



## Section B

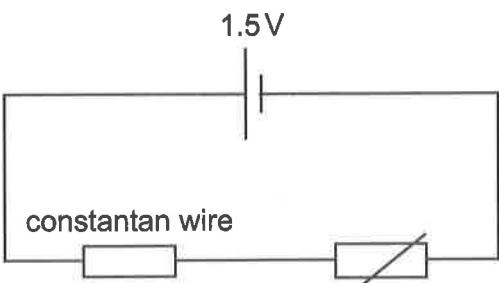
Answer **one** question from this section.

- 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 1.5V cell with negligible internal resistance to make a potential divider.

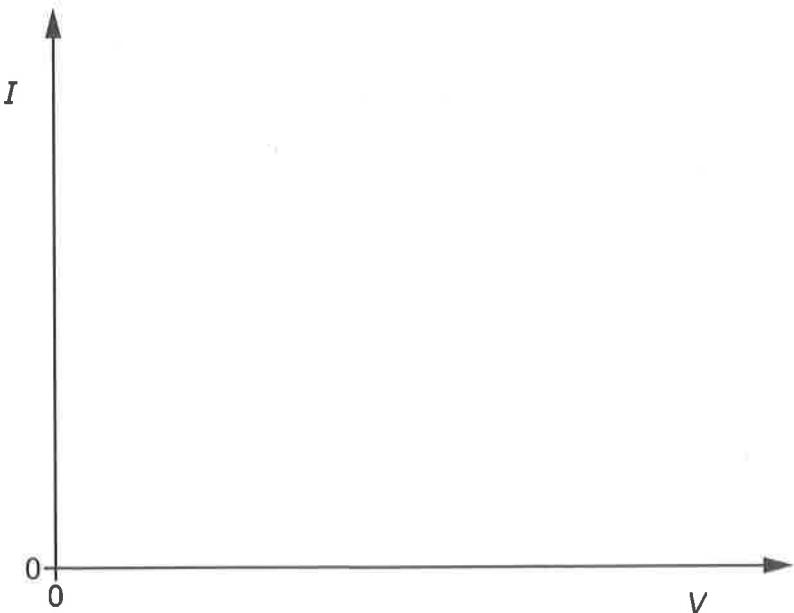
This is shown in Fig. 6.1.



**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.

.....  
.....  
.....  
.....

[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  $20^\circ\text{C}$  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.

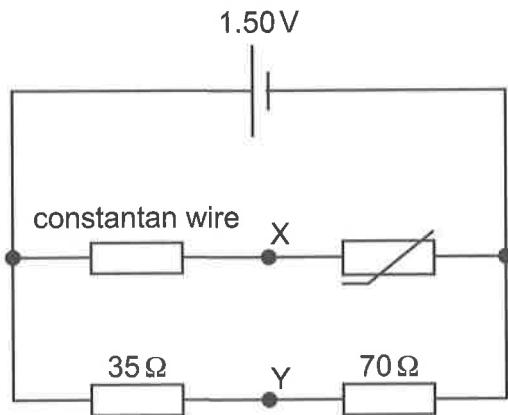


Fig. 6.3

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

$$\text{potential difference} = \dots \text{V} [2]$$

- (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  $\mu\text{m}$  and the resistivity of the nichrome is  $1.5 \times 10^{-6} \Omega\text{ m}$ .

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

DO NOT WRITE IN THIS MARGIN

number of electrons = ..... [5]

[Total: 20]

