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 V and negligible internal resistance is connected by two identical wires to three filament lamps, as shown in Fig. 5.1.
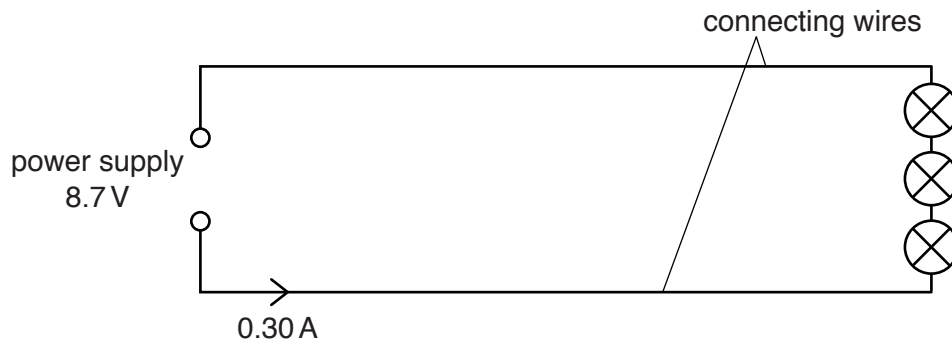
Fig. 5.1 (not to scale)

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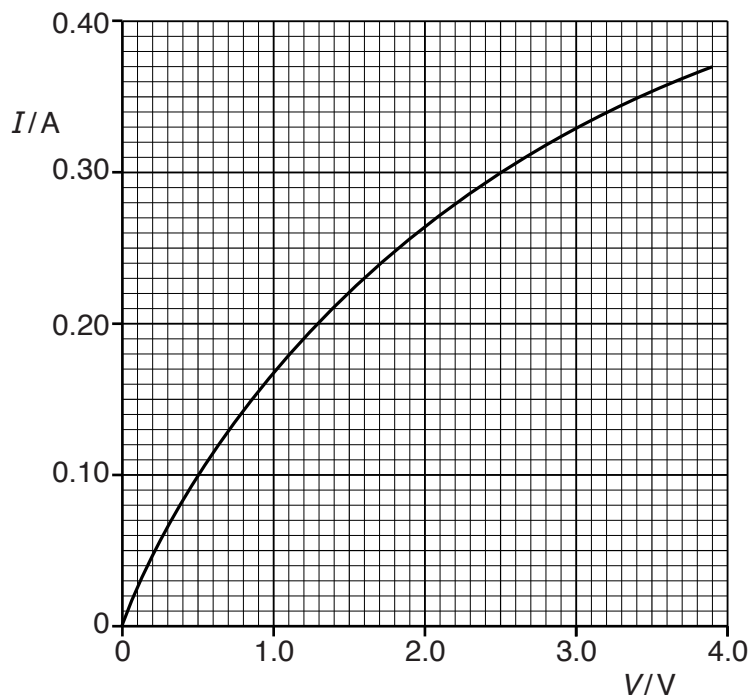The filament lamps are identical. The I–V characteristic for **one** of the lamps is shown in Fig. 5.2.

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 = ... m s^{-1} [2]

[Total: 12]

 [Turn over