AQA

Please write clearly in block capitals.

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

Surname ____________________

Forename(s) ____________________

Candidate signature ____________________

GCSE
ADDITIONAL SCIENCE
PHYSICS

F

Foundation Tier   Unit Physics P2

Friday 17 June 2016   Morning   Time allowed: 1 hour

Materials

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

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 9(d) should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

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

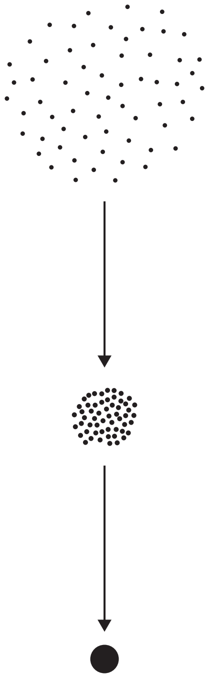
Answer **all** questions in the spaces provided.

1 (a) **Figure 1** shows how a star is formed.

Use **one** answer from each box to complete the sentences in **Figure 1**.

[3 marks]

Figure 1



gas	**rock**	**water**

A star starts as a huge cloud of dust and ____________________ particles in space.

friction	**fusion**	**gravity**

The force of ____________________ pulls the particles in the cloud closer together.

protostar	**red giant**	**white dwarf**

The compressed mass of particles

forms a ____________________ .

1 (b) Elements heavier than iron are formed in a supernova.
What is a supernova?

[1 mark]

Tick (✓) **one** box.

the explosion of a massive star ☐

a very bright, hot young star ☐

a very cool super giant star ☐

1 (c) Brown dwarf stars are small stars too cool to give out visible light. They were first discovered in 1995. Scientists think that there are millions of these stars spread throughout the Universe.

Which **one** of the following is the most likely reason why brown dwarf stars were not discovered before 1995?

[1 mark]

Tick (✓) **one** box.

Brown dwarf stars did not exist before 1995. ☐

Scientists were looking in the wrong part of the Universe. ☐

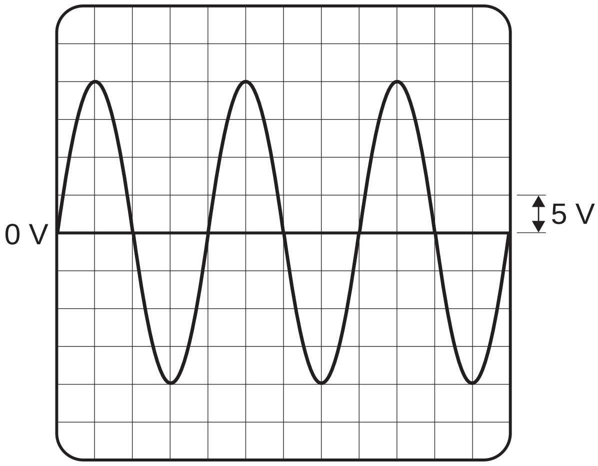
The telescopes and measuring instruments were not sensitive enough. ☐

5

Turn over for the next question

2 (a) **Figure 2** shows the oscilloscope trace an alternating current (a.c.) electricity supply produces.

Figure 2



One vertical division on the oscilloscope screen represents 5 volts.

Calculate the peak potential difference of the electricity supply.

[1 mark]

____

Peak potential difference = ____________________ V

2 (b) Use the correct answer from the box to complete the sentence.

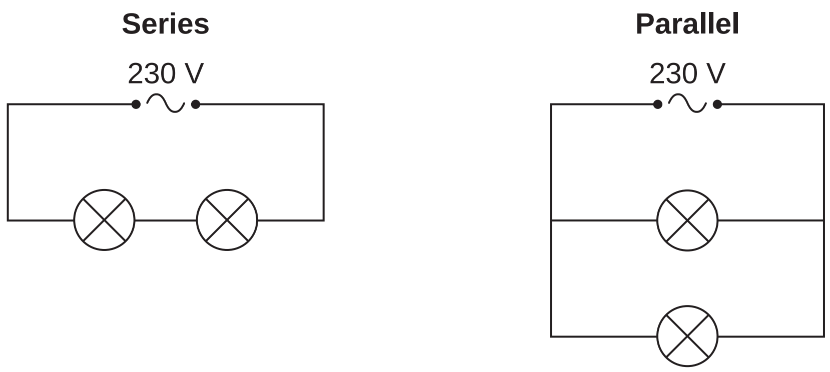
[1 mark]

40	**50**	**60**

In the UK, the frequency of the a.c. mains electricity supply is ________________ hertz.

2 (c) **Figure 3** shows how two lamps may be connected in series or in parallel to the 230 volt mains electricity supply.

Figure 3



2 (c) (i) Calculate the potential difference across each lamp when the lamps are connected in **series**.
The lamps are identical.

[1 mark]

____

Potential difference when in series = ____________ V

2 (c) (ii) What is the potential difference across each lamp when the lamps are connected in **parallel**?

[1 mark]

Tick (✓) **one** box.

115 V ☐ 230 V ☐ 460 V ☐

2 (c) (iii) Give **one** advantage of connecting the lamps in parallel instead of in series.

[1 mark]

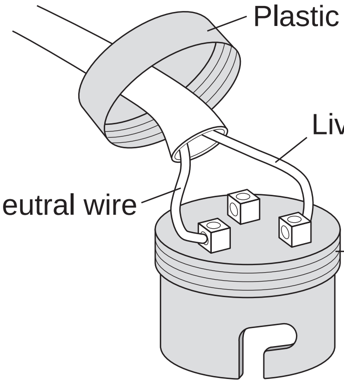
____

____

Question 2 continues on the next page

2 (d) **Figure 4** shows the light fitting used to connect a filament light bulb to the mains electricity supply.

Figure 4



The light fitting does **not** have an earth wire connected.

Explain why the light fitting is safe to use.

[2 marks]

____

____

____

____

2 (e) A fuse can be used to protect an electrical circuit.

Name a different device that can also be used to protect an electrical circuit.

[1 mark]

____

8

Turn over for the next question

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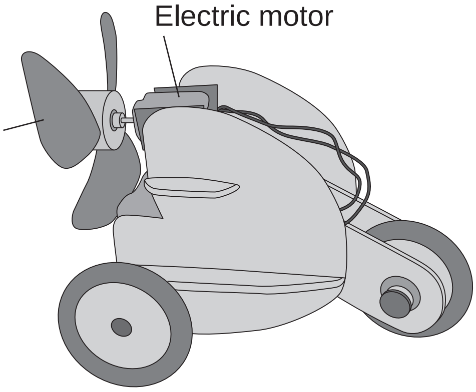
ANSWER IN THE SPACES PROVIDED

Turn over ▶

3 **Figure 5** shows an air-driven toy.
When the electric motor is switched on the fan rotates.
The fan pushes air backwards making the toy move forwards.

Figure 5



3 (a) (i) The toy has a mass of 0.15 kg and moves forward with a velocity of 0.08 m/s.

How is the momentum of the toy calculated?

[1 mark]

Tick (✓) **one** box.

0.15 + 0.08 = 0.230 ☐

0.15 ÷ 0.08 = 1.875 ☐

0.15 × 0.08 = 0.012 ☐

3 (a) (ii) What is the unit of momentum?

[1 mark]

Tick (✓) **one** box.

kg m/s ☐ m/s^2 ☐ kg/m/s ☐

3 (a) (iii) Use the correct answer from the box to complete the sentence.

[1 mark]

less than	**equal to**	**more than**

The momentum of the air backwards is ____________________________________ the momentum of the toy forwards.

3 (b) The electric motor can rotate the fan at two different speeds.

Explain why the toy moves faster when the fan rotates at the higher of the two speeds.

[2 marks]

____

____

____

____

5

Turn over for the next question

4 (a) Uranium has two natural isotopes, uranium-235 and uranium-238.

Use the correct answer from the box to complete the sentence.

[1 mark]

electrons	**neutrons**	**protons**

The nucleus of a uranium-238 atom has three more ______________________________ than the nucleus of a uranium-235 atom.

4 (b) Uranium-235 is used as a fuel inside a nuclear reactor.
Energy is released from nuclear fuels by the process of nuclear fission.

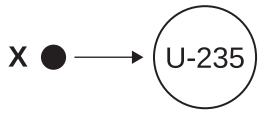
What is the energy released from nuclear fuels inside a nuclear reactor used for?

[1 mark]

____

4 (c) **Figure 6** shows the nucleus of an atom of uranium-235 (U-235) about to undergo nuclear fission.

Figure 6



4 (c) (i) Before nuclear fission can happen the nucleus of a uranium atom has to absorb the particle labelled **X**.

What is particle **X**?

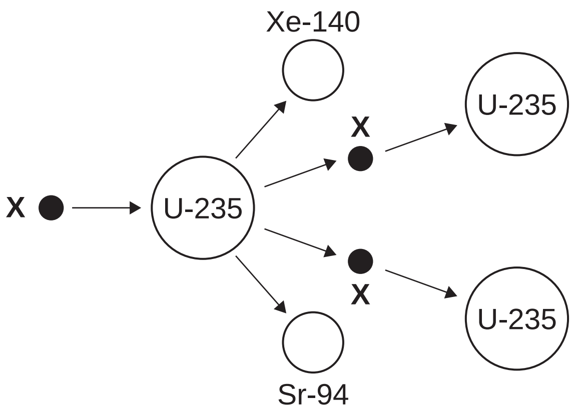
[1 mark]

Tick (✓) **one** box.

an electron ☐ a neutron ☐ a proton ☐

4 (c) (ii) The process of nuclear fission, shown in **Figure 7**, causes the nucleus of the uranium-235 (U-235) atom to split apart and release two of the particles **X**.

Figure 7



Complete **Figure 7** to show how the particles **X start** a chain reaction.

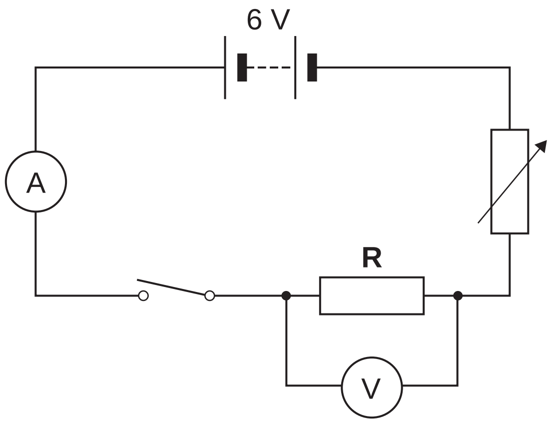
[2 marks]

5

Turn over for the next question

5 **Figure 8** shows an electrical circuit.

Figure 8



5 (a) The 6 V battery shown in **Figure 8** is made up of a number of identical 1.5 V cells.

Calculate the minimum number of cells needed to make the battery.

[1 mark]

____

Number of cells = ______________________

5 (b) The switch in **Figure 8** is shown in the open position. Closing the switch completes the circuit.
Charge flows through the completed circuit and a reading is shown on both the ammeter and the voltmeter.

5 (b) (i) In 10 seconds, 20 coulombs of charge flows through the circuit.

Calculate the current reading shown on the ammeter.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

____

____

Current = ______________________ A

Do not write outside the box

5 (b) (ii) For 20 coulombs of charge to flow through the resistor **R**, 100 joules of work must be done.

Calculate the potential difference reading given by the voltmeter.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

____

____

Potential difference = ____________________ V

5

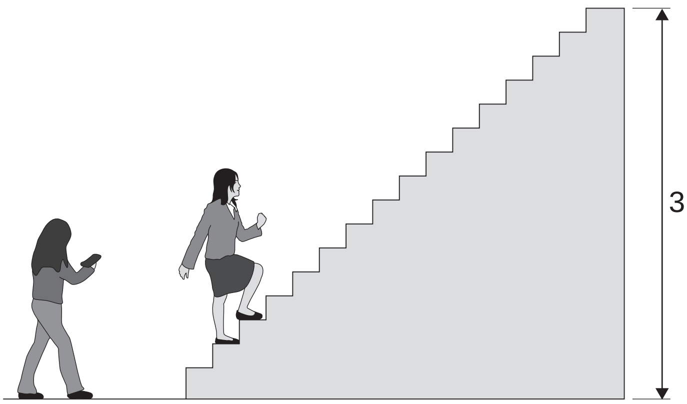
Turn over for the next question

Turn over ▶

6 A student did an experiment to calculate her power.
Figure 9 shows how she obtained the measurements needed.

The student first weighed herself and then ran up a flight of stairs. A second student timed how long it took her to go from the bottom to the top of the stairs. The height of the stairs was also measured.

Figure 9



6 (a) Complete the following sentence.

[1 mark]

To run up the stairs the student must do work against

the force of ____________________________________ .

6 (b) The student did 2240 J of work going from the bottom of the stairs to the top of the stairs.
The student took 2.8 seconds to run up the stairs.

6 (b) (i) Calculate the power the student developed when running up the stairs.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

____

____

Power = ______________________ W

6 (b) (ii) How much gravitational potential energy did the student gain in going from the bottom to the top of the stairs?

[1 mark]

Tick (✓) **one** box.

much more than 2240 J ☐

2240 J ☐

much less than 2240 J ☐

6 (c) Another four students did the same experiment.
The measurements taken and the calculated values for power are given in **Table 1**.

Table 1

Student	Weight in newtons	Time taken in seconds	Power in watts
A	285	3.8	240
B	360	2.4	480
C	600	3.4	560
D	725	4.0	580

6 (c) (i) To make a fair comparison of their powers the students kept **one** variable in the experiment constant.

What variable did the students keep constant?

[1 mark]

____

6 (c) (ii) From the data in **Table 1** a student wrote the following conclusion.

'The greater the weight of the student the greater the power developed.'

Suggest why this conclusion may **not** be true for a larger group of students.

[1 mark]

____

____

6

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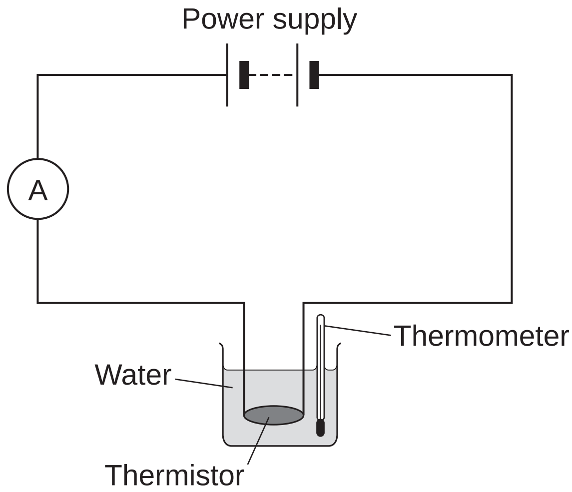
7 **Figure 10** shows the apparatus used to investigate how the current through a thermistor depends on the temperature of the thermistor.

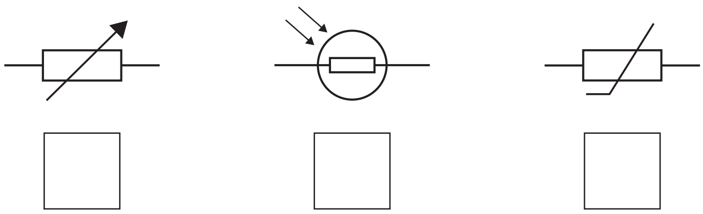
Figure 10



7 (a) Which **one** of the following is the correct circuit symbol for a thermistor?

[1 mark]

Tick (✓) **one** box.

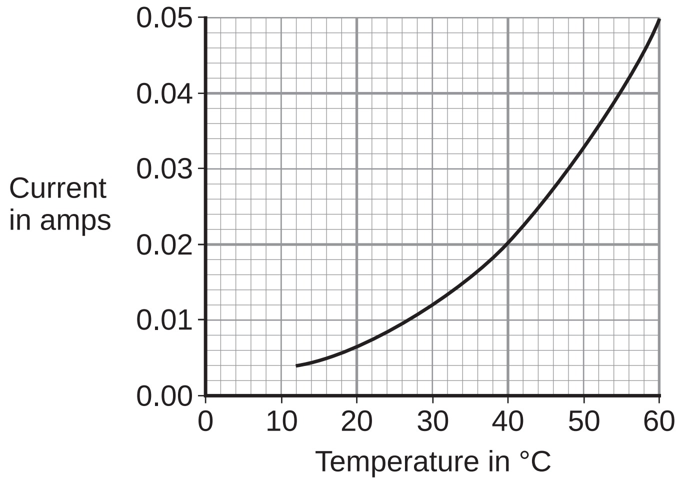


Question 7 continues on the next page

7 (b) To get a range of results, hot water at 60 °C was poured into the beaker.
The temperature of the water and current through the thermistor were then recorded as the water cooled.

The results of the investigation are shown in **Figure 11**.

Figure 11



7 (b) (i) Suggest **one** way the investigation could have been changed to give a wider range of temperatures.

[1 mark]

____

____

7 (b) (ii) Describe how the current through the thermistor depends on the temperature of the thermistor.

[1 mark]

____

____

7 (b) (iii) Use **Figure 11** to determine the current through the thermistor at 40 °C.

[1 mark]

Current at 40 °C = ______________________ A

7 (b) (iv) At 40 °C the thermistor has a resistance of 250 Ω.

Use your answer to part **(b)(iii)** and the resistance of the thermistor to calculate the potential difference across the thermistor.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

____

____

____

____

Potential difference = ____________________ V

7 (b) (v) The potential difference across the thermistor stays the same all through the investigation.

What conclusion can be made from the results in **Figure 11** about the resistance of the thermistor as the temperature of the thermistor **decreases**?

[1 mark]

Tick (✓) **one** box.

the resistance increases ☐

the resistance does not change ☐

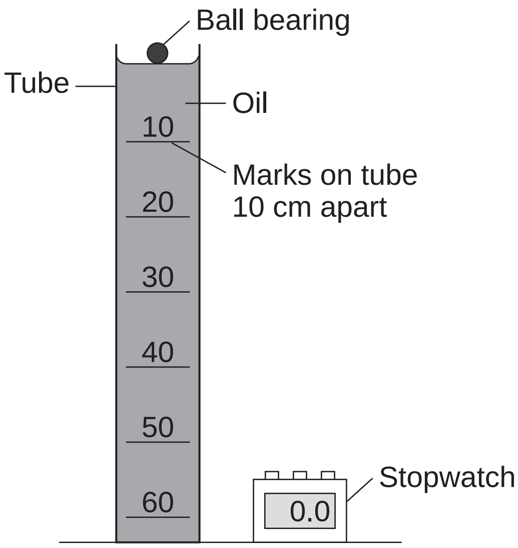
the resistance decreases ☐

7

Turn over for the next question

8 A student investigated how the speed of a ball bearing changes as the ball bearing falls through a tube of oil.
Figure 12 shows the equipment the student used.

Figure 12



The student measured the time taken for the ball bearing to fall different distances.
Each distance was measured from the top of the oil.

8 (a) What is likely to have been the main source of error in this investigation?

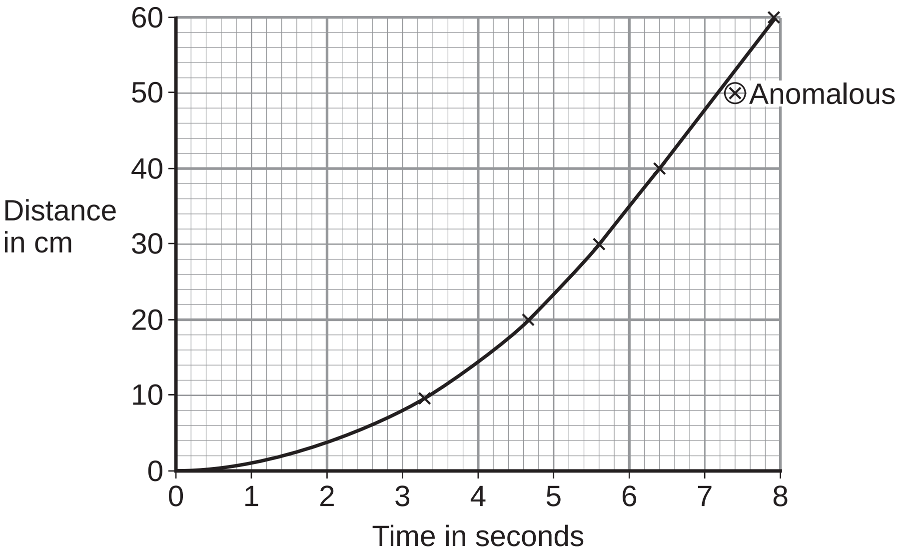
[1 mark]

____

____

8 (b) **Figure 13** shows the student's results plotted as a graph.

Figure 13



8 (b) (i) The student has identified one of the results as being anomalous.

Use the correct answer from the box to complete the sentence.

[1 mark]

after	**as**	**before**

The anomalous result was caused by the stopwatch being started ____________________ the ball bearing was released.

8 (b) (ii) What can you conclude from the graph about the speed of the ball bearing during the first four seconds?

[1 mark]

____

____

8 (b) (iii) The graph shows that the ball bearing reached its terminal velocity.

Describe how the graph would be used to calculate the terminal velocity of the ball bearing.

[1 mark]

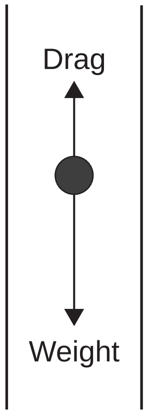
____

____

Question 8 continues on the next page

8 (b) (iv) The directions of the two forces acting on the ball bearing as it falls through the oil are shown in **Figure 14**.

Figure 14



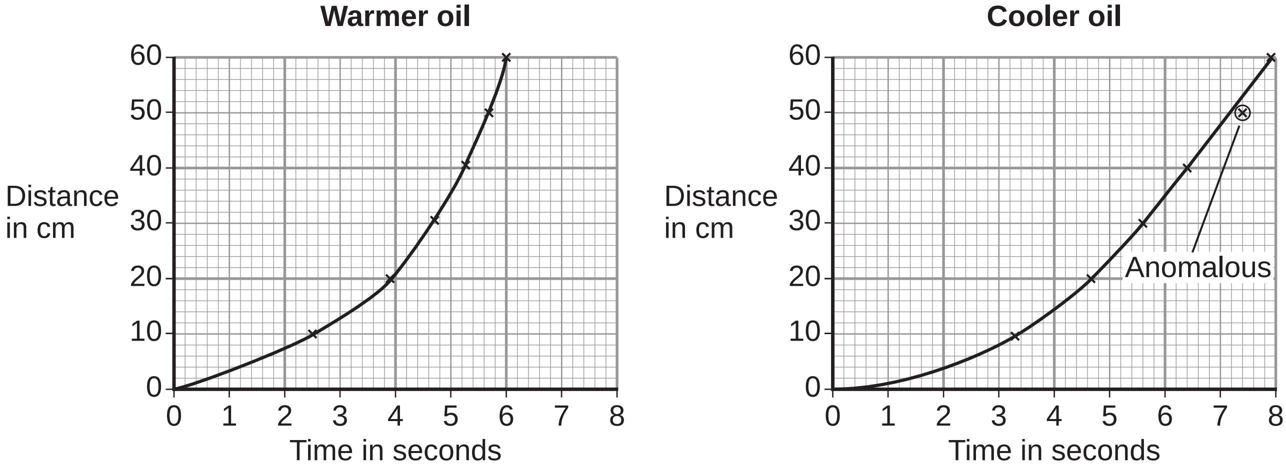
Explain, in terms of the forces shown in **Figure 14**, why the ball bearing reaches its terminal velocity.

[2 marks]

8 (c) The student repeated the investigation using warmer oil.

Figure 15 shows the set of results using the warmer oil **and** the set of results using the cooler oil.

Figure 15



Compare the two graphs in **Figure 15**.

Use the correct answer from the box to complete the sentence.

[3 marks]

less than	**equal to**	**greater than**

After falling 40 cm, the drag force on the ball bearing in the warmer oil is

________________________________ the drag force on the ball bearing in the cooler oil.

Explain the reason for your answer.

____

____

____

____

9

Turn over ▶

9 Alpha particles, beta particles and gamma rays are types of nuclear radiation.

9 (a) Describe the structure of an alpha particle.

[1 mark]

____

____

9 (b) Nuclear radiation can change atoms into ions by the process of ionisation.

9 (b) (i) Which type of nuclear radiation is the least ionising?

[1 mark]

Tick (✓) **one** box.

alpha particles ☐ beta particles ☐ gamma rays ☐

9 (b) (ii) What happens to the structure of an atom when the atom is ionised?

[1 mark]

____

____

9 (c) People working with sources of nuclear radiation risk damaging their health.

State **one** precaution these people should take to reduce the risk to their health.

[1 mark]

____

____

9 (d) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

The type of radiation emitted from a radioactive source can be identified by comparing the properties of the radiation to the properties of alpha, beta and gamma radiation.

Describe the properties of alpha, beta and gamma radiation in terms of their:

- penetration through materials
- range in air
- deflection in a magnetic field.

[6 marks]

Extra space

10

END OF QUESTIONS

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