**1** In the circuit shown in Fig. 9.1, resistors can be connected between terminals P and Q. The e.m.f. of the battery is 6.0 V.

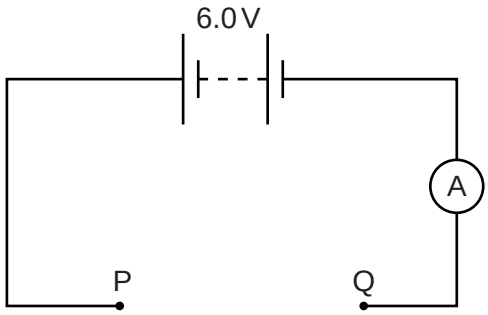


**Fig. 9.1**

**(a)** Calculate the current shown by the ammeter when a 12.0 Ω resistor and a 4.0 Ω resistor are

**(i)** connected in series between P and Q,

current = ..... [2]

**(ii)** connected in parallel between P and Q.

current = ..... [3]

**(b)** State the relationship between

**(i)** the resistance $R$ and the length $l$ of a wire of constant cross-sectional area,

.....

**(ii)** the resistance $R$ and the cross-sectional area $A$ of a wire of constant length.

.....
[2]

**(c)** The 12.0 Ω and 4.0 Ω resistors in **(a)** are wires of the same length and are made of the same alloy.

Calculate the ratio: $\frac{\text{cross-sectional area of 12.0 Ω resistor}}{\text{cross-sectional area of 4.0 Ω resistor}}$

ratio = ..... [1]

[Total: 8]

**2** Fig. 8.1 shows three cells each with e.m.f. 1.5 V connected in series.

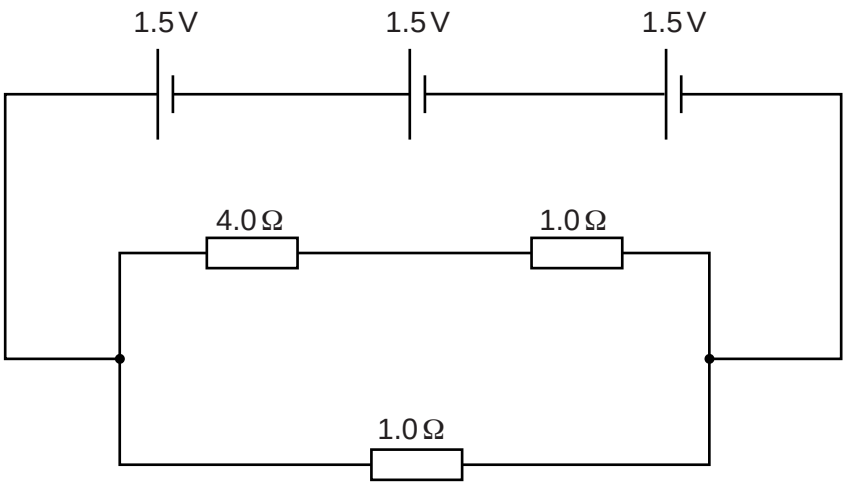


**Fig. 8.1**

**(a)** Calculate the combined e.m.f. of the cells.

e.m.f. = ..... [1]

**(b)** Calculate the combined resistance of the three resistors shown in Fig. 8.1.

resistance = ..... [2]

**(c)** Calculate the current in the 4.0 Ω resistor in Fig. 8.1.

current = ..... [3]

**(d)** Calculate the combined e.m.f. of the cells if one cell is reversed.

e.m.f. = ..... [1]

[Total: 7]

**3** **(a)** Fig. 8.1 shows two resistors **X** and **Y** in series.

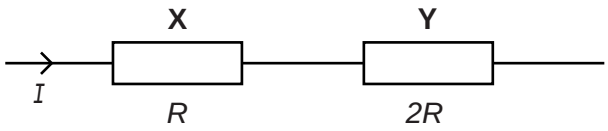


**Fig. 8.1**

Complete the table below, using only the symbols $I$ and $R$, alone or in combination.

| resistor | resistance | current | potential difference | power |
|---|---|---|---|---|
| **X** | $R$ | $I$ | | $I^2R$ |
| **Y** | $2R$ | | $2IR$ | |

[3]

**(b)** Fig. 8.2 represents the system used to transmit electricity from a power station to a factory.

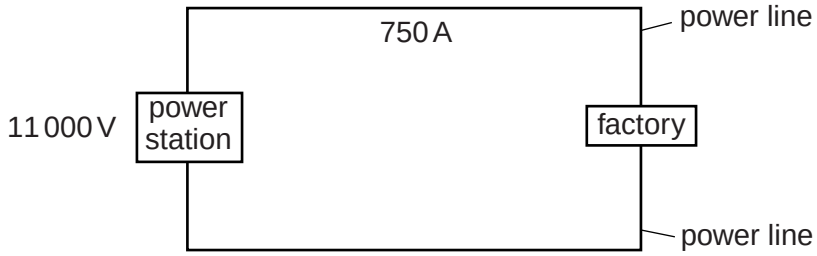


**Fig. 8.2**

The power station generates 11 000 V and supplies a current of 750 A. The total resistance of the power lines between the power station and the factory is 1.5 Ω.

Calculate

**(i)** the power output of the power station,

power = ..... [1]

**(ii)** the potential difference across the 1.5 Ω of the power lines,

potential difference = ..... [1]

**(iii)** the power supplied to the factory.

power = ..... [3]

[Total: 8]

**4** A student sets up a circuit containing three identical cells. Each cell has an e.m.f. (electromotive force) of 2.0 V.

Fig. 8.1 shows the cells in series with a length of uniform metal wire connected between two terminals K and L, an ammeter and a resistor X.

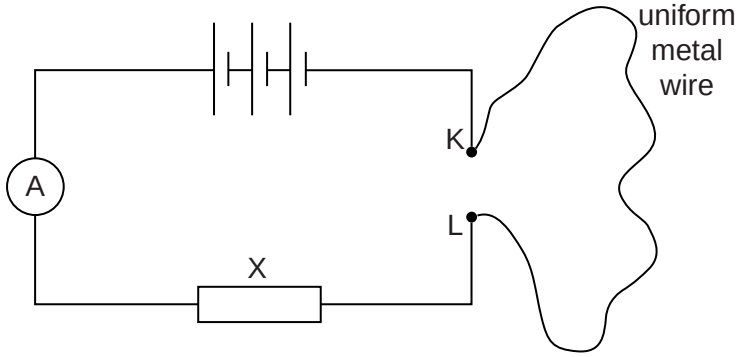


**Fig. 8.1**

**(a)** State the total e.m.f. of the three cells in series.

total e.m.f. = ..... [1]

**(b)** The ammeter reading is 0.25 A.

**(i)** State the name of the unit in which electric charge is measured.

.....[1]

**(ii)** Calculate the charge that flows through the circuit in twelve minutes.

charge = ..... [2]

**(iii)** The metal wire has a resistance of 16 Ω.

Calculate the resistance of resistor X.

resistance = ..... [2]

**(c)** The student removes the 16 Ω wire from the circuit and cuts it into two equal lengths.

He then connects the two lengths in parallel between K and L, as shown in Fig. 8.2.

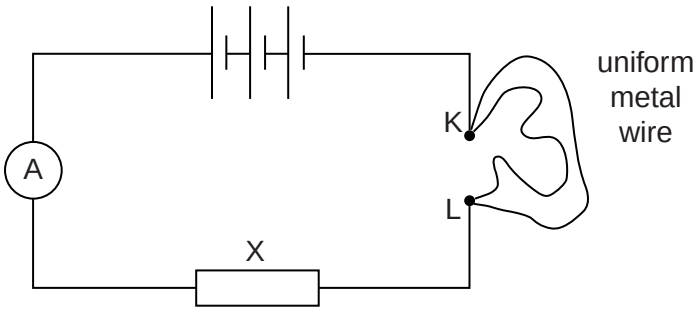


**Fig. 8.2**

Calculate the resistance of the two lengths of wire in parallel.

resistance = ..... [3]

[Total: 9]

**5** Fig. 9.1 shows the circuit that operates the two headlights and the two sidelights of a car.

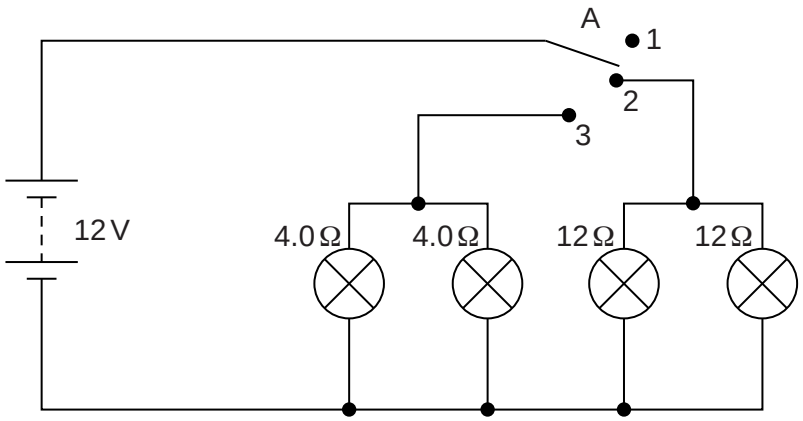


**Fig. 9.1**

Two of the lamps have resistances of 4.0 Ω when lit. The other two lamps have resistances of 12 Ω when lit. Switch A can be connected to positions 1, 2 or 3.

**(a)** State what happens when switch A is connected to

**(i)** position 1, .....

**(ii)** position 2, .....

**(iii)** position 3. .....

[1]

**(b)** **(i)** State the potential difference across each lamp when lit.

potential difference = .....[1]

**(ii)** Calculate the current in each 12 Ω lamp when lit.

current = .....[2]

**(c)** Show, with reasons for your answer, which type of lamp, 4.0 Ω or 12 Ω, has the higher power.

.....

.....

.....

.....[3]

[Total: 7]

**6** **(a)** An electrical safety expert is inspecting a laundry. The main workroom has a very hot and damp atmosphere.

The safety expert recommends that normal domestic light switches, as shown in Fig. 9.1, are replaced.

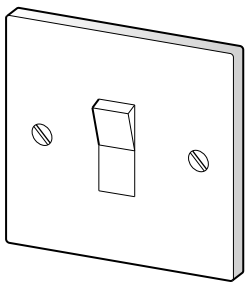

**Fig. 9.1**

**(i)** Explain why this recommendation is made.

.....

.....

.....

.....[2]

**(ii)** Suggest how the lights should be switched on and off.

.....

.....

.....

.....[1]

**(b)** Fig. 9.2 shows an aircraft being refuelled through a rubber hose.

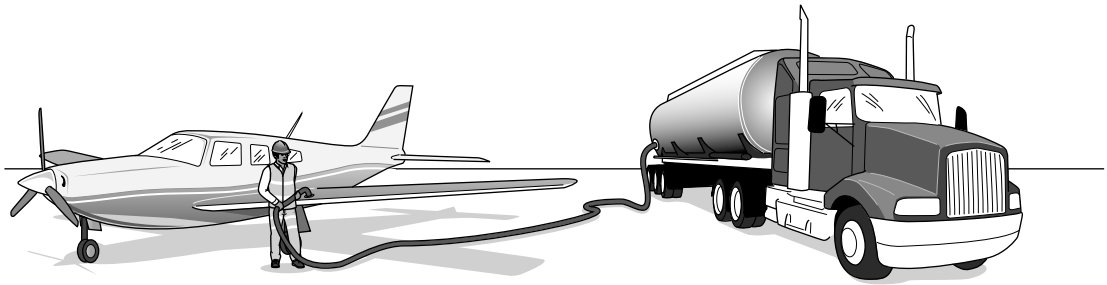

**Fig. 9.2**

**(i)** Suggest how fuel flowing through the hose can cause a large build-up of electric charge on the aircraft.

.....

.....

.....

.....[2]

**(ii)** The aircraft is refuelled on a particular day when the tyres and wheels are wet.

Explain why there will be no large build-up of charge in this case.

.....

.....

.....

.....[1]

[Total: 6]