6 **(a)** A circuit suitable for temperature measurement includes the use of a thermistor as shown in Fig. 6.1. Any change in temperature will cause a change in the value of the thermistor R_T so that there is a significant change in potential difference between X and Y which is connected to a voltmeter. A cell of electromotive force (e.m.f) E supplies current to the circuit.

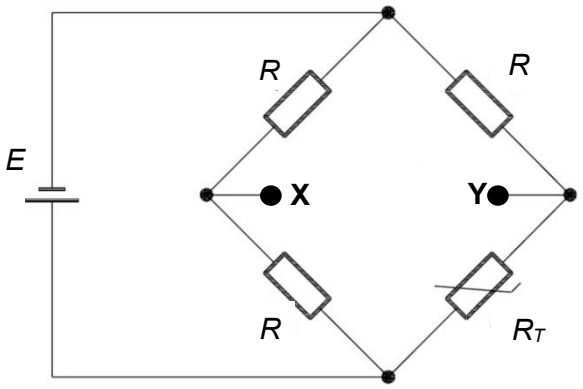

Fig. 6.1

(i) Distinguish between electromotive force (e.m.f) and potential difference.

.....

.....

..... [2]

(ii) Show that the potential difference between X and Y is given as

$$V_{XY} = \frac{R - R_T}{2(R + R_T)} E$$

[2]

(c) Another cell of e.m.f. E_1 is then connected in a simple series circuit, which is connected to a potentiometer as shown in Fig. 6.2. The potentiometer consists of a battery of e.m.f. E_2, a variable resistor and a uniform slide-wire of length L. The balance length, L_Y, is achieved by sliding the key along the slide-wire till the galvanometer shows a null deflection.

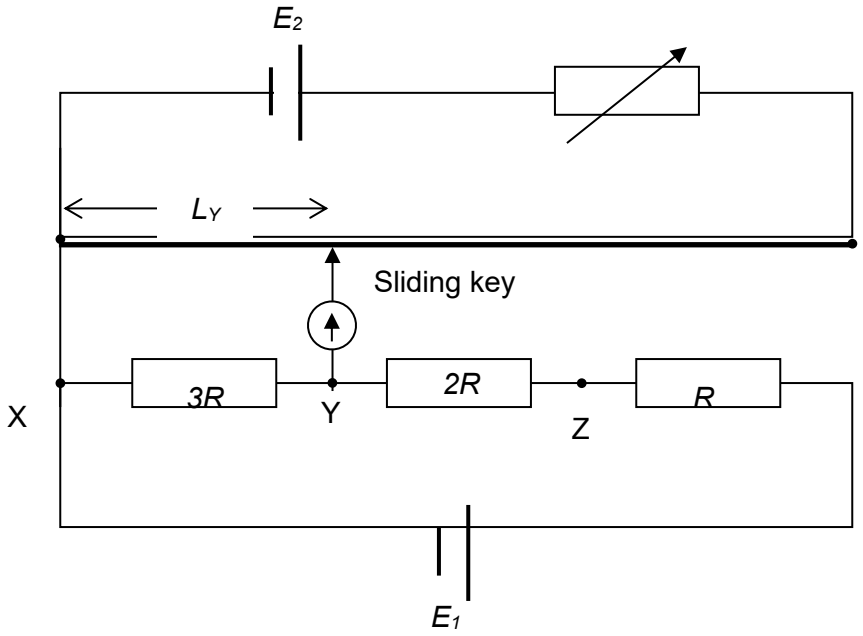

Fig. 6.2

(i) Explain in detail how a *decrease* in the resistance of the variable resistor will affect the magnitude of L_Y.

.....

.....

.....

..... [2]

(ii) A balance length of L_Z is found when one end of the wire attached to the galvanometer is connected to Z. Calculate the ratio of $L_Y : L_Z$.

ratio = ... [2]

(iii) State and explain any change in the answer to (**c)(ii)** if the internal resistance of the cell E_1 is not negligible.

.....

.....

.....

..... [2]

[Total: 10]