5 **(a)** **(i)** State Kirchhoff's second law.

.....

.....[1]

(ii) Kirchhoff's second law is linked to the conservation of a certain quantity. State this quantity.

.....[1]

(b) The circuit shown in Fig. 5.1 is used to compare potential differences.

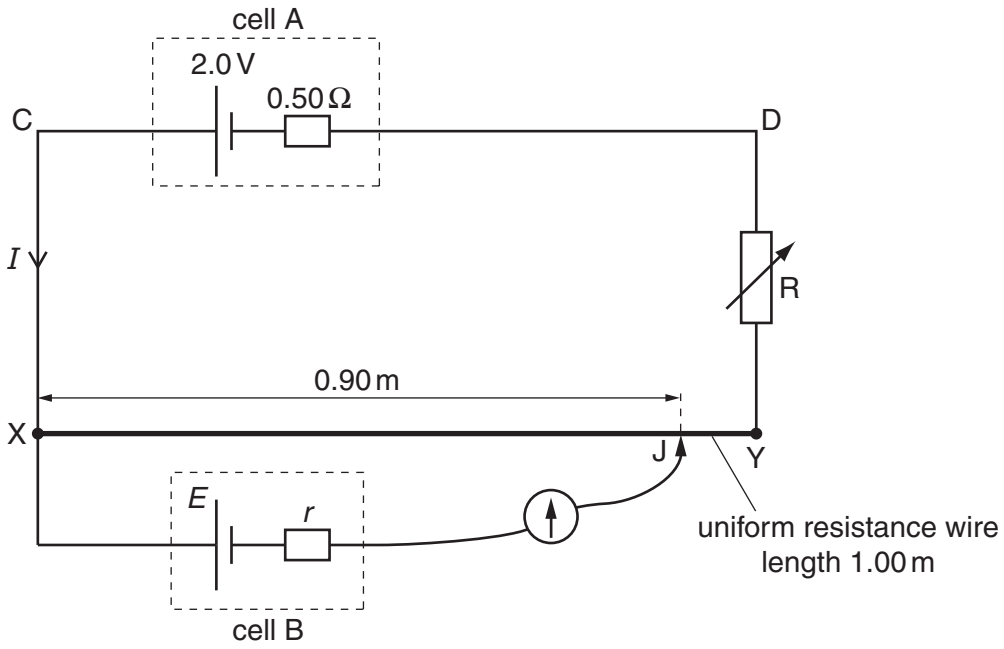

Fig. 5.1

The uniform resistance wire XY has length 1.00 m and resistance 4.0 Ω. Cell A has e.m.f. 2.0 V and internal resistance 0.50 Ω. The current through cell A is I. Cell B has e.m.f. E and internal resistance r.

The current through cell B is made zero when the movable connection J is adjusted so that the length of XJ is 0.90 m. The variable resistor R has resistance 2.5 Ω.

(i) Apply Kirchhoff's second law to the circuit CXYDC to determine the current I.

I = ... A [2]

(ii) Calculate the potential difference across the length of wire XJ.

potential difference = ... V [2]

(iii) your answer in **(ii)** to state the value of *E*.

E = ... V [1]

(iv) State why the value of the internal resistance of cell B is not required for the determination of *E*.

.....

.....[1]