6 **(a)** State Kirchhoff's first law.

.....

..... [1]

(b) The variations with potential difference V of the current I for a resistor X and for a semiconductor diode are shown in Fig. 6.1.

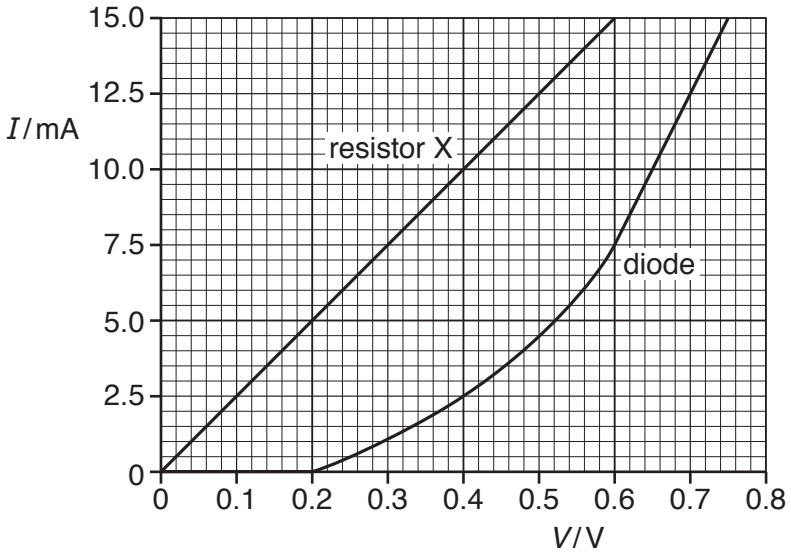

Fig. 6.1

(i) Determine the resistance of the diode for a potential difference V of 0.60 V.

resistance = ... Ω [3]

(ii) Describe, qualitatively, the variation of the resistance of the diode as V increases from 0.60 V to 0.75 V.

..... [1]

(c) The diode and the resistor X in **(b)** are connected into the circuit shown in Fig. 6.2.

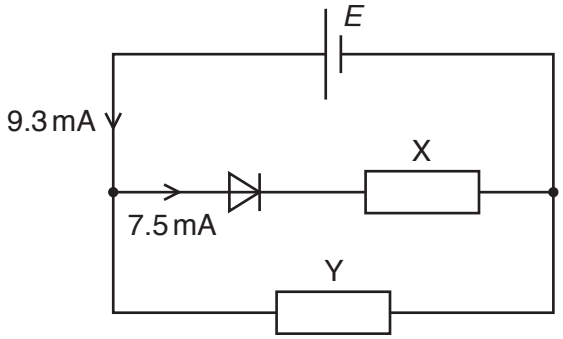

Fig. 6.2

The cell has electromotive force (e.m.f.) *E* and negligible internal resistance. Resistor Y is connected in parallel with resistor X and the diode. The current in the cell is 9.3 mA and the current in the diode is 7.5 mA.

(i) Fig. 6.1 to determine *E*.

E = ...V [1]

(ii) Determine the resistance of resistor Y.

resistance = ... Ω [2]

(iii) Calculate the power dissipated in the diode.

power = ...W [2]

(iv) The cell is now replaced by a new cell of e.m.f. 0.50 V and negligible internal resistance. Fig. 6.1 to determine the new current in the diode.

current = ...mA [1]

[Total: 11]