7 A student set up the circuit shown in Fig. 7.1.

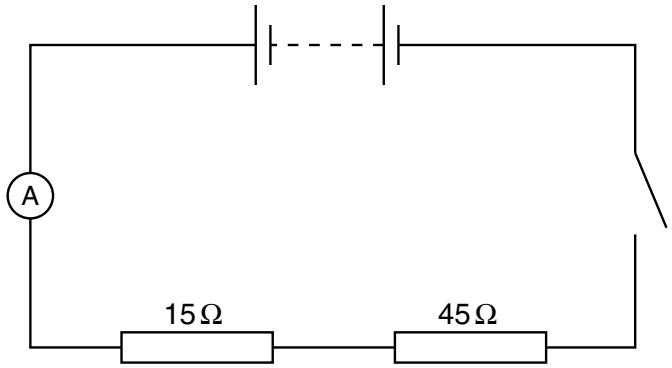

Fig. 7.1

The resistors are of resistance 15 Ω and 45 Ω. The battery is found to provide 1.6×10^5 J of electrical energy when a charge of 1.8×10^4 C passes through the ammeter in a time of 1.3×10^5 s.

(a) Determine

(i) the electromotive force (e.m.f.) of the battery,

e.m.f. = ... V

(ii) the average current in the circuit.

current = ... A

[4]

8 A student has available some resistors, each of resistance 100 Ω.

(a) Draw circuit diagrams, one in each case, to show how a number of these resistors may be connected to produce a combined resistance of

(i) 200 Ω,

(ii) 50 Ω,

(iii) 40 Ω.

[4]

(b) The arrangement of resistors shown in Fig. 8.1 is connected to a battery.

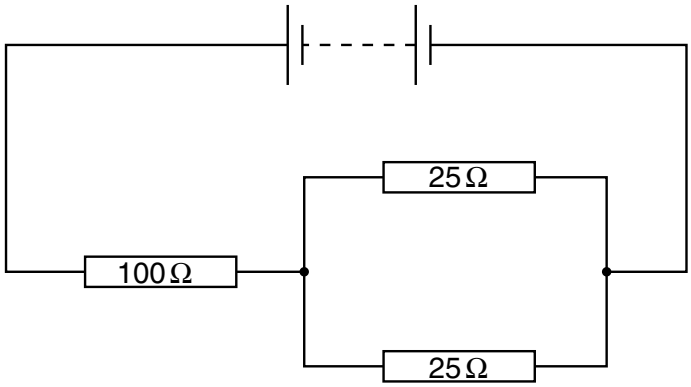

Fig. 8.1

The power dissipation in the 100 Ω resistor is 0.81 W. Calculate

(i) the current in the circuit,

current = ... A

(ii) the power dissipation in each of the 25 Ω resistors.

power = ... W

[4]

[Turn over

7 **(a)** A student has been asked to make an electric heater. The heater is to be rated as 12 V 60 W, and is to be constructed of wire of diameter 0.54 mm. The material of the wire has resistivity $4.9 \times 10^{-7}\ \Omega\,m$.

(i) Show that the resistance of the heater will be 2.4 Ω.

[2]

(ii) Calculate the length of wire required for the heater.

length = ... m [3]

(b) Two cells of e.m.f. E_1 and E_2 are connected to resistors of resistance R_1, R_2 and R_3 as shown in Fig. 7.1.

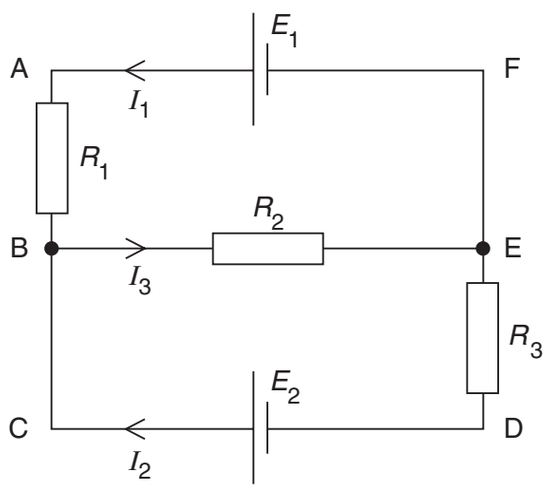

Fig. 7.1

The currents I_1, I_2 and I_3 in the various parts of the circuit are as shown.

(i) Write down an expression relating I_1, I_2 and I_3.

.....[1]

(ii) Use Kirchhoff's second law to write down a relation between

1. E_1, R_1, R_2, I_1 and I_3 for loop ABEFA,

.....

2. E_1, E_2, R_1, R_3, I_1 and I_2 for loop ABCDEFA.

.....
[2]