6 (a) Describe the *I–V* characteristic of

   (i) a metallic conductor at constant temperature,

....

....[1]

   (ii) a semiconductor diode.

....

....

....[2]

(b) Two identical filament lamps are connected in series and then in parallel to a battery of electromotive force (e.m.f.) 12 V and negligible internal resistance, as shown in Fig. 6.1a and Fig. 6.1b.
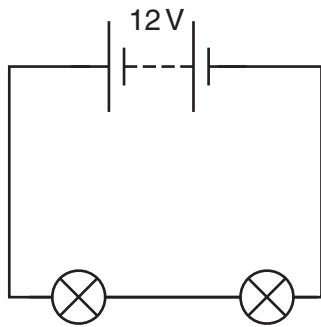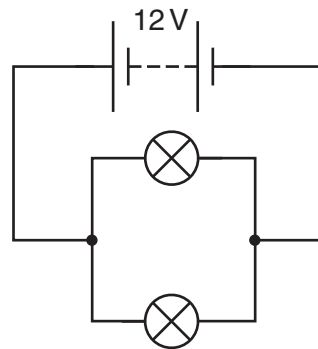

Fig. 6.1a   **Fig. 6.1b**

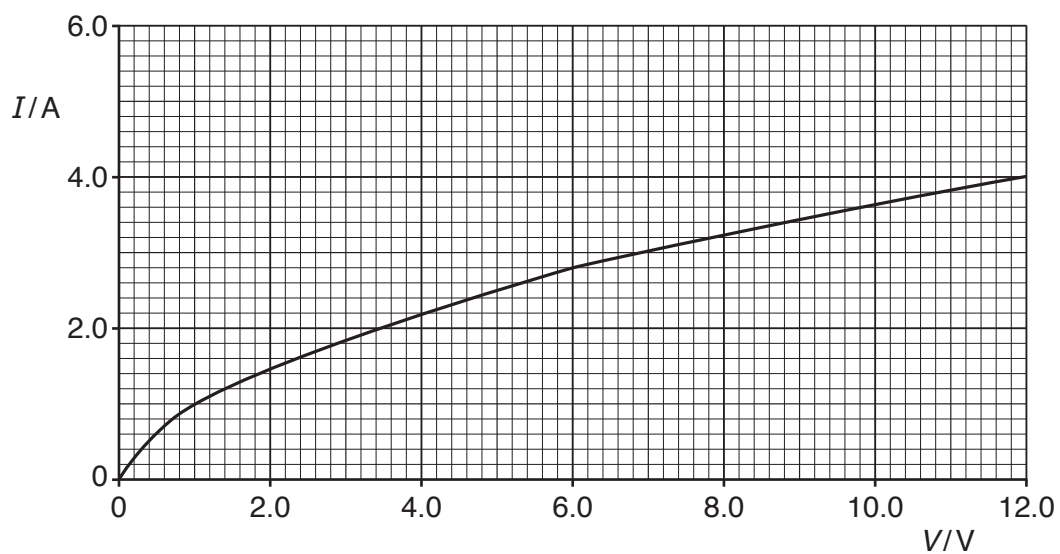The *I–V* characteristic of each lamp is shown in Fig. 6.2.

Fig. 6.2

(i) Use the information shown in Fig. 6.2 to determine the current through the battery in

    1.   the circuit of Fig. 6.1a,

               current = ...A

    2.   the circuit of Fig. 6.1b.

               current = ...A

                                                                                    [3]

(ii) Calculate the total resistance in

    1.   the circuit of Fig. 6.1a,

               resistance = ...Ω

    2.   the circuit of Fig. 6.1b.

               resistance = ...Ω

                                                                                    [3]

(iii) Calculate the ratio

           $\dfrac{\text{power dissipated in a lamp in the circuit of Fig. 6.1a}}{\text{power dissipated in a lamp in the circuit of Fig. 6.1b}}.$

               ratio = ...[2]

                                                                                   [Total: 11]