

- 5 (a) A power supply of electromotive force (e.m.f.) 8.7 V and negligible internal resistance is connected by two identical connecting wires to three filament lamps, as shown in Fig. 5.1.

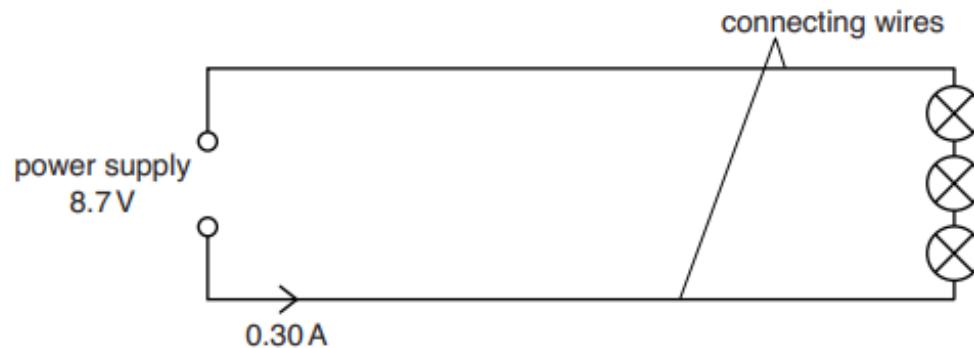


Fig. 5.1

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.

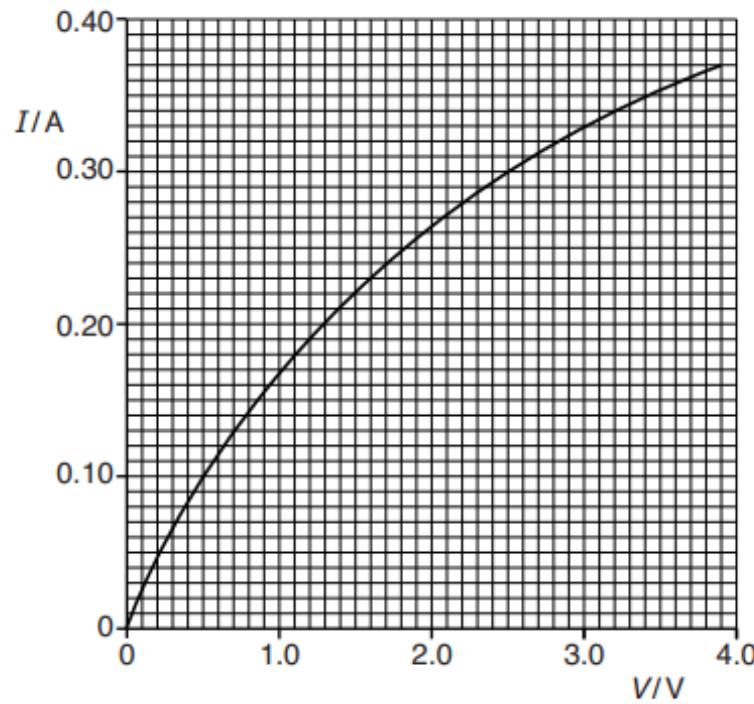


Fig. 5.2

- (i) State and explain the  $I$ - $V$  characteristic of the filament lamp.

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.....  
.....  
.....

[3]

- (ii) Determine the resistance of each connecting wire.

[2]

resistance = .....  $\Omega$

- (iii) 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.

[1]

- (b) The potentiometer shown in Fig. 5.3 is used to measure the e.m.f. and internal resistance of battery  $E_2$ .

The wire AB is 80.0 cm long and has a resistance of  $15.0 \Omega$ .  $E_1$  is a driver cell of 3.0 V with an internal resistance of  $0.50 \Omega$ .

$R_1$  and  $R_2$  have resistance of  $20.0 \Omega$  and  $5.0 \Omega$  respectively.

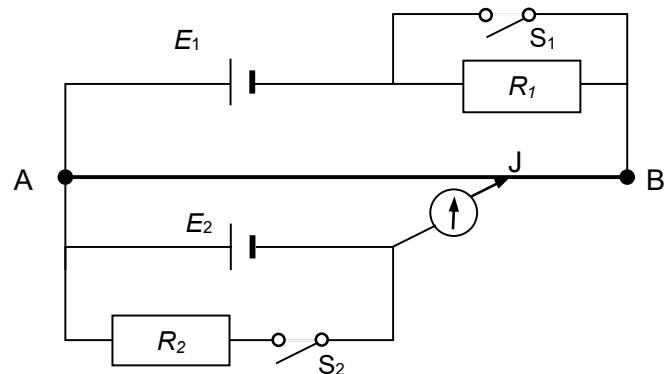


Fig. 5.3

When the switches  $S_1$  and  $S_2$  are both open, the galvanometer has zero deflection when AJ is 63.1 cm in length. When both switches are closed, the balanced length is 12.5 cm.

- (i) Show that the e.m.f. of  $E_2$  is 1.00 V.

[3]

- (ii) Hence, or otherwise, determine the internal resistance of  $E_2$ .

resistance = .....  $\Omega$  [3]

