



Section B

Answer **one** question from this section.

- 6 (a) Define electrical resistance.

[1]

- (b) A piece of constantan wire is connected in series with a negative temperature coefficient (NTC) thermistor and a 1.5 V cell with negligible internal resistance to make a potential divider.

This is shown in Fig. 6.1.

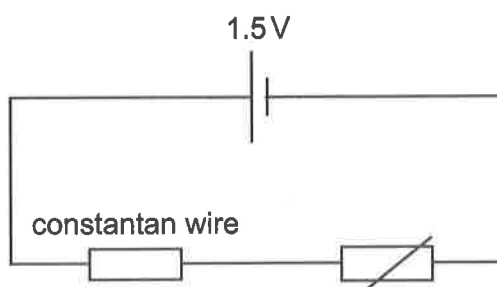


Fig. 6.1

The resistivity of constantan is constant over the temperature range explored in this question.

- (i) On Fig. 6.2, sketch the I - V characteristic of an NTC thermistor.

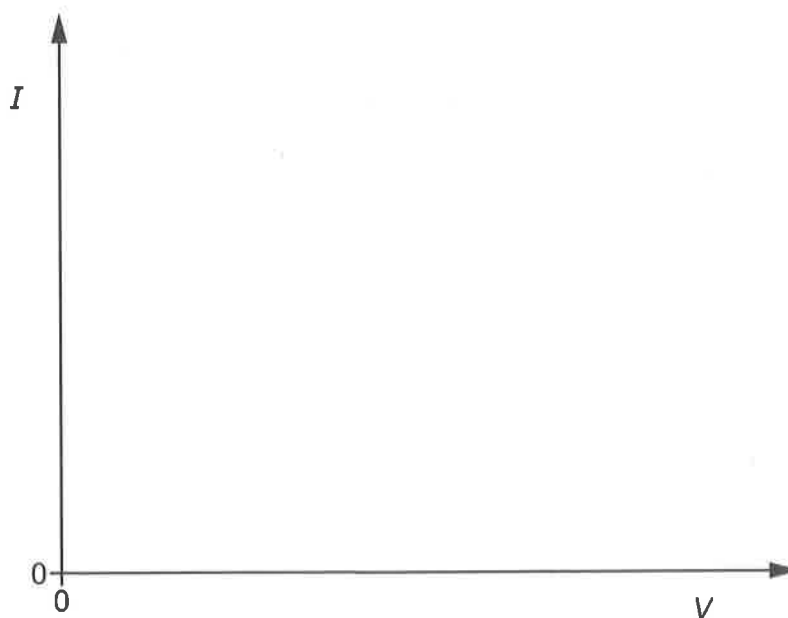


Fig. 6.2

[1]



- (ii) Explain the shape of the I - V characteristic of the thermistor.

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.....

..... [3]

- (iii) Explain the effect on the current in the cell of decreasing the temperature of the thermistor.

.....

..... [2]

- (iv) Explain the effect on the potential difference across the constantan wire of decreasing the temperature of the thermistor.

.....

..... [2]

- (v) The resistance of the constantan wire is $12\ \Omega$ and the resistance of the thermistor at 20°C is $50\ \Omega$.

Calculate the potential difference across the thermistor.

potential difference = V [2]





(c) The circuit in (b) is modified as shown in Fig. 6.3.

Two fixed resistors in series are added in parallel with the constantan wire and thermistor.

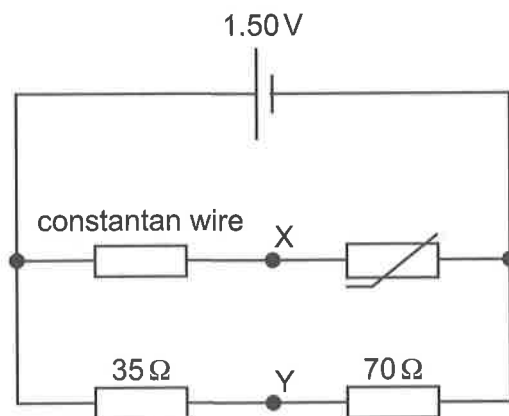


Fig. 6.3

(i) Calculate the potential difference between point X and point Y at 20°C.

potential difference = V [2]

(ii) The temperature of the thermistor increases. This causes the potential difference between point X and point Y to change.

Explain how the piece of constantan wire could be modified to return the potential difference to the value found in (c)(i).

.....

 [2]



- (d) A 0.25 m length of nichrome wire is connected to a 1.5 V cell with negligible internal resistance. The diameter of the wire is $100\text{ }\mu\text{m}$ and the resistivity of the nichrome is $1.5 \times 10^{-6}\text{ }\Omega\text{ m}$.

Calculate the number of electrons flowing past a point in the circuit in 90 seconds.

number of electrons = [5]

[Total: 20]

