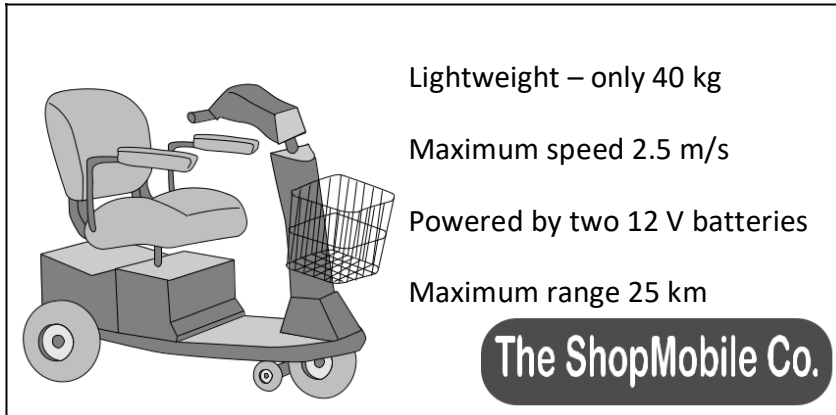


# SERIES AND PARALLEL CIRCUITS 1

**Q:1** The picture shows an advert for an electric mobility scooter.



Lightweight – only 40 kg  
Maximum speed 2.5 m/s  
Powered by two 12 V batteries  
Maximum range 25 km

**The ShopMobile Co.**

(a) The batteries are joined in series.

(i) What is the potential difference provided by the batteries to the motor?

\_\_\_\_\_

(1 mark)

(ii) The batteries supply a direct current (d.c.). What is a direct current (d.c.)?

\_\_\_\_\_  
\_\_\_\_\_

(1 mark)

(b) At 2.5 m/s on flat ground, the motor takes a current of 3.0 A from the batteries.

(i) Explain why a bigger current is taken from the batteries when the scooter is going uphill at 2.5 m/s.

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(2 marks)

(ii) What effect does travelling uphill have on the range of the scooter?

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(1 mark)

(c) The mass of the scooter driver is 80 kg.

Use the equation in the box to calculate the kinetic energy of the scooter and driver when they are travelling at maximum speed.

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times \text{speed}^2$$

Show clearly how you work out your answer.

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Kinetic energy = \_\_\_\_\_ J

(2 marks)

(d) A battery which has run down is recharged in 8 hours. The average current delivered by the battery charger is 1.5 A.

Use the equation in the box to calculate the maximum charge stored by both batteries.

$$\text{charge} = \text{current} \times \text{time}$$

Show clearly how you work out your answer and give the unit.

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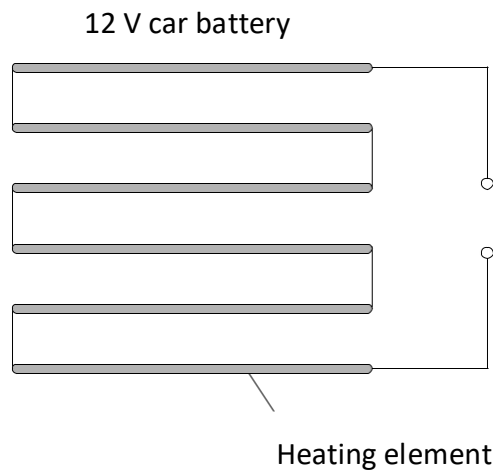
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Charge stored = \_\_\_\_\_

(3 marks)

**Q:2** The diagram shows a simple type of car rear window heater. The six heating elements are exactly the same.



(a) Each heating element has a resistance of  $5 \Omega$ . The current passing through each element is  $0.4 \text{ A}$ .

(a)(i) Calculate the total resistance of the six heating elements. Show clearly how you work out your answer.

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Total resistance = ..... ohms

(2 marks)

(a)(ii) Why is the current passing through each element the same?

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(1 mark)

(a)(iii) What is the total current passing through the whole circuit?

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(1 mark)

(a)(iv) How is the 12 volt potential difference of the car battery shared between the six heating elements?

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(1 mark)

(b) It takes the heater two minutes to demist the car window.

Use the equation in the box to calculate how much charge flows through the heater in this time.

$$\text{charge} = \text{current} \times \text{time}$$

Show clearly how you work out your answer and give the unit.

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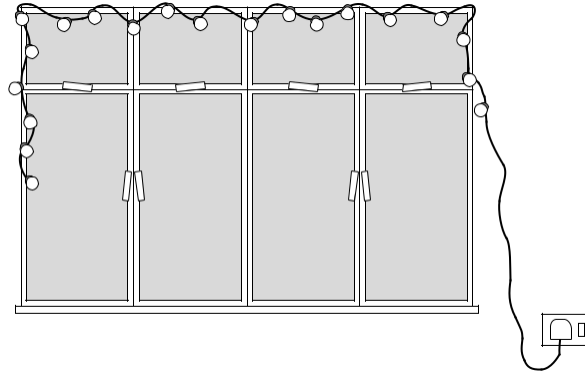
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Charge = \_\_\_\_\_

(3 marks)

**Q:3** A set of lights consists of 20 lamps connected in series to the 230 V mains electricity supply.



(a) When the lights are switched on and working correctly, the current through each lamp is 0.25 A.

(a) (i) What is the total current drawn from the mains supply?

\_\_\_\_\_

(1 mark)

(a) (ii) Use the equation in the box to calculate the charge passing through one of the lamps in 5 minutes.

$$\text{charge} = \text{current} \times \text{time}$$

Show clearly how you work out your answer and give the unit.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Total charge = \_\_\_\_\_

(3 marks)

(b) One of the lamps in the set is a fuse lamp. This contains a filament which melts if a fault occurs. A short time after the lights are switched on, a fault causes the filament inside the fuse lamp to melt and all the lamps go out.

The householder cannot find another fuse lamp so connects a piece of aluminium foil across the contacts inside the fuse lamp holder.

When switched on, the nineteen remaining lamps work.

What the householder has done is dangerous.

Explain why.

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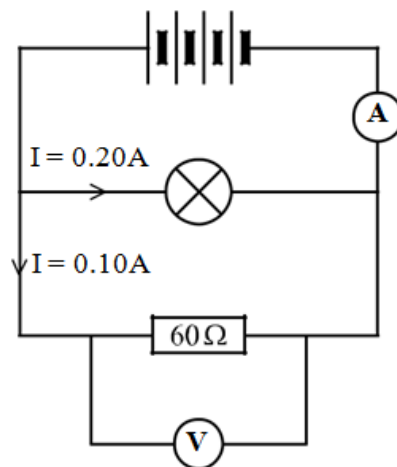
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(2 marks)

**Q:4** A circuit was set up as shown in the diagram.



(a) Each cell provides a potential difference of 1.5 volts.

(a)(i) What is the total potential difference provided by the four cells in the circuit?

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Total potential difference = \_\_\_\_\_volts

(1 mark)

(a)(ii) What will be the reading on the voltmeter?

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(1 mark)

(b) The current through the lamp is 0.20 amps. The current through the resistor is 0.10 amps.

What is the reading on the ammeter?

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Reading on ammeter = \_\_\_\_\_ amps

(1 mark)

(c) Use a phrase from the box to complete the following sentence.

greater than    equal to    smaller than
--

The resistance of the lamp is \_\_\_\_\_  $60\Omega$ .

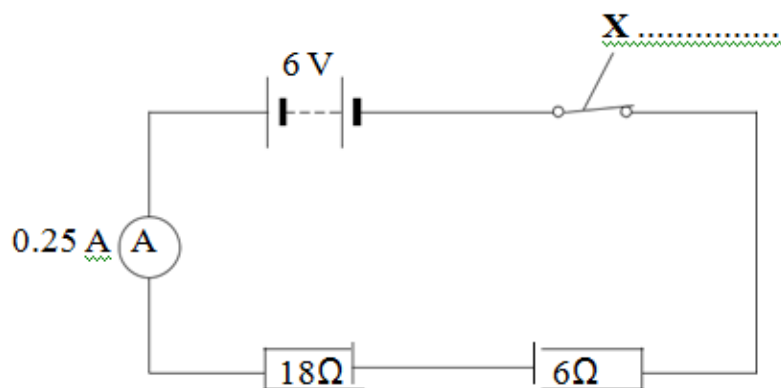
Give a reason for your answer.

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(2 marks)

**Q:5** A circuit diagram is shown below.



(a) Use a word from the box to label component X.

fuse    switch    thermistor

(1 mark)

(b) Calculate the total resistance of the two resistors in the circuit.

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Total resistance = \_\_\_\_\_  $\Omega$

(1 mark)

(c) The reading on the ammeter is 0.25 A.

The current through the 6  $\Omega$  resistor will be:

bigger than 0.25 A    equal to 0.25 A    smaller than 0.25 A

Draw a ring around your answer.

(1 mark)

(d) The 6 V battery is made by correctly joining several 1.5 V cells in series. Calculate the number of cells needed to make the battery.

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Number of cells = \_\_\_\_\_

(1 mark)

**Q:6** Complete each of the following sentences, A, B, C, D and E, by choosing the correct ending from K, L, M, N or O.

The first one has been done for you.



A)The current through a resistor depends .....

B)A direct current .....

C) In a series circuit, the potential difference.....

D.An alternating current .....

E In a parallel circuit, the potential difference .....

K ..... across each component is the same.

L ..... is supplied by a cell or battery.

M ..... is constantly changing direction.

N ..... of the power supply is shared by the components.

O ..... on the potential difference across the resistor.

(3 marks)

**TOTAL MARKS= 36 MARKS**