

- 5 The circuit is set up to measure the e.m.f. E of an unknown cell as shown in Fig. 5.1.

The potentiometer wire AB is 1.00 m long and has a resistance of $10.0\ \Omega$.

When switch S_1 is closed and switch S_2 is opened, the standard cell of e.m.f. 1.02 V is balanced when the sliding contact is at Y which is 800 mm from end A.

When switch S_2 is closed and switch S_1 is opened, the unknown cell E is balanced when its sliding contact is at Z, which is 742 mm from end A.

Assume that unknown cell, standard cell and accumulator have negligible internal resistance.

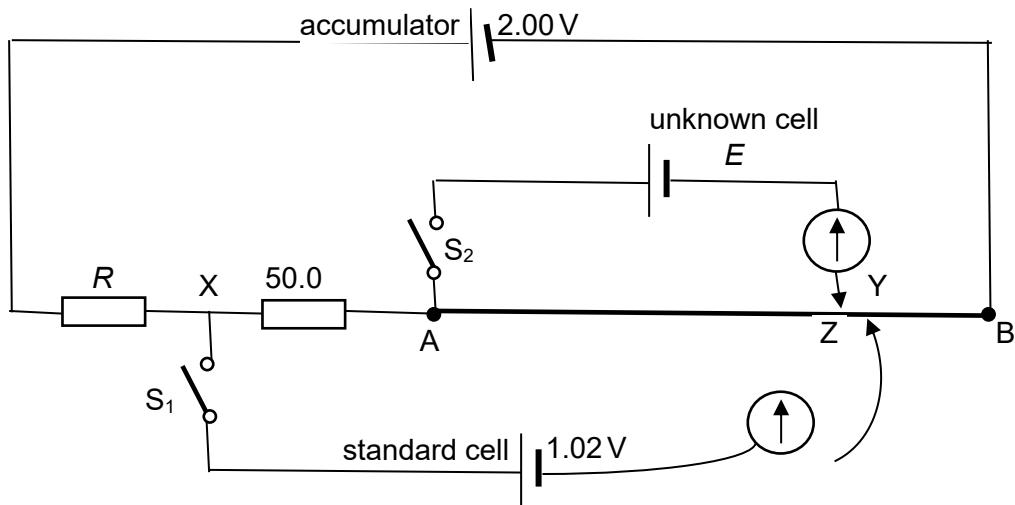


Fig. 5.1

- (a) State the potential difference (p.d.) across XY.

$$\text{p.d. across XY} = \underline{\hspace{10cm}} \text{V} \quad [1]$$

- (b) Use the answer in (a) to determine the current in the potentiometer wire.

current in potentiometer wire = _____ A [3]

- (c) Calculate the e.m.f. of the unknown cell, E .

$E =$ _____ V [3]

- (d) Show that the p.d. per unit length of the potentiometer wire AB is $1.76 \times 10^{-4} \text{ V mm}^{-1}$.

[1]

- (e) (i) Use your answer in (b) to calculate the value of R if the accumulator has an e.m.f. of 2.00 V.
(ii)

$$R = \underline{\hspace{2cm}} \Omega \quad [3]$$

- (ii) State and explain the change to the balance length AY if the value of R is increased.

[Total: 13]