2 A car headlamp, rated at 12V and 24W, is used with a constant 12V supply for 1800s.

(a) Calculate, for the lamp used in this way,

(i) the resistance of the lamp,

resistance = ... Ω [2]

(ii) the energy transferred in the lamp,

energy = ... J [1]

(iii) the number of electrons passing through the lamp.

number = ... [2]

(b) The *I-V* characteristics of the lamp are investigated using the circuit shown in Fig. 2.1.
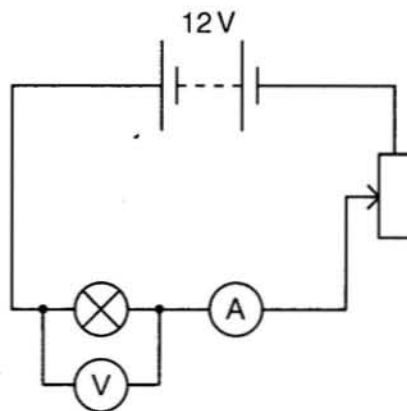
12 V

Fig. 2.1

The variable resistor can be adjusted to have resistance values between 0 and 10 Ω. Readings of potential difference (p.d.) *V* across the lamp and current *I* in the circuit are taken. The results obtained are shown in Fig. 2.2.
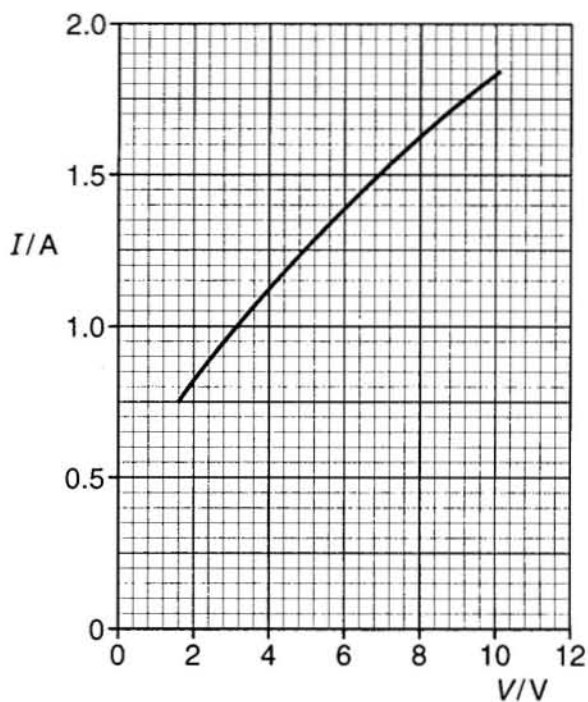

Fig. 2.2

(i) Explain how the resistance of the lamp can be obtained from Fig. 2.2.

....

....

....[1]

(ii) On Fig. 2.3 sketch the variation in resistance of the lamp when the p.d. across it is varied over the range of 2V to 10V. (Numerical values for the resistance are not expected.)
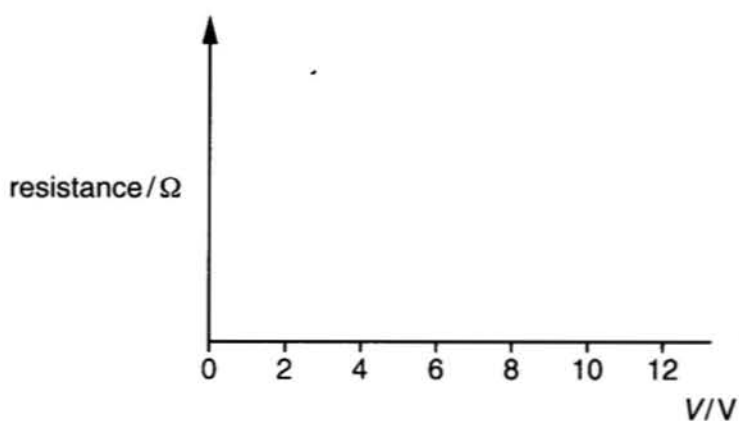
Fig. 2.3

[2]

(iii) Explain why, in the circuit of Fig. 2.1, the p.d. across the lamp cannot be varied from 0 to 12V.

....

....

....[2]