4 **(a)** The variation with potential difference (p.d.) V of current I of a semi-conductor diode is shown in Fig. 4.1.

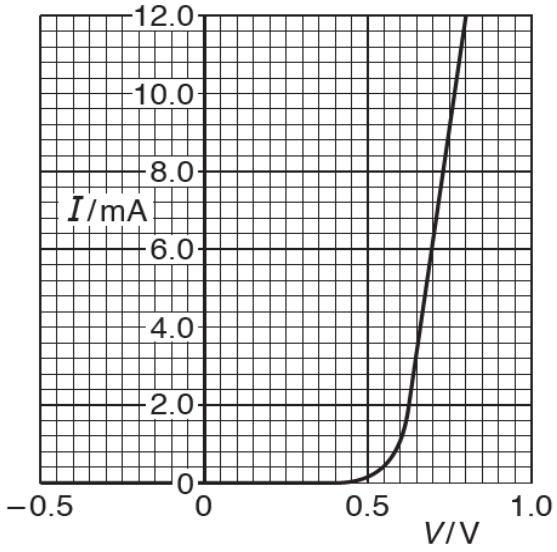

Fig. 4.1

(i) Use Fig. 4.1 to describe the variation of the resistance of the diode between V = - 0.5 V and V = 0.8 V.

……

……

……

…… [2]

(ii) Determine the resistance of the diode at the instant when I = 0.4 mA.

resistance = …….. Ω [2]

(b) On Fig. 4.2, sketch the variation with p.d. V of current I for a filament lamp. Numerical values are not required.

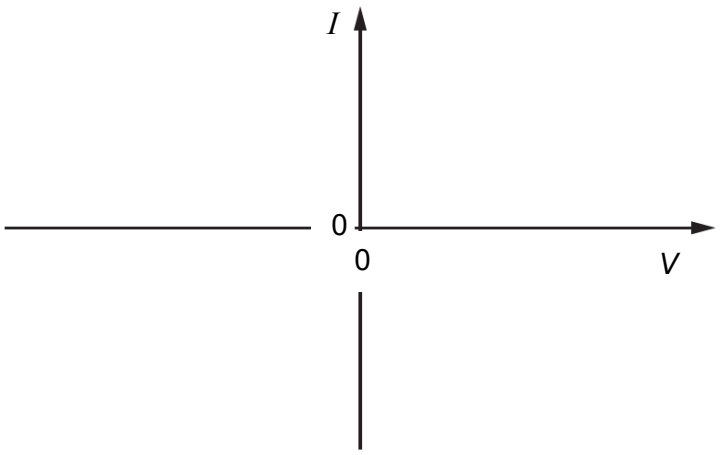

Fig. 4.2

[1]

(c) Fig. 4.3 shows a power supply of electromotive force (e.m.f.) of 12 V and internal resistance 0.50 Ω connected to a filament lamp, a variable resistor and a switch.

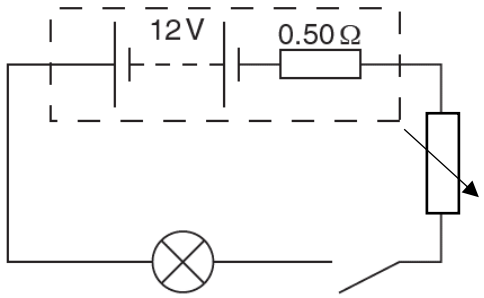

Fig. 4.3

(i) The switch is closed. The filament lamp has a power of 20 W when the p.d. across it is 10 V. Calculate the resistance of the lamp.

resistance = …….. Ω [2]

(ii) The variable resistor is adjusted to 2.0 Ω and the p.d. across the lamp is now measured to be 2.0 V. Calculate the resistance of the lamp.

resistance = …….. Ω [2]

(d) Explain how the two values of resistance calculated in **(c)** provide evidence for the shape of the sketch you have drawn in **(b)**.

…….…….....

……..…….. [1]