

- 4 (a) The graphs on Fig. 4.1 show how the resistance of a metal resistor **R** and a thermistor **T** varies when the temperature changes.

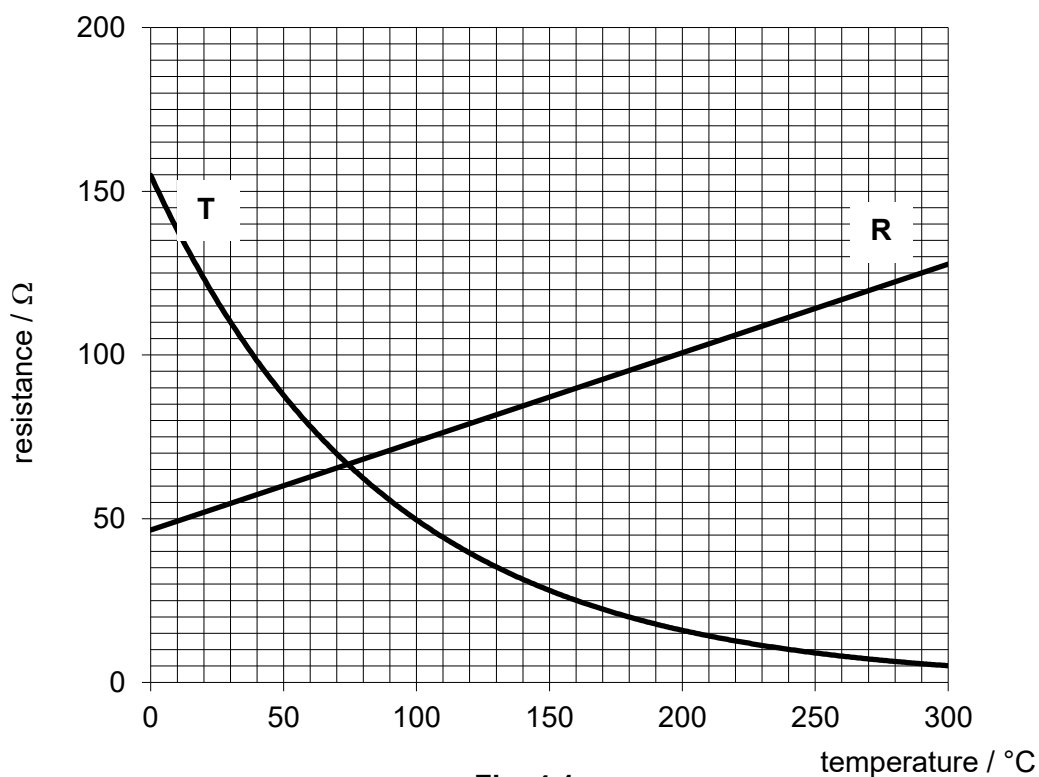


Fig. 4.1

The metal resistor **R** and the thermistor **T** are connected in series as shown in Fig. 4.2 together with a battery of negligible internal resistance. **R** and **T** are kept at the same temperature as each other

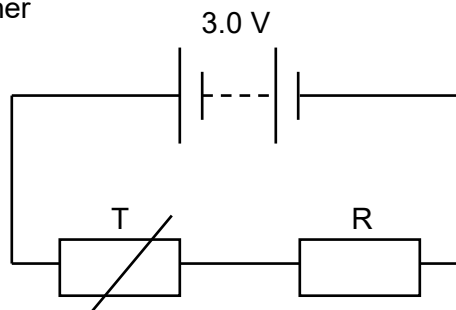


Fig. 4.2

- (i) Determine the current in the circuit shown in Fig 4.2 when the resistance of **R** is twice that of **T**.

current = ..... A [2]

- (ii) Describe how the effective resistance of the circuit in Fig 4.2 changes as temperature increases from 0 °C to 75 °C.

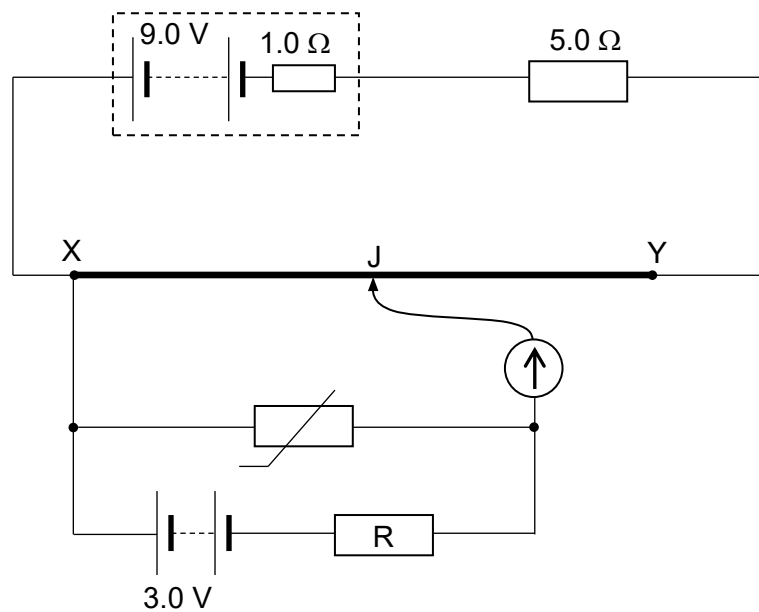
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..... [1]

- (iii) When the temperature is at 30 °C, determine the potential difference across **T**.

potential difference across **T** = ..... V [2]

- (b) The circuit shown in Fig 4.2 is now connected to a potentiometer as shown in Fig. 4.3.



**Fig. 4.3**

The potentiometer has a driver cell of e.m.f. 9.0 V with internal resistance of  $1.0\ \Omega$ . It is connected in series with a resistor of resistance  $5.0\ \Omega$  and a uniform resistance wire XY of length 120 cm and radius 0.200 mm. The resistivity of the wire is  $1.20 \times 10^{-6}\ \Omega\text{ m}$ .

- (i) Determine the resistance of the wire XY.

resistance of wire XY = .....  $\Omega$  [2]

- (ii) At a temperature of 30 °C, determine the balance length XJ where there is no deflection in the galvanometer.

balance length XJ = ..... m [2]

- (iii) Explain what will happen to the position of the balance point J if the temperature is at 75 °C.

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..... [1]