

Please write clearly in block capitals.

Centre number

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# GCSE COMBINED SCIENCE: TRILOGY

# H

Higher Tier  
Physics Paper 1H

Wednesday 23 May 2018

Afternoon

Time allowed: 1 hour 15 minutes

## Materials

For this paper you must have:

- a ruler
- a scientific 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 in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

## Information

- The maximum mark for this paper is 70.
- 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.

| For Examiner's Use |      |
|--------------------|------|
| Question           | Mark |
| 1                  |      |
| 2                  |      |
| 3                  |      |
| 4                  |      |
| 5                  |      |
| 6                  |      |
| <b>TOTAL</b>       |      |

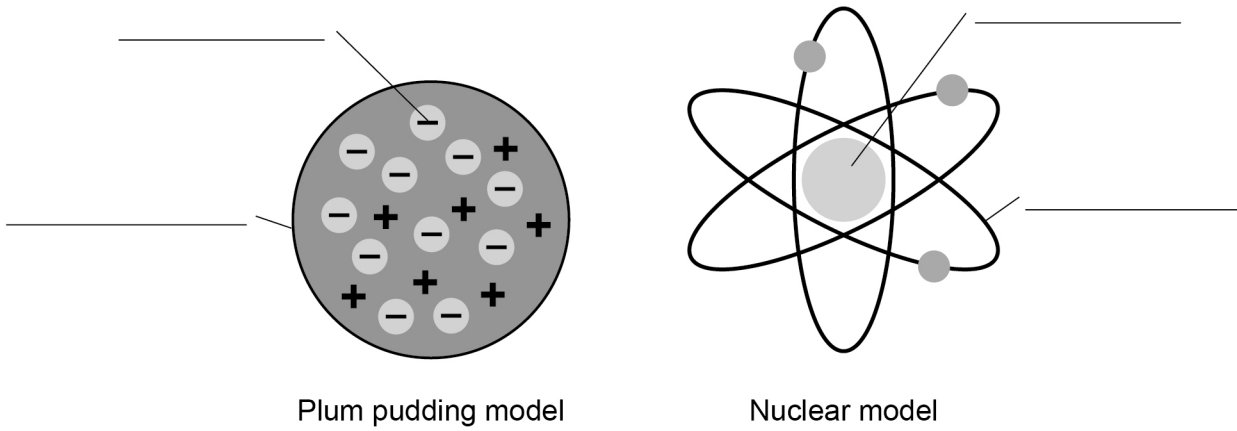


J U N 1 8 8 4 6 4 P 1 H O 1

0 1

Figure 1 shows two models of the atom.

Figure 1



0 1 . 1

Write the labels on **Figure 1**

Choose the answers from the box.

**[4 marks]**

|         |          |         |
|---------|----------|---------|
| atom    | electron | nucleus |
| neutron | orbit    | proton  |

0 1 . 2

Explain why the total positive charge in every atom of an element is always the same.

**[2 marks]**


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0 1 . 3

The results from the alpha particle scattering experiment led to the nuclear model.

Alpha particles were fired at a thin film of gold at a speed of 7% of the speed of light.

Determine the speed of the alpha particles.

Speed of light = 300 000 000 m/s

[2 marks]

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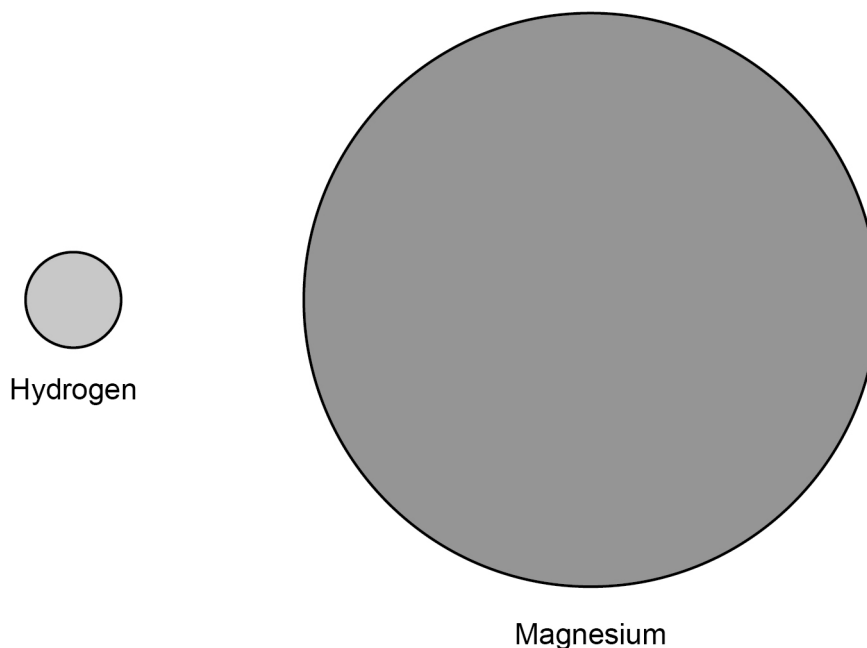
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Speed = \_\_\_\_\_ m/s

0 1 . 4

**Figure 2** shows two atoms represented as solid spheres.

**Figure 2**



A hydrogen atom has a radius of  $2.5 \times 10^{-11}$  m

Determine the radius of a magnesium atom.

Use measurements from **Figure 2**

[2 marks]

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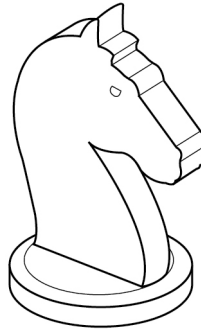
Radius = \_\_\_\_\_ m

10

Turn over ►



### Figure 3



**[6 marks]**

[illegible]

0 2 . 2

Another student did a similar experiment.

He determined the density of five common plastic materials.

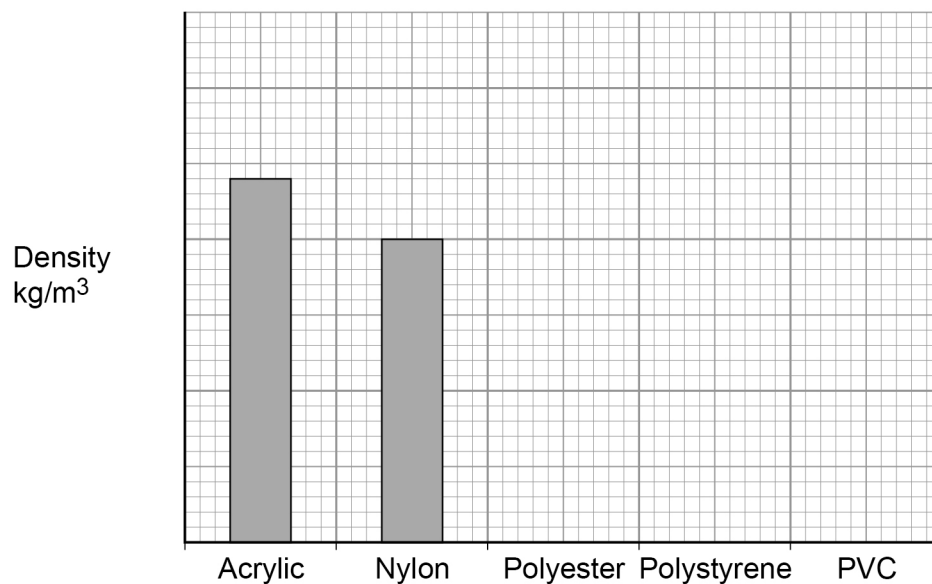
**Table 1** shows the results.

**Table 1**

| Plastic material | Density in $\text{kg/m}^3$ |
|------------------|----------------------------|
| Acrylic          | 1200                       |
| Nylon            | 1000                       |
| Polyester        | 1380                       |
| Polystyrene      | 1040                       |
| PVC              | 1100                       |

**Figure 4** shows the results plotted in a bar chart.

**Figure 4**



Complete **Figure 4**

You should:

- Write the correct scale on the y-axis.
- Draw the bars for polyester, polystyrene and PVC.

**[4 marks]**

Turn over ►



0 2 . 3

The student is given a piece of a different plastic material.

The student determined the density of the material three times.

**Table 2** shows the results.

**Table 2**

|   | Density in $\text{kg/m}^3$ |
|---|----------------------------|
| 1 | 960                        |
| 2 | 1120                       |
| 3 | 1040                       |

Determine the uncertainty in the student's results.

**[2 marks]**

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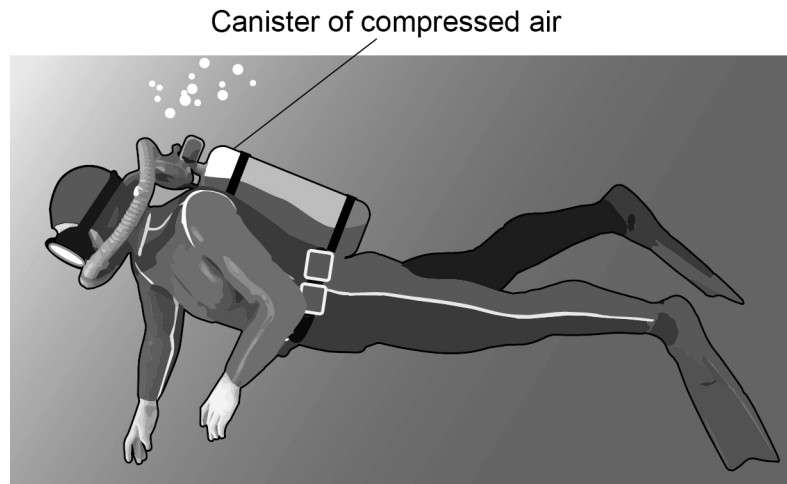
Uncertainty = \_\_\_\_\_  $\text{kg/m}^3$



0 3

**Figure 5** shows a diver.

The diver is using a canister of compressed air so that he can breathe underwater.

**Figure 5**

0 3 . 1

Which **two** sentences describe the movement of the air particles in the canister?**[2 marks]**Tick **two** boxes.

They vibrate about a fixed position.

☐

They move in random directions.

☐

The motion of all the particles is predictable.

☐

They move with a range of different speeds.

☐

They move in circular paths.

☐

0 3 . 2

The temperature of the air inside the canister increases.

What happens to the movement of the air particles?

**[1 mark]**

\_\_\_\_\_

**Turn over ►**

0 3 . 3

It could be dangerous if the temperature of the air inside the canister increased by a large amount.

Explain why.

[2 marks]

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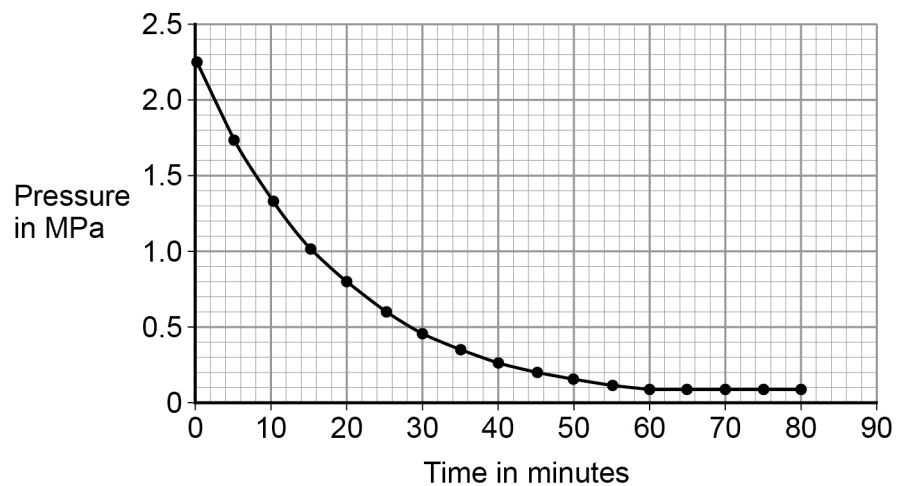
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A canister of air was tested to find out how the pressure changed when it was used by a diver.

- Air was allowed to escape from the canister.
- The pressure of the air in the canister was recorded every 5 minutes for 80 minutes.

Figure 6 shows the results.

Figure 6



0 3 . 4

Estimate the atmospheric pressure.

Use Figure 6

[1 mark]

Atmospheric pressure = \_\_\_\_\_ MPa



0 3 . 5

Divers can safely stay underwater until the pressure of the air in the canister has reduced to 25% of its original value.

Determine the maximum time the diver can safely stay underwater.

Use **Figure 6**

**[3 marks]**

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Time = \_\_\_\_\_ minutes

0 3 . 6

What happens to the volume of the air when it is released from the canister?

**[1 mark]**

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**Turn over for the next question**

10

**Turn over ►**



**0 4**

The Chernobyl disaster was a nuclear accident that happened in 1986

Radioactive isotopes were released into the environment.

The radioactive isotopes emitted alpha, beta and gamma radiation.

**0 4 . 1**

What is an alpha particle?

**[1 mark]**

Tick **one** box.

2 charged particles and 2 neutral particles.

☐

2 charged particles and 4 neutral particles.

☐

4 charged particles and 2 neutral particles.

☐

4 charged particles and 4 neutral particles.

☐**0 4 . 2**

Which statement about beta radiation is true?

**[1 mark]**

Tick **one** box.

It is the fastest moving type of radiation.

☐

It is the type of radiation with a negative charge.

☐

It is the type of radiation with the greatest mass.

☐

It is the type of radiation with the greatest range in air.

☐

**0 4 . 3** Which statement about gamma radiation is true?

**[1 mark]**

Tick **one** box.

It is a low frequency electromagnetic wave.

☐

It causes the charge of the nucleus to change.

☐

It causes the mass of the nucleus to change.

☐

It has a very long range in air.

☐

**Question 4 continues on the next page**

**Turn over ►**



**Table 3** shows the half-lives of two of the radioactive isotopes that contaminated the environment.

**Table 3**

| Isotope     | Half-life |
|-------------|-----------|
| Caesium-137 | 30 years  |
| Iodine-131  | 8 days    |

**0 4 . 4**

A soil sample was taken from the area around Chernobyl in 1986

The soil sample was contaminated with equal amounts of caesium-137 and iodine-131

Explain how the risk linked to each isotope has changed between 1986 and 2018

Both isotopes emit the same type of radiation.

**[4 marks]**

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**0 4 . 5**

Determine the year when the activity of the caesium-137 in the soil sample will be  $\frac{1}{32}$  of its original value.

**[3 marks]**

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Year = \_\_\_\_\_

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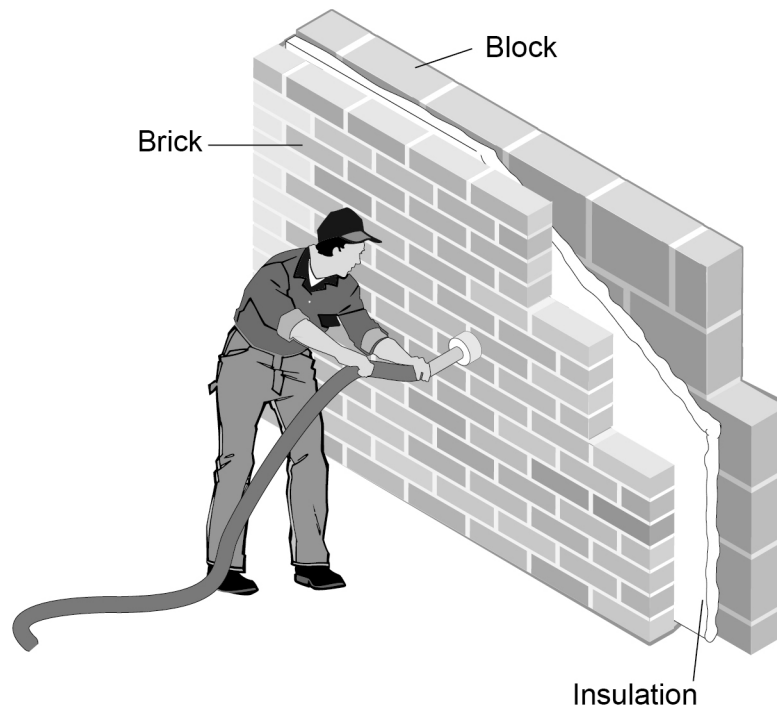


0 5

**Figure 7** shows cavity wall insulation being installed in the wall of a house.

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**Figure 7**



0 5 . 1

Explain how the wall reduces unwanted energy transfers.

**[3 marks]**

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**Question 5 continues on the next page**

**Turn over ►**



**0 5 . 2** The cavity insulation was tested.

- The heating inside the house was switched off.
- The temperature inside the house was measured every 20 minutes for 2 hours.

**Table 4** shows the results.

**Table 4**

| Time in minutes | Temperature in °C |
|-----------------|-------------------|
| 0               | 25.0              |
| 20              | 20.8              |
| 40              | 17.4              |
| 60              | 14.5              |
| 80              | 12.1              |
| 100             | 10.0              |
| 120             | 8.4               |

Determine the temperature inside the house after 30 minutes.

**[2 marks]**

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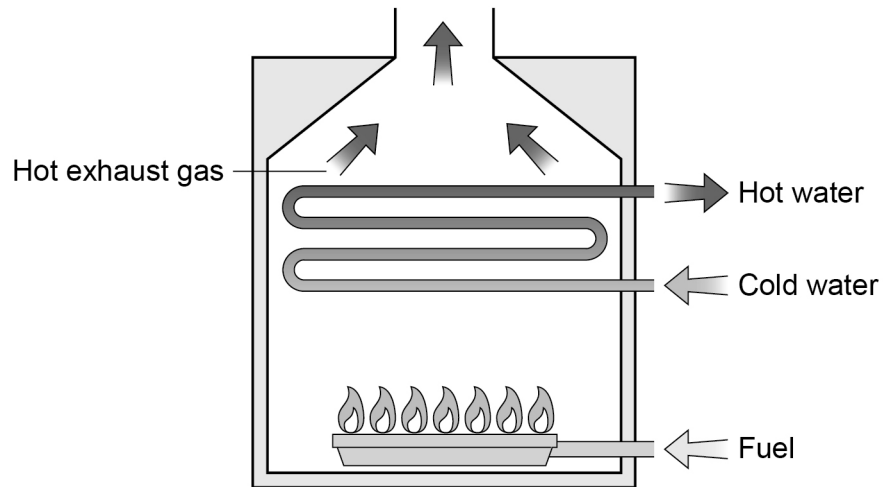
Temperature = \_\_\_\_\_ °C



0 5 . 3

Figure 8 shows the gas boiler used to heat the house.

Figure 8



Describe how different energy stores are changed by the boiler.

**[3 marks]**


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0 5 . 4

To heat the house, the boiler transfers 15 MJ of energy in 10 minutes.

Calculate the power of the boiler.

Write any equation that you use.

**[4 marks]**


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Power = \_\_\_\_\_ W

Turn over for the next question

12

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|   |   |
|---|---|
| 0 | 6 |
|---|---|

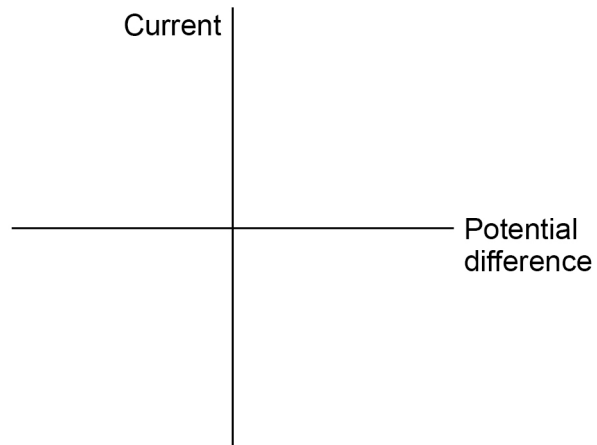
A student built a circuit using filament lamps.

|   |   |   |   |
|---|---|---|---|
| 0 | 6 | . | 1 |
|---|---|---|---|

Sketch a current potential difference graph for a filament lamp on **Figure 9**

**[2 marks]**

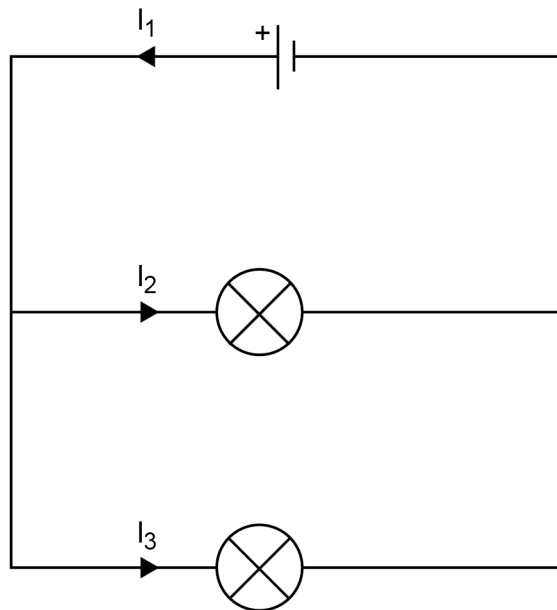
**Figure 9**



**Figure 10** shows the circuit with two identical filament lamps.

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**Figure 10**



**0 6 . 2**

Compare the currents  $I_1$ ,  $I_2$  and  $I_3$

**[2 marks]**

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**Question 6 continues on the next page**

**Turn over ►**



0 6 . 3

Calculate the charge that flows through the cell in 1 minute.

Each filament lamp has a power of 3 W and a resistance of  $12\ \Omega$

Write any equations that you use.

Give the unit.

**[6 marks]**

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Charge = \_\_\_\_\_

Unit = \_\_\_\_\_



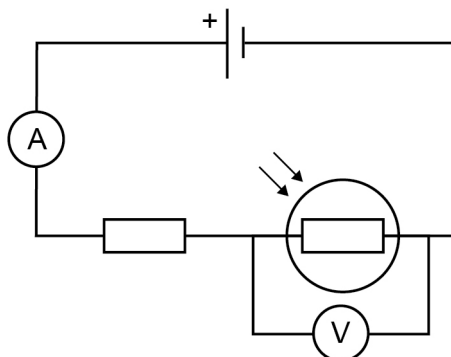
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|   |   |   |   |
|---|---|---|---|
| 0 | 6 | . | 4 |
|---|---|---|---|

The student builds a different circuit.

**Figure 11** shows the circuit.

### Figure 11



Explain how the readings on both meters change when the environmental conditions change.

**[6 marks]**

**END OF QUESTIONS**

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ANSWER IN THE SPACES PROVIDED**

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