Please write clearly in block capitals.

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

Surname ____________________

Forename(s) ____________________

Candidate signature ____________________

GCSE
ADDITIONAL SCIENCE
PHYSICS

H

Higher 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.

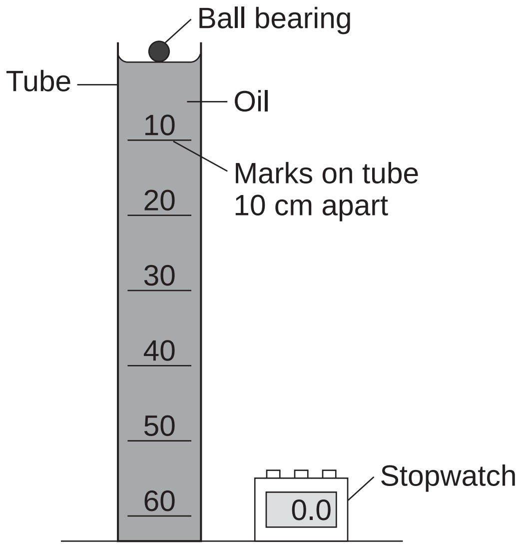
Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 2(d) should be answered in continuous prose.
  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 student investigated how the speed of a ball bearing changes as the ball bearing falls through a tube of oil.
Figure 1 shows the equipment the student used.

Figure 1



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

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

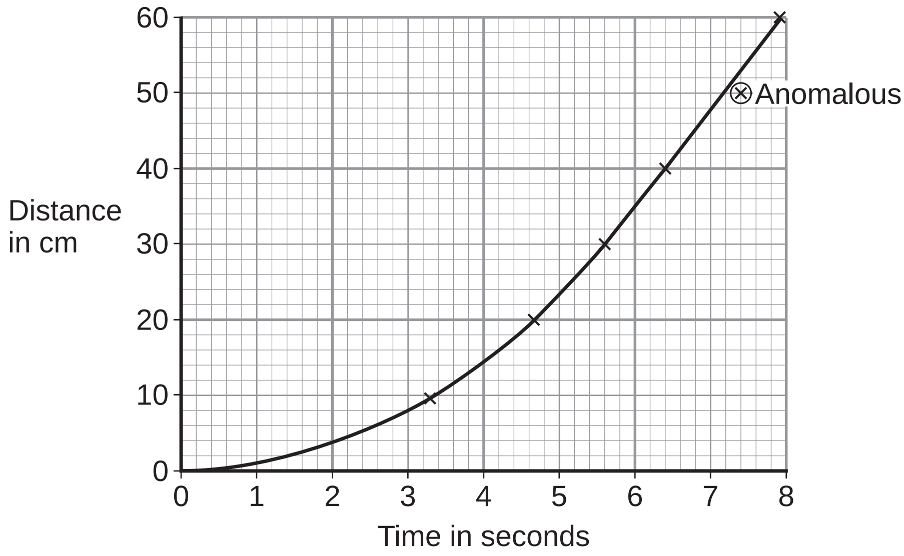
[1 mark]

____

____

1 (b) **Figure 2** shows the student's results plotted as a graph.

Figure 2



1 (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.

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

[1 mark]

____

____

1 (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]

____

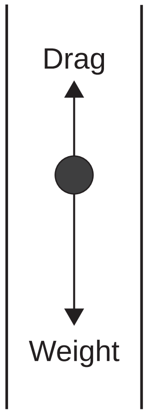
____

Question 1 continues on the next page

Turn over ▶

1 (b) (iv) The directions of the two forces acting on the ball bearing as it falls through the oil are shown in **Figure 3**.

Figure 3



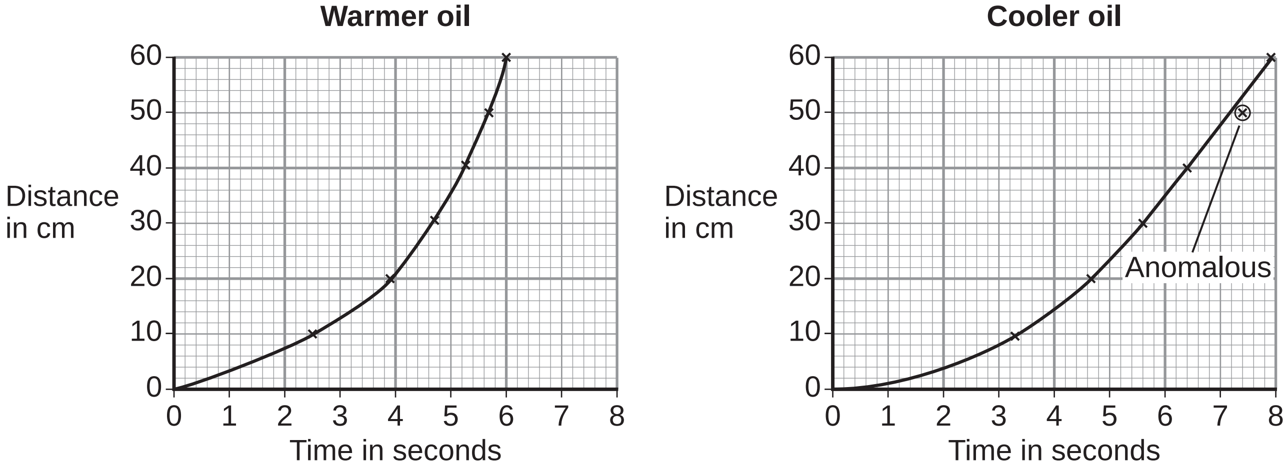
Explain, in terms of the forces shown in **Figure 3**, why the ball bearing reaches its terminal velocity.

[2 marks]

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

Figure 4 shows the set of results using the warmer oil **and** the set of results using the cooler oil.

Figure 4



Compare the two graphs in **Figure 4**.

Use the correct phrase 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

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

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

[1 mark]

____

____

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

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

[1 mark]

Tick (✓) **one** box.

alpha particles ☐ beta particles ☐ gamma rays ☐

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

[1 mark]

____

____

2 (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]

____

____

2 (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.

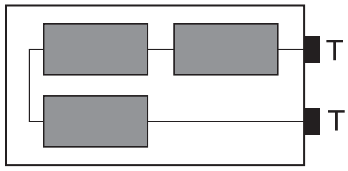
[6 marks]

Extra space

10

3 (a) **Figure 5** shows the inside of a battery pack designed to hold three identical 1.5 V cells.

Figure 5

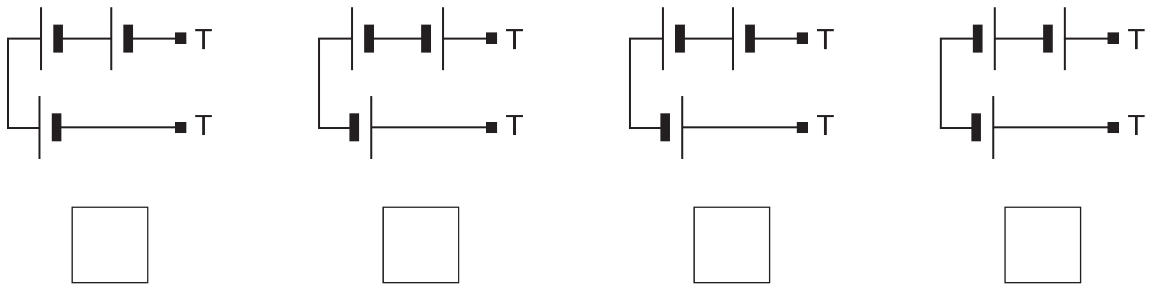


Which **one** of the arrangements shown in **Figure 6** would give a 4.5 V output across the battery pack terminals **T**?

[1 mark]

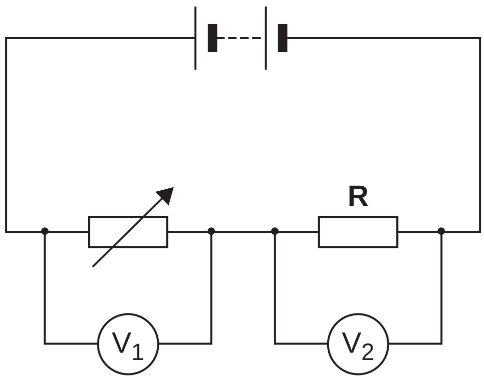
Tick (✓) **one** box.

Figure 6



3 (b) **Figure 7** shows a variable resistor and a fixed value resistor connected in series in a circuit.

Figure 7



Complete **Figure 7** to show how an ammeter would be connected to measure the current through the circuit.
Use the correct circuit symbol for an ammeter.

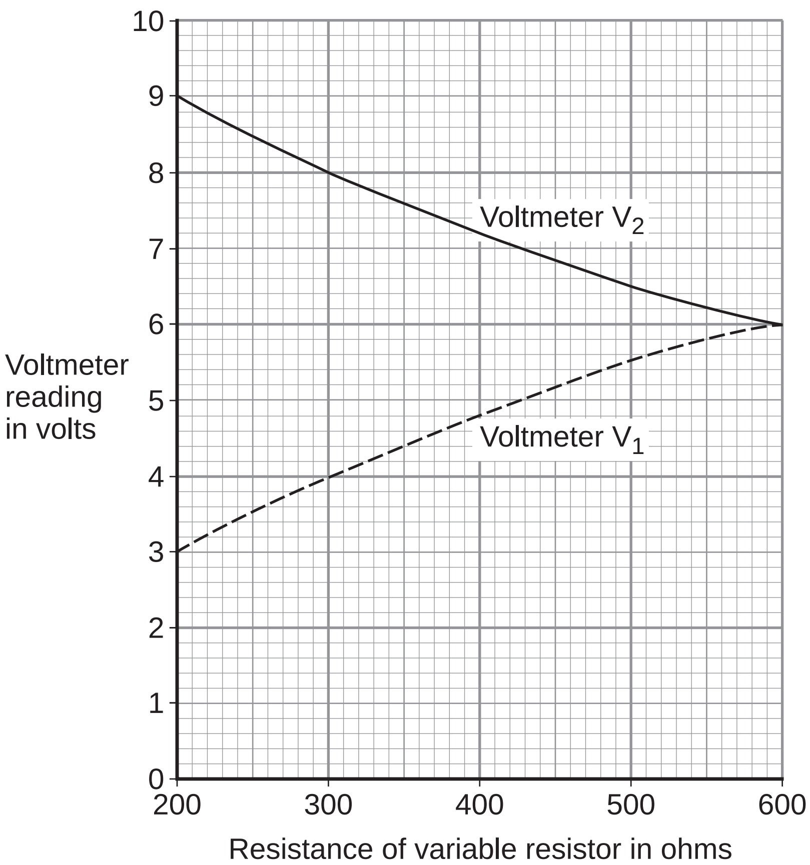
[1 mark]

Question 3 continues on the next page

3 (c) The variable resistor can be adjusted to have any value from 200 ohms to 600 ohms.

Figure 8 shows how the reading on voltmeter $\mathbf{V_1}$ and the reading on voltmeter $\mathbf{V_2}$ change as the resistance of the variable resistor changes.

Figure 8



3 (c) (i) How could the potential difference of the battery be calculated from **Figure 8**?

[2 marks]

Tick (✓) **one** box.

9 + 3 = 12 V ☐

9 – 3 = 6 V ☐

9 ÷ 3 = 3 V ☐

Give the reason for your answer.

____

____

3 (c) (ii) Use **Figure 8** to determine the resistance of the fixed resistor, **R**.

[2 marks]

Resistance of **R** = ________________ Ω

Give the reason for your answer.

____

____

3 (c) (iii) Calculate the current through the circuit when the resistance of the variable resistor equals 200 Ω.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

____

____

____

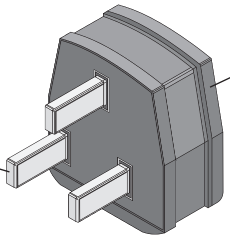
Current = ______________________ A

9

Turn over for the next question

4 (a) A washing machine is connected to the mains electricity supply using a cable and three-pin plug.
Figure 9 shows a three-pin plug.

Figure 9



Name the materials used in the structure of a plug. Give the reason why each material is used.

[2 marks]

Pin ____

____

Outer case ____

____

4 (b) The three-pin plug contains a fuse. The fuse is connected to one of the wires inside the cable.

4 (b) (i) Which **one** of the wires inside the cable is the fuse connected to?

[1 mark]

____

4 (b) (ii) The fuse is a thin wire inside a closed glass tube. The wire acts as a resistor.

What effect does a current through a wire have on the wire?

[1 mark]

____

4 (b) (iii) The power of the washing machine varies between 0.7 kW and 2 kW depending on which part of the wash cycle is operating.

Calculate the maximum current drawn from the mains electricity supply by the washing machine.

The mains electricity supply is at a potential difference of 230 V.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

____

____

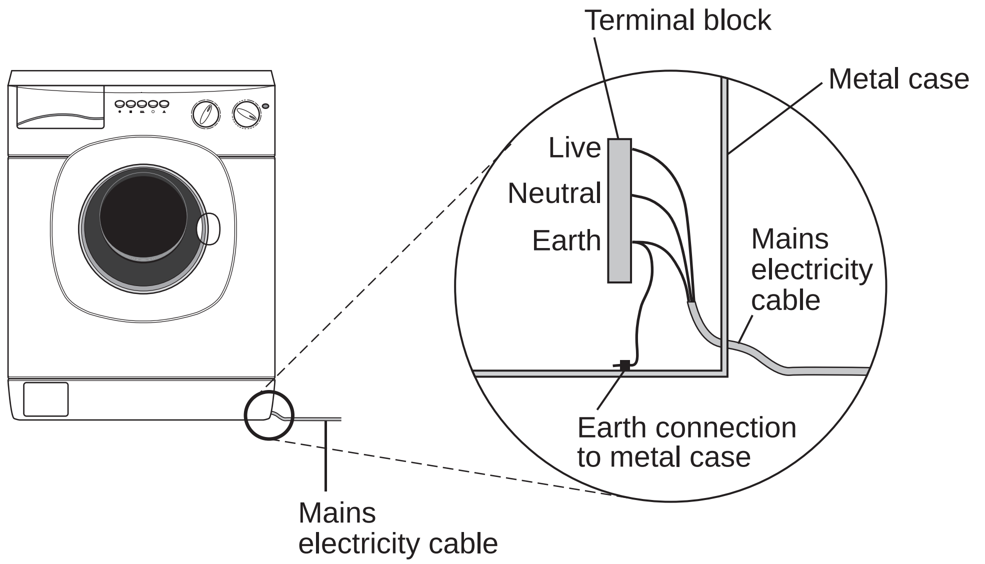
____

Current = ____________ A

Question 4 continues on the next page

4 (c) **Figure 10** shows how the mains electricity cable is connected to the washing machine.
The earth wire is connected to the metal case of the washing machine.

Figure 10



If a fault makes the metal case live, the earth wire and fuse inside the plug prevent the mains cable from overheating and causing a fire.

Explain how.

[2 marks]

____

____

____

____

4 (d) New research has shown that many people underestimate the hazards of using mains electricity.

It is important that people do understand the hazards of using mains electricity.
Suggest why.

[1 mark]

____

____

____

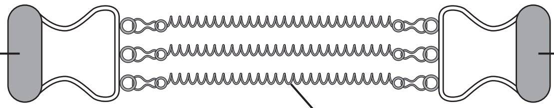
9

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

5 **Figure 11** shows an exercise device called a chest expander. The three springs are identical.

Figure 11



A person pulls outwards on the handles and does work to stretch the springs.

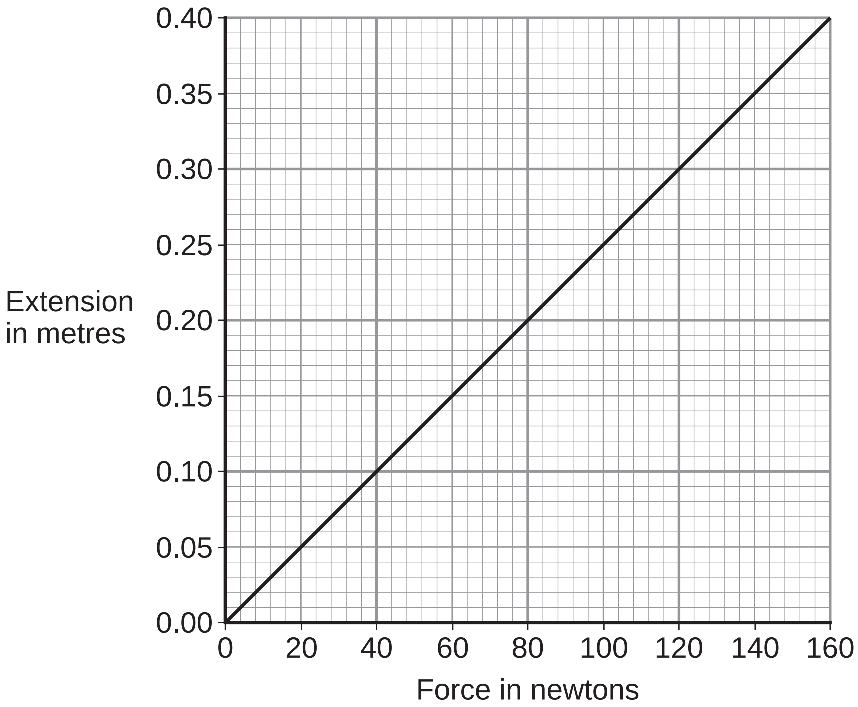
5 (a) Complete the following sentence.

[1 mark]

When the springs are stretched ________________ ________________ energy is stored in the springs.

5 (b) **Figure 12** shows how the extension of a single spring from the chest expander depends on the force acting on the spring.

Figure 12



5 (b) (i) How can you tell, from **Figure 12**, that the limit of proportionality of the spring has not been exceeded?

[1 mark]

____

____

5 (b) (ii) Use data from **Figure 12** to calculate the spring constant of the spring.
Give the unit.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

____

____

____

Spring constant = ________________ Unit ______________________________

5 (b) (iii) Three identical resistors joined in parallel in an electrical circuit share the total current in the circuit.

In a similar way, the three springs in the chest expander share the total force exerted.

By considering this similarity, use **Figure 12** to determine the total force exerted on the chest expander when each spring is stretched by 0.25 m.

[2 marks]

____

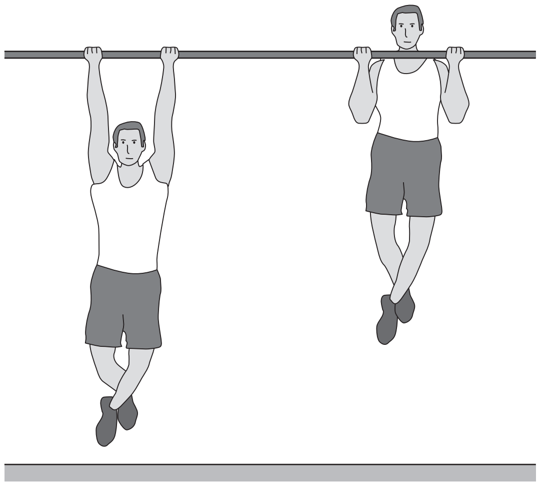
____

Total force = __________________ N

Question 5 continues on the next page

5 (c) The student in **Figure 13** is doing an exercise called a chin-up.

Figure 13



Each time the student does one chin-up he lifts his body 0.40 m vertically upwards.
The mass of the student is 65 kg.
The student is able to do 12 chin-ups in 60 seconds.

Calculate the power developed by the student.

Gravitational field strength = 10 N/kg

Use the correct equations from the Physics Equations Sheet.

[3 marks]

___

___

___

___

___

Power = ________________ W

10

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

6 (a) Brown dwarf stars are thought to have been formed in the same way as other stars. They are too small for nuclear fusion reactions to take place in them.
Brown dwarf stars emit infrared radiation but are not hot enough to emit visible light.

6 (a) (i) Describe how a star is formed.

[2 marks]

6 (a) (ii) Describe the process of nuclear fusion.

[1 mark]

6 (a) (iii) Scientists predicted that brown dwarf stars existed before the first one was discovered in 1995.

Suggest **one** reason why scientists are now able to observe and identify brown dwarf stars.

[1 mark]

6 (b) In the 18th century some scientists suggested a theory about how the planets formed in the Solar System. The theory was that after the Sun formed, there were cool discs of matter rotating around the Sun. These cool discs of matter formed the planets. The scientists thought this must have happened around other stars too.

6 (b) (i) Thinking about this theory, what would the scientists have predicted to have been formed in other parts of the Universe?

[1 mark]

____

____

6 (b) (ii) Since the 1980s scientists studying young stars have shown the stars to be surrounded by cool discs of rotating matter.

What was the importance of these observations to the theory the scientists suggested in the 18th century?

[1 mark]

____

____

6 (c) The Earth contains elements heavier than iron.

Why is the presence of elements heavier than iron in the Earth evidence that the Solar System was formed from material produced after a massive star exploded?

[1 mark]

____

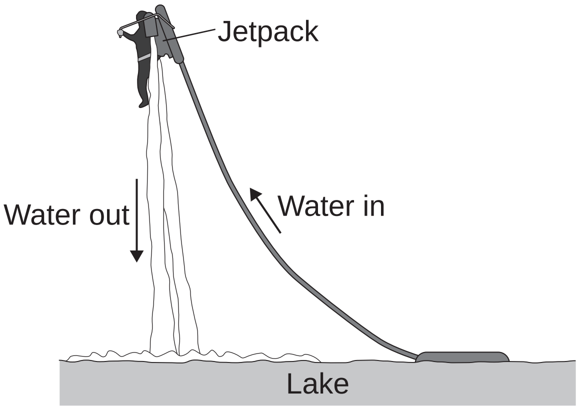
____

7

Turn over for the next question

7 **Figure 14** shows a person using a device called a jetpack. Water is forced downwards from the jetpack and produces an upward force on the person.

Figure 14



7 (a) State the condition necessary for the person to be able to remain stationary in mid-air.

[1 mark]

____

____

7 (b) The person weighs 700 N and the jetpack weighs 140 N.

7 (b) (i) Calculate the combined mass of the person and the jetpack.

Gravitational field strength = 10 N/kg

Use the correct equation from the Physics Equations Sheet.

[2 marks]

____

____

____

Combined mass = ______________________ kg

7 (b) (ii) Increasing the upward force to 1850 N causes the person to accelerate upwards.

Calculate the acceleration of the person and the jetpack. Give the unit.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

____

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____

____

Acceleration = ____________________ Unit ________________

6

END OF QUESTIONS

There are no questions printed on this page

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