6 **(a)** Fig. 6.1 shows a circuit with a network of resistors.

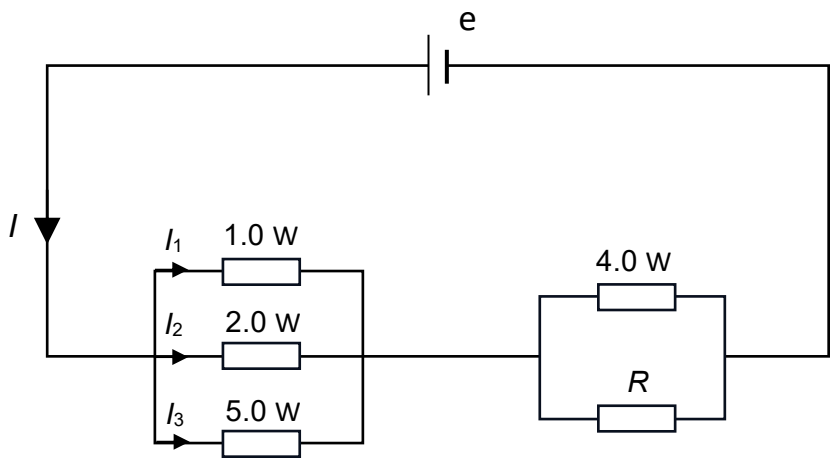

Fig. 6.1

The current from the cell is *I*.

(i) Determine the ratio of the currents $I_1 : I_2 : I_3$.

$I_1 : I_2 : I_3$ = ... [2]

(ii) 1.0×10^{-3} mol of electrons flowed through the 4.0 $\wedge$ resistor in a time interval of 320 s. During this time interval,

1. Show that the total charge that flowed through the 4.0 $\wedge$ resistor is 96 C.

[1]

2. Show that the electrical energy dissipated in the 4.0 $\wedge$ resistor is approximately
115 J.

[2]

3. The current through the 4.0 $\wedge$ resistor is three times the current through resistor *R*. Determine *R*.

R = ... ∧ [2]

(b) Fig. 6.2 shows a circuit in which a non-ohmic device X is connected in series with a 20 ∧ resistor. The cell has e.m.f. 6.0 V and negligible internal resistance. Fig 6.3 shows the *I*-*V* characteristics of X and the 20 ∧ resistor.

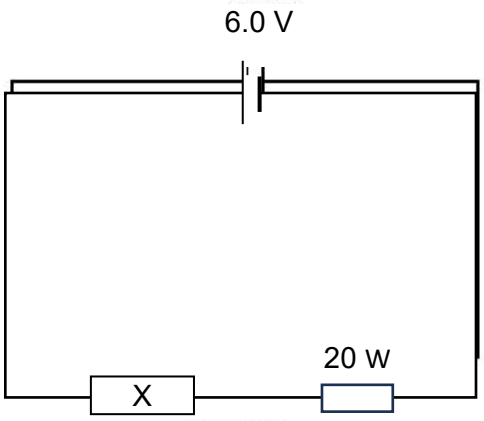

Fig. 6.2

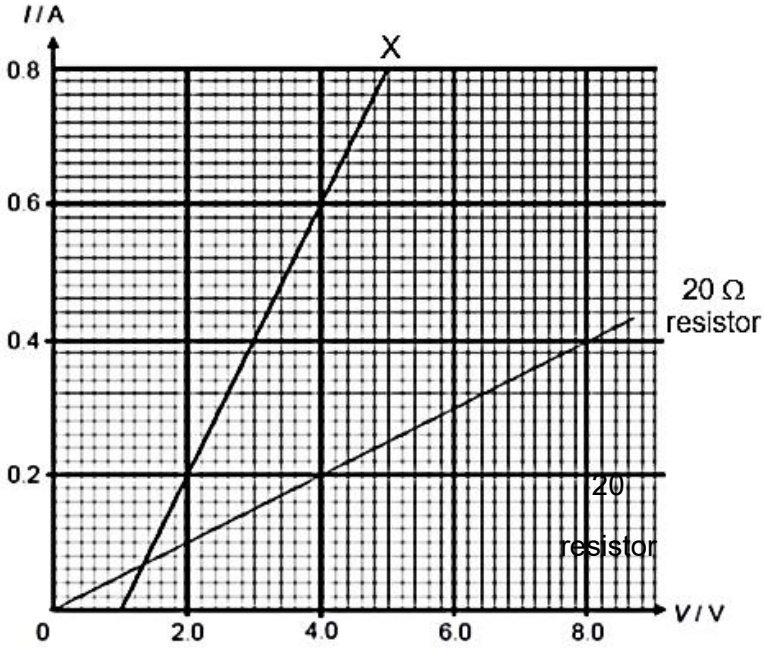

Fig. 6.3

Fig. 6.3

(i) Determine the current in the circuit.

current = ... A [1]

(ii) Device X consists of an ideal diode, a cell with negligible internal resistance and an ohmic resistor, connected in series as shown in Fig. 6.4. Suggest the values of the e.m.f of the cell and resistance of the ohmic resistor that will give the I-V characteristics shown in Fig. 6.3.

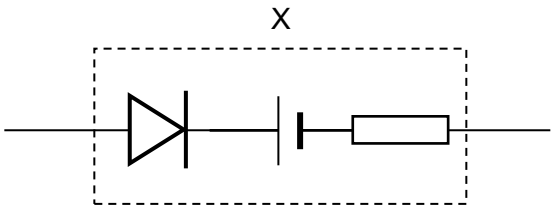

Fig. 6.4

emf of cell = …… V

resistance of resistor = …… Ω

[2]

[Total: 10 marks]

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