

Practical

1. Carry out your planned practical and draw a graph to show the resistance of a thermistor in the range 0–100 °C. You should plot this using logs – the 'All the maths you need' and 'Analysis of results' section will help. Use a graph plotting program to draw your graph.

Design

1. Use your graph to help you design a potential divider circuit that uses your thermistor and a variable resistor. Your circuit should give an output of 3.0 V at 40 °C from a 6 V DC supply.
2. Construct your circuit and test your design. To do this, set up the Bunsen burner, tripod, gauze and heatproof mat, then raise the temperature of the water in the beaker to 40 °C as measured by the alcohol thermometer. Measure the output voltage from your circuit using the ohmmeter.

Analysis of results

1. The resistance R of a thermistor varies with absolute temperature T according to the formula

$$R = R_0 e^{\left(\frac{b}{T}\right)} \quad \text{so} \quad \ln R = \frac{b}{T} + a \quad \text{where } a = \ln R_0$$

and a graph of $\ln R$ against $\frac{1}{T}$ will give you a straight line which is easier than a curve to read accurately.

Learning tip

- Thermal experiments can be very difficult to control due to the thermal inertia of the components, so measuring the temperature of the actual semiconductor rather than the temperature of the water requires careful thought.

Questions

1. Consider the uncertainty in your measurement of temperature during your practical and comment on the outcome of your design.
2. State two ways in which you might improve your experiment – not your design.
3. Comment on how well your risk assessment worked and describe any safety issues that arose as you were carrying out the experiment.