

1×10^{-10} m ☐

1×10^{-15} m ☐

1×10^{-20} m ☐

0 3 . 2 A helium atom is much larger than an alpha particle.

Give **one** other difference between a helium atom and an alpha particle.

[1 mark]

0 3 . 3 What is the atomic number of the helium atom in **Figure 4**?

Tick **one** box.

[1 mark]

2 ☐

4 ☐

6 ☐

8 ☐

0 3 . 4 What is the charge on the helium atom in **Figure 4**?

Explain your answer.

[3 marks]

0 3 . 5 Helium is a gas that occurs naturally.

There is very little helium on Earth.

Helium has important uses in medicine and is also used to inflate party balloons.

Some scientists believe that helium should **not** be used to inflate party balloons.

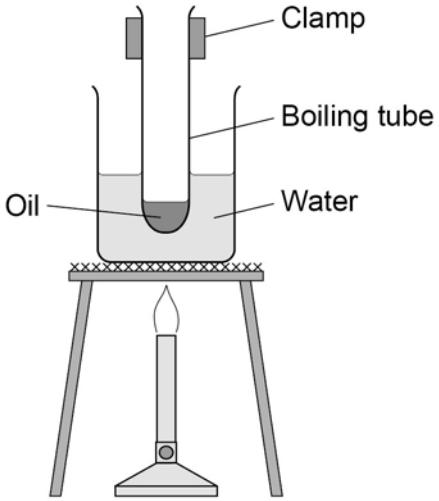
Why?

[2 marks]

0 4 A student investigated the change in temperature when oils of different specific heat capacities were heated.

She set up the apparatus shown in **Figure 5**.

Figure 5



This is the method used.

1. Put 25 g of oil into a boiling tube.
2. Pour 100 ml of water into a beaker and heat it with a Bunsen burner.
3. When the water is boiling, put the boiling tube into the beaker.
4. When the temperature of the oil reaches 30 °C, heat for a further 30 seconds and record the rise in temperature.
5. Repeat with different oils.
6. Repeat the whole investigation.

0 4 . 1 Name **two** pieces of apparatus the student used that are **not** shown in **Figure 5**.

[2 marks]

1 _____

2 _____

0 4 . 2 What are the independent and dependent variables in the student's investigation?

[2 marks]

Independent

Dependent

0 4 . 3 Give **two** safety precautions the student should have taken.

[2 marks]

1

2

0 4 . 4 Suggest **one** improvement to the student's method.

[2 marks]

Table 1 shows the student's results.

Table 1

	Temperature rise in °C			
Type of oil	**1**	**2**	**3**	**Mean**
Castor oil	20	19	21	20
Linseed oil	19	18	19	19
Mineral oil	21	21	21	21
Olive oil	17	17	18	
Sesame oil	23	23	20	22

0 4 . 5 Calculate the mean temperature rise for olive oil.

Give your answer to two significant figures.

[2 marks]

Mean temperature rise = _____ °C

0 4 . 6 The mean change in temperature of the castor oil is 20 °C

The specific heat capacity of castor oil is 1 800 J/kg °C

The mass of oil used is 0.025 kg

Calculate the change in thermal energy of the castor oil the student used.

Use the correct equation from the Physics Equations Sheet.

Select the correct unit from the box.

joule	**newton**	**volt**

[3 marks]

Change in thermal energy = _____

Unit _____

Turn over for the next question

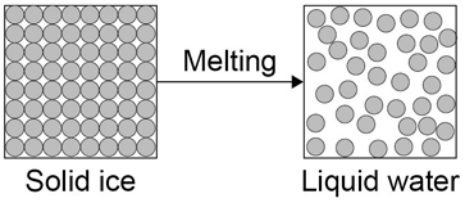
0 5 **Figure 6** shows solid ice on a car's rear window.

Figure 6

The glass window contains an electrical heating element.

0 5 . 1 Use the particle model in **Figure 7** to describe how the heating element causes the arrangement of the ice particles to change as the ice melts.

Figure 7



You should include a description of how the particles are arranged in the solid ice and in the water.

[6 marks]

0 5 . 2 A car manufacturer tests different heating elements by measuring how long it takes ice to melt.

During the test some variables must be controlled.

Identify **two** control variables in the car manufacturer's test.

[2 marks]

Tick **two** boxes.

- The colour of the car ☐
- The current in the heating element ☐
- The mass of ice ☐
- The size of the car ☐
- The time taken for the ice to melt ☐

Question 5 continues on the next page

Some of the energy supplied by the heater causes the ice to melt without the temperature of the ice increasing.

0 5 . 3 What is the name given to this energy supplied by the heater?

[1 mark]

Tick **one** box.

Latent heat of freezing ☐

Latent heat of fusion ☐

Latent heat of vaporisation ☐

0 5 . 4 When the heater is supplied with 120 J of energy each second, the internal energy of the ice increases by 45 J each second.

Use the following equation to calculate the efficiency of the heater.

$$\text{Efficiency} = \frac{\text{output energy transfer}}{\text{input energy transfer}}$$

Give your answer to two decimal places.

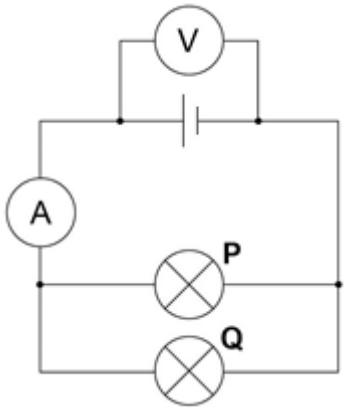
[2 marks]

Efficiency = _____

0 6 **Figure 8** shows a circuit diagram containing two identical lamps arranged in parallel.

The reading on the ammeter is 186 mA.

Figure 8



0 6 . 1 Which statement about the current through the lamps is true?

[1 mark]

Tick **one** box.

The current through both lamp **P** and lamp **Q** is **0.093 A** ☐

The current through both lamp **P** and lamp **Q** is **0.186 A** ☐

The current through both lamp **P** and lamp **Q** is **0.93 A** ☐

The current through both lamp **P** and lamp **Q** is **1.86 A** ☐

0 6 . 2 One of the lamps breaks and is not replaced.

Which statement about the current in the other lamp is true?

Tick **one** box.

[1 mark]

The current through the lamp is **0.093 A** ☐

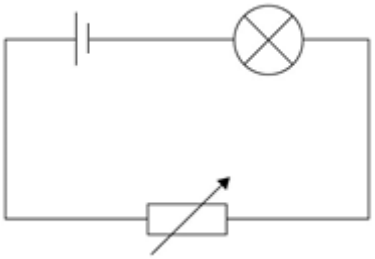
The current through the lamp is **0.186 A** ☐

The current through the lamp is **0.93 A** ☐

The current through the lamp is **1.86 A** ☐

Figure 9 shows a circuit that can be used to alter the brightness of a lamp.

Figure 9



0 6 . 3 The resistance of the variable resistor is increased.

What effect will this have on the brightness of the lamp?

Explain your answer.

[2 marks]

When the potential difference across the lamp is 3.3 V, the current is 0.15 A.

0 6 . 4 Write down the equation that links current, potential difference and resistance.

[1 mark]

Equation _____

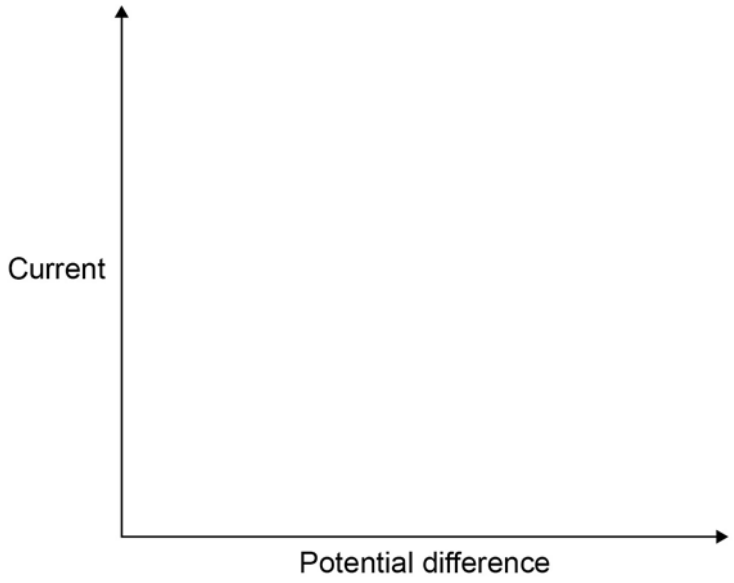
0 6 . 5 Calculate the resistance of the lamp.

[3 marks]

Resistance = _____ Ω

0 6 . 6 Sketch a current–potential difference graph for a filament lamp.

[1 mark]



Turn over for the next question

0 7 **Figure 10** shows a battery operated remote control car.

Figure 10

0 7 . 1 The car's battery contains a store of energy.

As the car moves, energy from one store is transferred to another store.

Describe how different stores of energy change as the car moves.

[2 marks]

The car has a top speed of 12 m/s and a mass of 800 g.

0 7 . 2 Write down the equation that links kinetic energy, mass and speed.

[1 mark]

Equation _____

0 7 . 3 Calculate the maximum kinetic energy of the car.

[2 marks]

Maximum kinetic energy = _____ J

0 7 . 4 Explain why having a more efficient motor increases the top speed of the car.

[2 marks]

Question 7 continues on the next page

Figure 11 shows an electric car being charged.

Figure 11

0 7 . 5 A driver wishes to buy a new car.

Table 2 gives some data about an electric car and one with a petrol engine.

Table 2

	Electric car	**Petrol engine car**
Cost (£)	27 000	15 000
Running cost per year (£)	250	2 000
Average lifetime (years)	12	12

Which car would be the most economic over its 12 year lifetime?

Use data from **Table 2** to support your answer.

You should include the difference in cost in your answer.

[4 marks]

END OF QUESTIONS

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