

6-2 Electricity – Trilogy

1.0 Most domestic appliances are connected to the mains electricity.

1.1 What is the frequency of mains electricity?

Tick **one** box

[1 mark]

1.05 A

50 Hz

230 V

1.2 What is the potential difference of mains electricity?

Tick **one** box

[1 mark]

1.05 A

50 Hz

230 V

1.3 Most domestic appliances are connected to the mains electricity with a plug.

Explain why a plug needs a live **and** a neutral wire.

[2 marks]

1.4 The law specifies the colour that mains wires should be for all domestic electrical circuits.

It is important that the live wire is easy to identify to reduce the risk of an electric shock.

Explain how an electric shock can be caused by a person touching the live wire.

[2 marks]

1.5 An iron is supplied with a current of 3 A from the mains. The resistance of the iron is 100 Ω .

Calculate the power of the iron.

[2 marks]

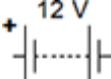




Power = _____ W

2.0 A student wants to investigate how the current through a filament lamp affects its resistance.

2.1 Use the circuit symbols in **Figure 1** to draw a circuit diagram that he could use.

[2 marks]

Figure 1

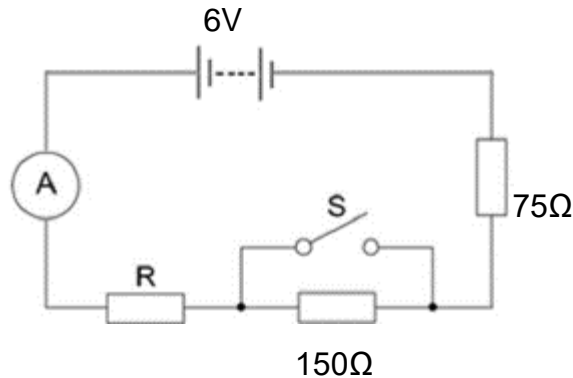
| 12 V battery | variable resistor | filament lamp | voltmeter | ammeter |
|---|---|---|--|---|
|  |  |  |  |  |

2.2 Describe how the student could use her circuit to investigate how the current through a filament lamp affects its resistance.

[4 marks]

3.0 A student sets up the electrical circuit shown in **Figure 2** below.

Figure 2



3.1 The ammeter displays a reading of 0.025 A.
Calculate the potential difference across the 75 Ω resistor.
Give your answer to 2 significant figures.

[2 marks]

Potential difference = _____ V

3.2 Calculate the resistance of the resistor labelled **R**.

[3 marks]

Resistance = _____ Ω

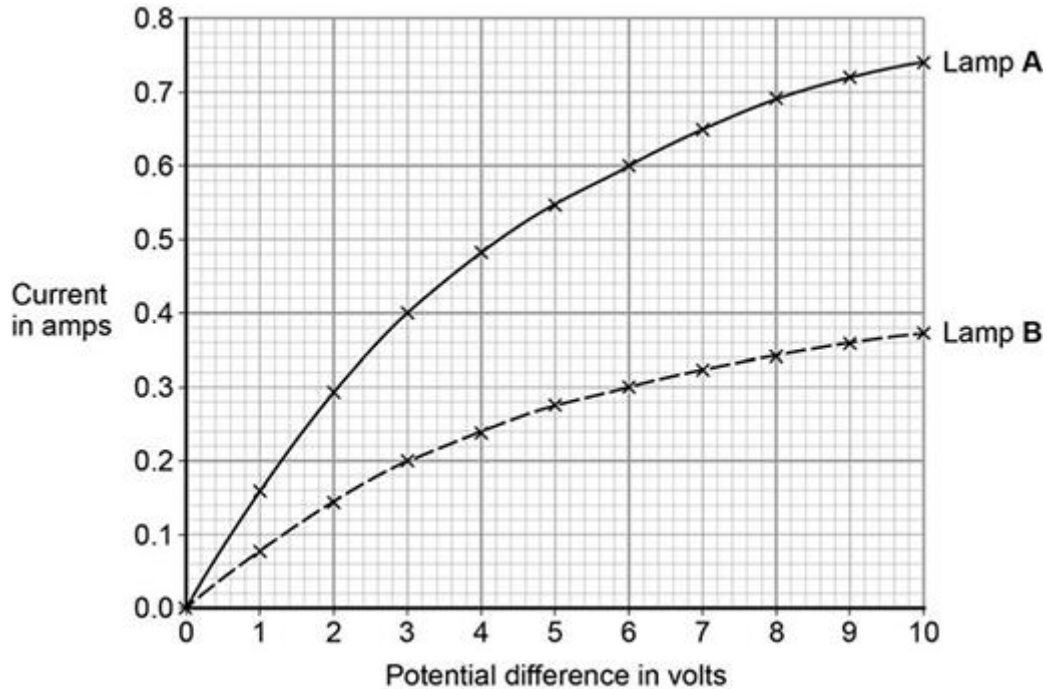
3.3 State what happens to the total resistance of the circuit and the current through the circuit when switch **S** is closed.

[2 marks]

4.0 A student investigated how current varies with potential difference for two different lamps of the same type.

Her results are shown in the **Figure 3** below.

Figure 3



4.1 Draw the circuit diagram for the circuit that the student could have used to obtain the results shown in the figure above.

[3 marks]

4.2 The student made the following conclusion,
‘Lamp A is twice as bright as lamp B’.

Use data from **Figure 3** to explain why the student’s conclusion is correct.

[3 marks]

4.3 The resistance of each lamp increases as the current increases.

Calculate the difference between the lowest and highest values of resistance for **lamp A** from **Figure 3**.

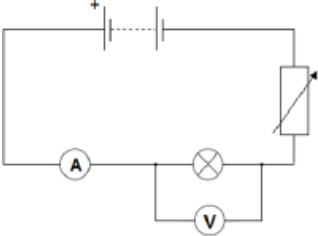
[3 marks]

MARK SCHEME

| Qu No. | | Extra Information | Marks |
|--------|---|--|-------|
| 1.1 | 50 Hz | | 1 |
| 1.2 | 230 V | | 1 |
| 1.3 | Live wire carries the (alternating) potential difference/voltage (from the supply) | | 1 |
| | Neutral wire completes the circuit | | 1 |
| 1.4 | connection is made to earth | Accept answer in terms of a complete circuit or establishing a path (for charge to flow) | 1 |
| | charge can flow through the body. or large potential difference across the body | | 1 |
| 1.5 | $P = (3)^2 \times 100$ | Allow one mark for $P=I^2V$ if substitution incorrect. | 1 |
| | 900 (W) | Allow 900 (W) with no working for 2 marks | 1 |

| Qu No. | | Extra Information | Marks |
|--|--|-------------------|-------|
| 2.1 | battery, lamp and ammeter connected in series with variable resistor | | 1 |
| | voltmeter in parallel with (filament) lamp | | 1 |
| 2.2 | | | |
| Level 2: | A detailed and coherent description of the experiment. The response provides a logical sequence. | | 3-4 |
| Level 1: | Simple description of the experiment with some steps missing. The response may not be in a logical sequence and may not lead to the collection of valid results. | | 1-2 |
| Level 0: | No relevant content. | | 0 |
| Indicative content | | | |
| <ul style="list-style-type: none"> • ammeter used to measure current • voltmeter used to measure potential difference • resistance of variable resistor altered to change current in circuit or change potential difference (across filament lamp) • resistance (of filament lamp) calculated or $R=V / I$ statement resistance calculated for a large enough range of different currents that would allow a valid conclusion about the relationship to be made | | | |

| Qu No. | | Extra Information | Marks |
|--------|--|---|-------------|
| 3.1 | $V = 0.025 \times 75$ 1.9 (V) | Allow 1.9 (V) with no working for 2 marks | 1 1 |
| 3.2 | total resistance = $6 / 0.025$ $R = 240 - 225$ $= 15 (\Omega)$ | | 1 1 1 |
| 3.3 | resistance decreases current increases | | 1 1 |

| Qu No. | | Extra Information | Marks |
|--------|---|---|---------------------|
| 4.1 |  | battery in series with bulb and ammeter voltmeter in parallel with the bulb variable resistor or variable power supply | 1 1 1 |
| 4.2 | correct pair of current readings at the same pd therefore current in lamp A is twice the current in lamp B so lamp A is twice as powerful and lamp B (hence is twice as bright) | eg at 10 V, $I_A = 0.74A$ and $I_B = 0.37A$ must refer to power/rate of energy transfer | 1 1 1 |
| 4.3 | $R = V / I$ lowest $R = 0.6 / 0.1$ $R = 6 \Omega$ Highest $R = 10 / 0.74$ $R = 13.5 \Omega$ Difference = $13.5 - 6 = 7.5 \Omega$ | allow $R = 1.0 / 0.16$ $R = 6.25 \Omega$ (other values may be acceptable but the values from the graph must be when $V \leq 1V$ and the lamp can reasonably be assumed to be ohmic) | 1 1 1 |