

- 5 (a) (i) State what is meant by an *electric current*.

.....  
..... [1]

- (ii) Define electric *potential difference* (*p.d.*).

.....  
..... [1]

- (b) A power supply of electromotive force (e.m.f.)  $8.7\text{ V}$  and negligible internal resistance is connected by two identical wires to three filament lamps, as shown in Fig. 5.1.

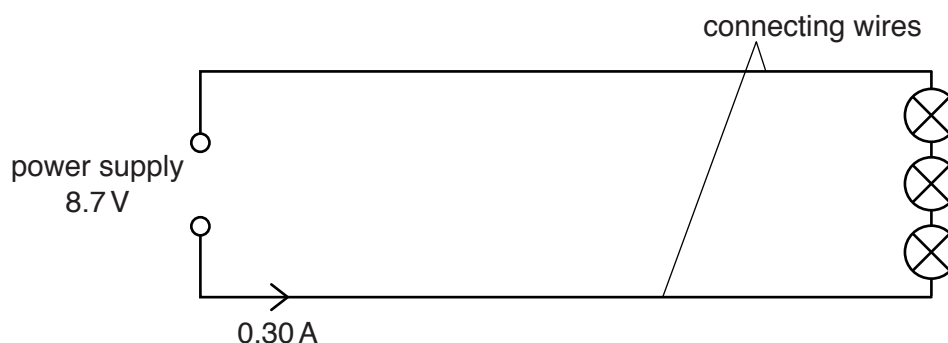


Fig. 5.1 (not to scale)

The power supply provides a current of  $0.30\text{ A}$  to the circuit.  
The filament lamps are identical. The  $I$ – $V$  characteristic for **one** of the lamps is shown in Fig. 5.2.

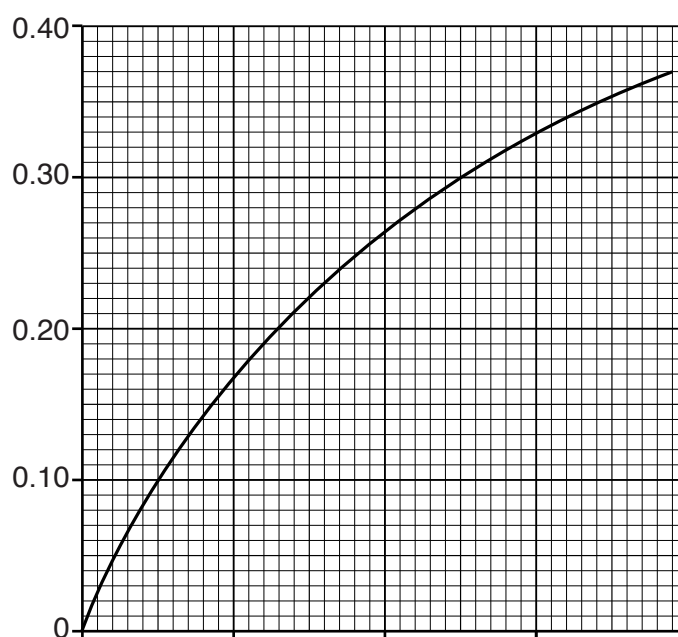


Fig. 5.2

- (i) Show that the resistance of each connecting wire is  $2.0\,\Omega$ .

[2]

- (ii) The resistivity of the metal of the connecting wires does not vary with temperature. On Fig. 5.2, sketch the  $I$ – $V$  characteristic for **one** of the connecting wires.

[2]

- (iii) Calculate the power loss in one of the connecting wires.

power = ..... W [2]

- (iv) Some data for the connecting wires are given below.

cross-sectional area =  $0.40\,\text{mm}^2$

resistivity =  $1.7 \times 10^{-8}\,\Omega\,\text{m}$

number density of free electrons =  $8.5 \times 10^{28}\,\text{m}^{-3}$

Calculate

1. the length of one of the connecting wires,

length = ..... m [2]

2. the drift speed of a free electron in the connecting wires.

drift speed = .....  $\text{ms}^{-1}$  [2]

[Total: 12]