3 A battery B, a variable resistor R and a uniform resistance wire PQ are connected in series, as shown in Fig. 3.1.

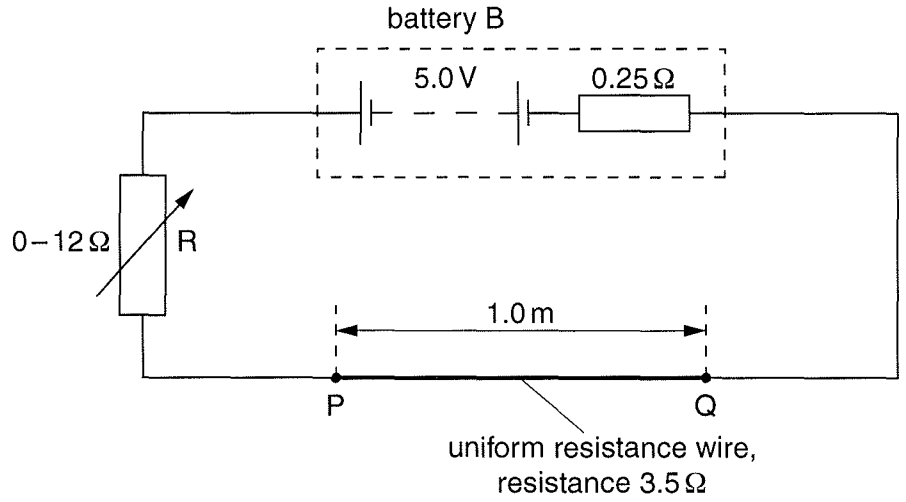

Fig. 3.1

Battery B has electromotive force (e.m.f.) 5.0 V and internal resistance 0.25 Ω. Wire PQ has length 1.0 m and resistance 3.5 Ω.

(a) The resistance of R is varied from 0 to 12 Ω.

Describe and explain the variation in the terminal potential difference (p.d.) across B. Numerical values are not required.

.....

.....

.....

.....

..... [3]

(b) The resistance of R is set to 4.0 Ω.

Calculate

(i) the terminal p.d. across B,

p.d. = ... V [3]

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(ii) the efficiency of power transfer of B.

efficiency = ... % [2]

(c) A cell C and a sensitive ammeter are connected to the circuit of Fig. 3.1, as shown in Fig. 3.2.

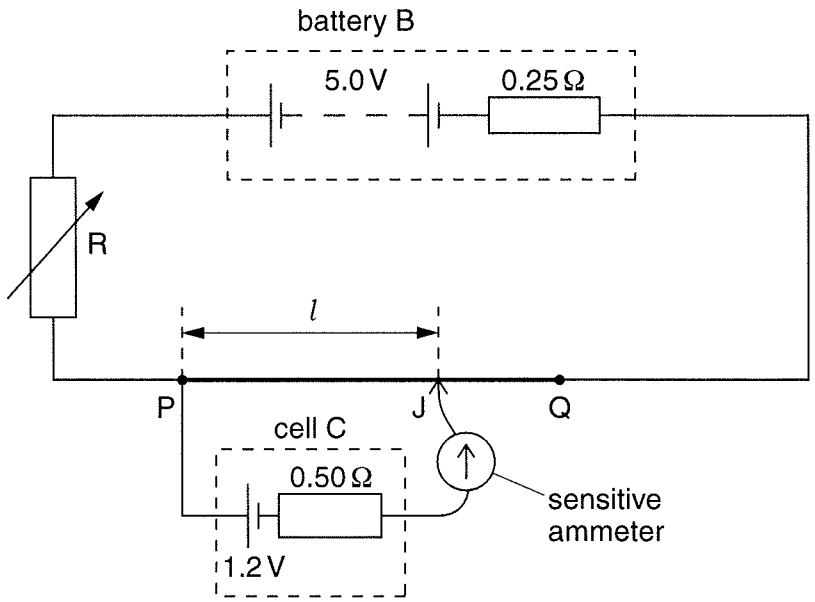

Fig. 3.2

Cell C has e.m.f. 1.2 V and internal resistance 0.50 Ω. The resistance of R remains at 4.0 Ω. The connection J is distance l from P.

The ammeter reads zero.

(i) State the value of the p.d. across PJ.

p.d. = ... V [1]

(ii) Calculate l.

l = ... m [2]

(iii) Explain why there is a reading on the ammeter when J is moved towards Q.

.....

..... [1]