1)

A thermistor has resistance 3900 Ω at 0 °C and resistance 1250 Ω at 30 °C. The thermistor is connected into the circuit of Fig. 8.1 in order to monitor temperature changes.

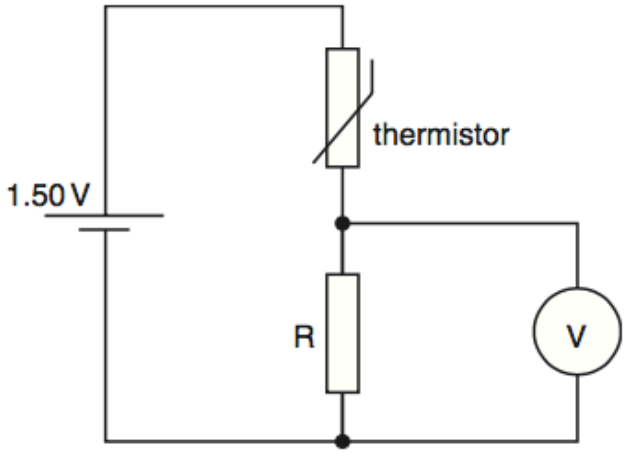

Fig. 8.1

The battery of e.m.f. 1.50 V has negligible internal resistance and the voltmeter has infinite resistance.

(a) The voltmeter is to read 1.00 V at 0 °C. Show that the resistance of resistor R is 7800 Ω.

[2]

(b) The temperature of the thermistor is increased to 30 °C. Determine the reading on the voltmeter.

reading = ... V [2]

(c) The voltmeter in Fig. 8.1 is replaced with one having a resistance of 7800 Ω.
Calculate the reading on this voltmeter for the thermistor at a temperature of 0 °C.

reading = ... V [2]

2)

A battery of e.m.f. 4.50 V and negligible internal resistance is connected in series with a fixed resistor of resistance 1200 Ω and a thermistor, as shown in Fig. 7.1.

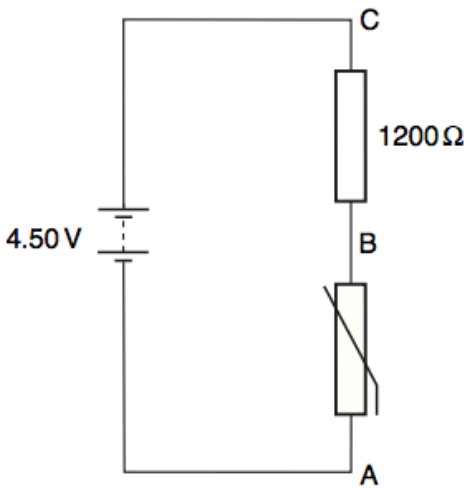

Fig. 7.1

(a) At room temperature, the thermistor has a resistance of 1800 Ω. Deduce that the potential difference across the thermistor (across AB) is 2.70 V.

[2]

(b) A uniform resistance wire PQ of length 1.00 m is now connected in parallel with the resistor and the thermistor, as shown in Fig. 7.2.

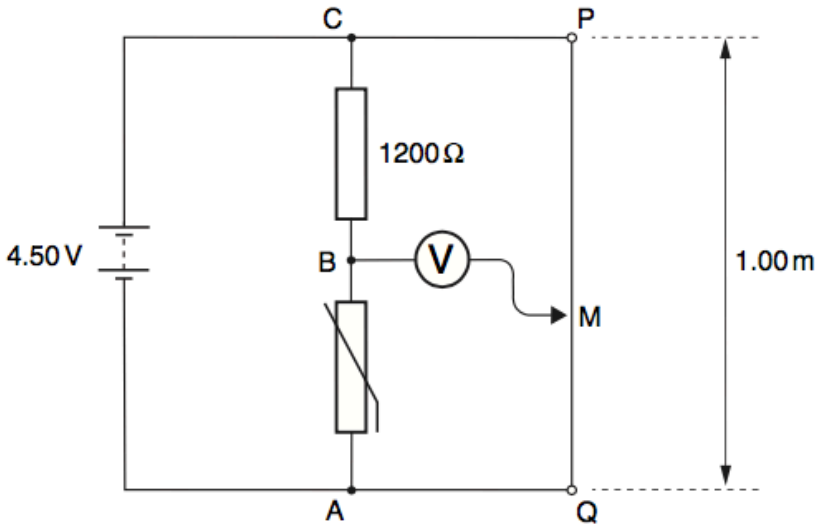

Fig. 7.2

A sensitive voltmeter is connected between point B and a moveable contact M on the wire.

(i) Explain why, for constant current in the wire, the potential difference between any two points on the wire is proportional to the distance between the points.

.....

.....

.....[2]

(ii) The contact M is moved along PQ until the voltmeter shows zero reading.

1. State the potential difference between the contact at M and the point Q.

potential difference = ... V [1]

2. Calculate the length of wire between M and Q.

length = ... cm [2]

(iii) The thermistor is warmed slightly. State and explain the effect on the length of wire between M and Q for the voltmeter to remain at zero deflection.

.....

.....

.....[2]

3)

A potential divider circuit consists of two resistors of resistances P and Q, as shown in Fig. 7.1.

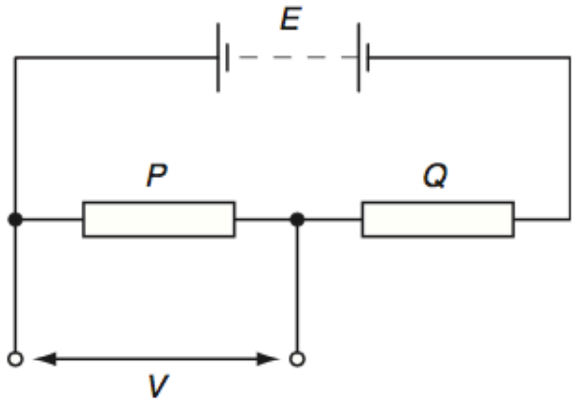

Fig. 7.1

The battery has e.m.f. E and negligible internal resistance.

(a) Deduce that the potential difference V across the resistor of resistance P is given by the expression

$$V = \frac{P}{P+Q} E.$$

[2]

(b) The resistances *P* and *Q* are 2000 Ω and 5000 Ω respectively.
A voltmeter is connected in parallel with the 2000 Ω resistor and a thermistor is connected in parallel with the 5000 Ω resistor, as shown in Fig. 7.2.

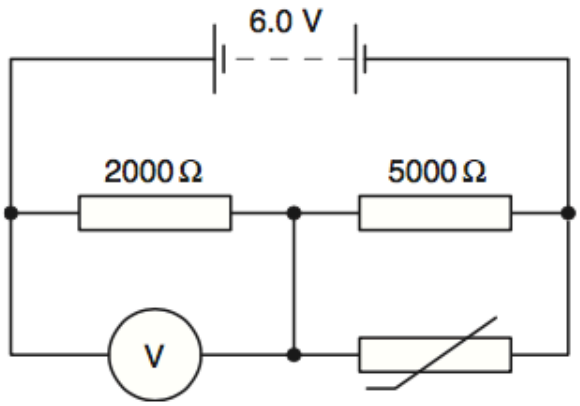

Fig. 7.2

The battery has e.m.f. 6.0V. The voltmeter has infinite resistance.

(i) State and explain qualitatively the change in the reading of the voltmeter as the temperature of the thermistor is raised.

.....

.....

.....

..... [3]

(ii) The voltmeter reads 3.6V when the temperature of the thermistor is 19 °C.
Calculate the resistance of the thermistor at 19 °C.

resistance = ... Ω [4]