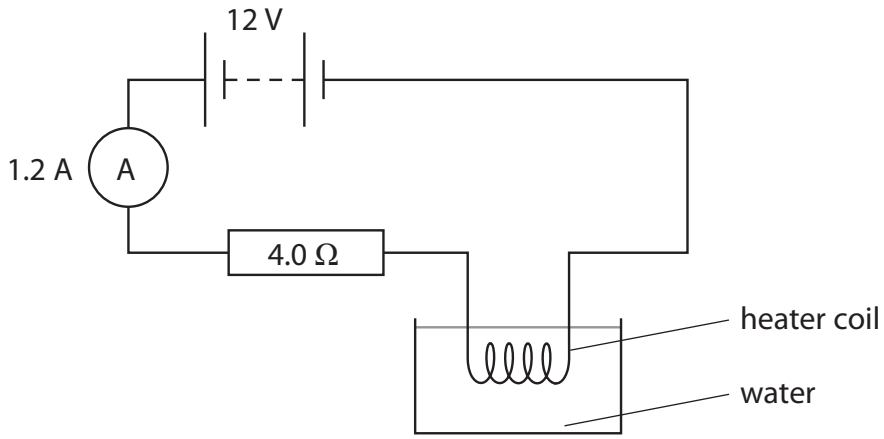
**1** The diagram shows a heater coil and a resistor connected to a 12 V battery and an ammeter. The ammeter reading is 1.2 A.




(a) (i) State the equation linking voltage, current and resistance.

**(1)**

(ii) Calculate the voltage across the 4.0 Ω resistor.

**(2)**

Voltage = ..... V

(iii) Show that the voltage across the heater coil is about 7 V.

**(2)**

(iv) Calculate the energy transferred to the heater coil in 5.0 minutes.

**(3)**

Energy transferred = ..... J

(v) At first, the temperature of the water increases.

After a while, the temperature reaches a steady value below the boiling point of water.

Explain why the temperature reaches a steady value.

**(2)**

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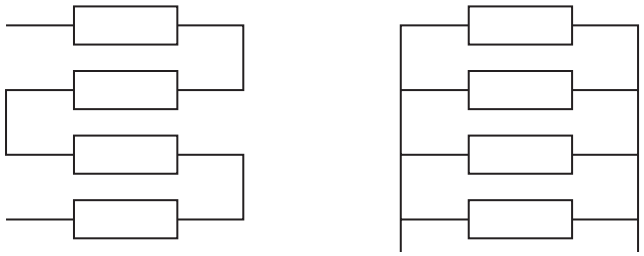
(b) Resistors can be used as heating elements in the rear windows of cars.

The diagram shows two possible designs.



**X** **Y**

(i) Complete the table by placing a tick (✓) in the correct boxes.

**(1)**

| Design | Series | Parallel |
|---|---|---|
| **X** | | |
| **Y** | | |

(ii) Describe the advantages and disadvantages of design **X** when used as a heater in a car window.

**(3)**

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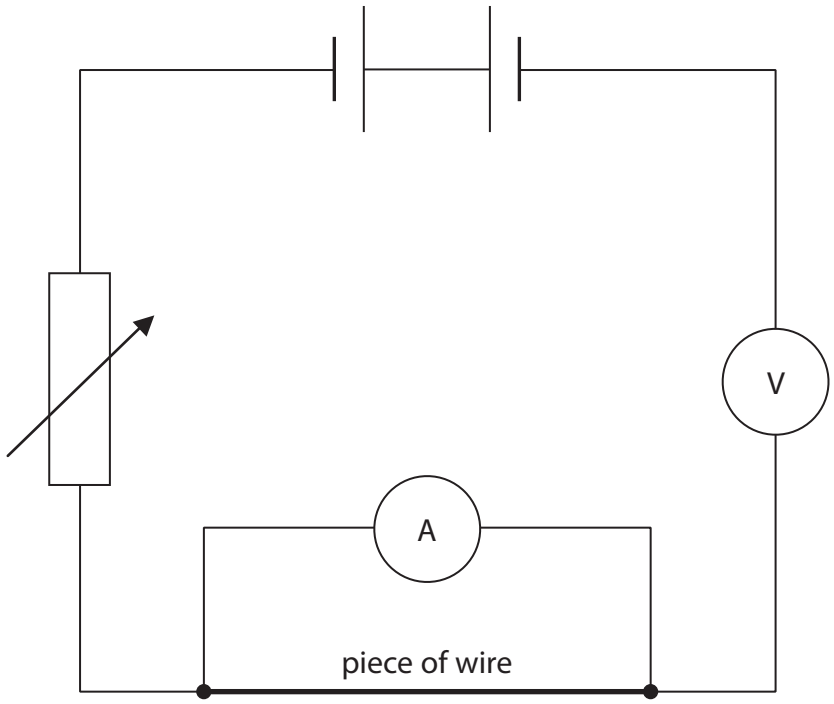
**(Total for Question 1 = 14 marks)**

**2** A student plans to measure the resistance of a piece of wire.

He sets up this circuit and finds that it does not work.




(a) Identify the three errors in the student's circuit.

**(3)**

1 .....

.....

2 .....

.....

3 .....

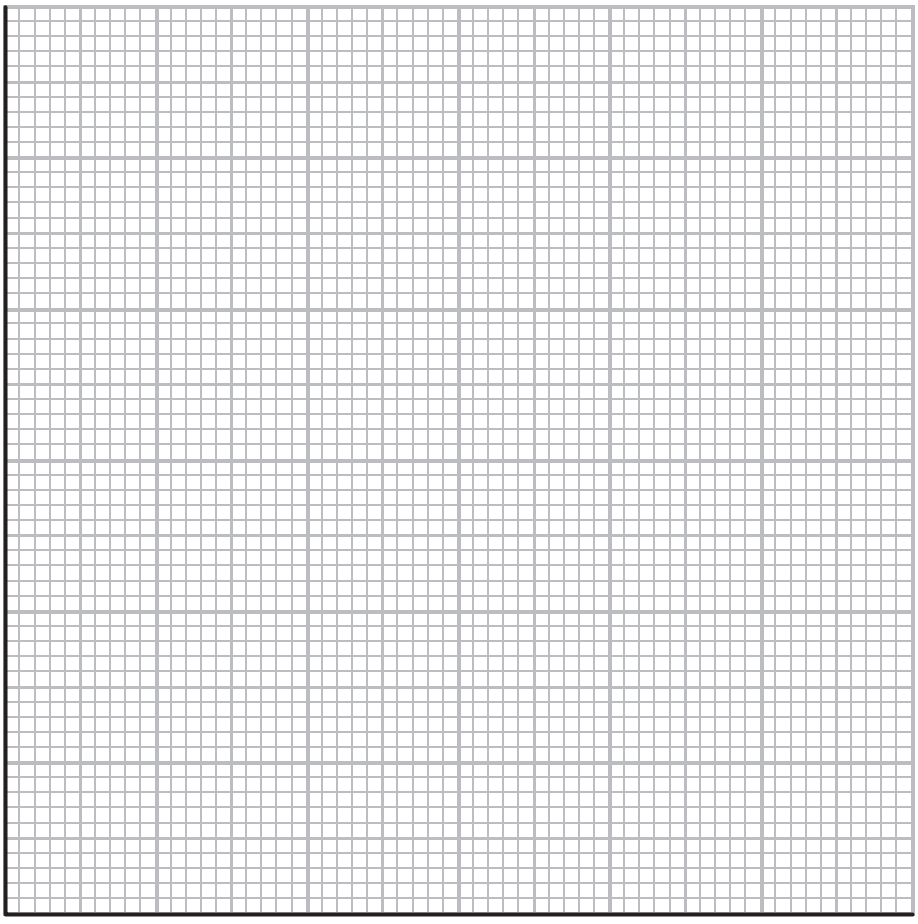
.....

(b) The student uses a correct circuit to obtain these results.

| Current in amps | Voltage in volts |
|---|---|
| 0.00 | 0.0 |
| 0.24 | 1.5 |
| 0.71 | 4.5 |
| 0.89 | 6.0 |
| 1.00 | 7.5 |
| 1.10 | 9.0 |

(i) Plot a graph to show the relationship between current and voltage for the wire.

**(5)**



(ii) Find the current when the voltage is 2.5 V.

**(1)**

(iii) Suggest why the line on the graph curves.

**(1)**

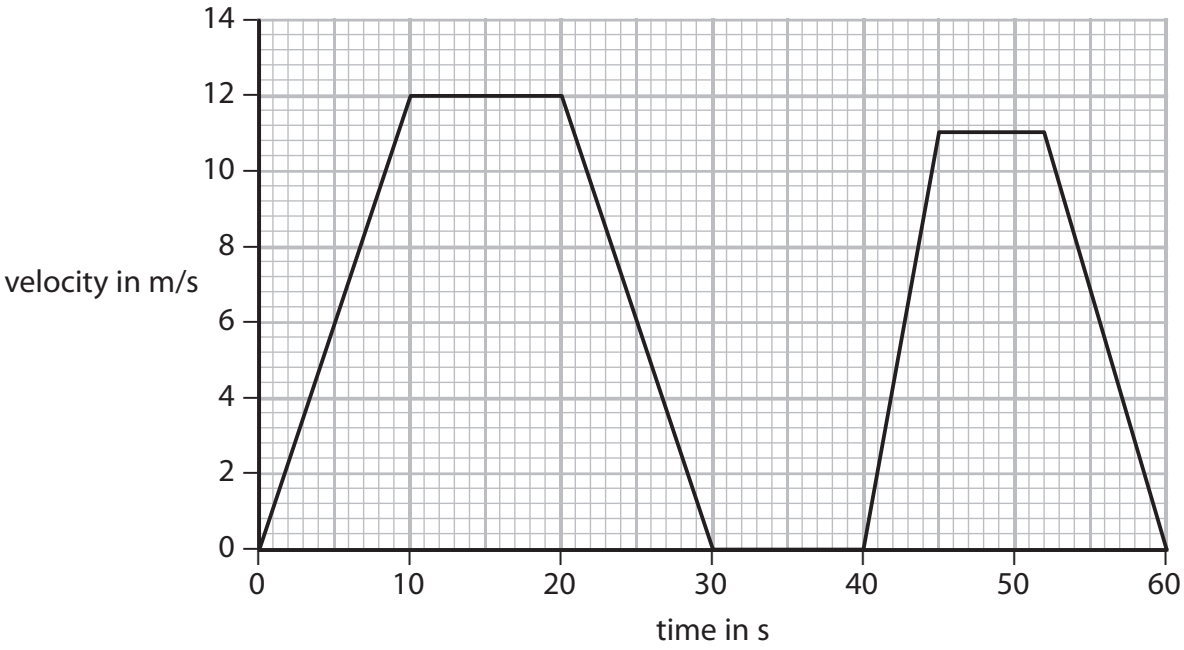
(iv) Describe what else the student should do to find an accurate value for the resistance of the piece of wire at a constant temperature.

**(4)**

**(Total for Question 2 = 14 marks)**

**4** A bus travels along a straight road.

The graph shows how the velocity of the bus changes during a short journey.




(a) (i) State the velocity of the bus after 25 s.

**(1)**

velocity = ..... m/s

(ii) How long is the bus stationary during its journey?

**(1)**

time = ..... s

(b) (i) State the equation linking acceleration, change in velocity and time taken.

**(1)**

(ii) Calculate the acceleration of the bus during the first 10 seconds.

Give the unit.

**(3)**

acceleration = ..... unit .....

(c) (i) State the equation linking average speed, distance moved and time taken.

**(1)**

(ii) The bus moves a total distance of 390 m during the journey.

Calculate the average speed of the bus.

**(2)**

average speed = ..... m/s

(d) The bus travels further in the first 30 seconds of its journey than it does during the last 30 seconds.

Explain how the graph shows this.

**(2)**

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**(Total for Question 4 = 11 marks)**