

Combined Science - Physics - Key Stage 4 - Electricity

# Thermistors Worksheet

Miss Walrond

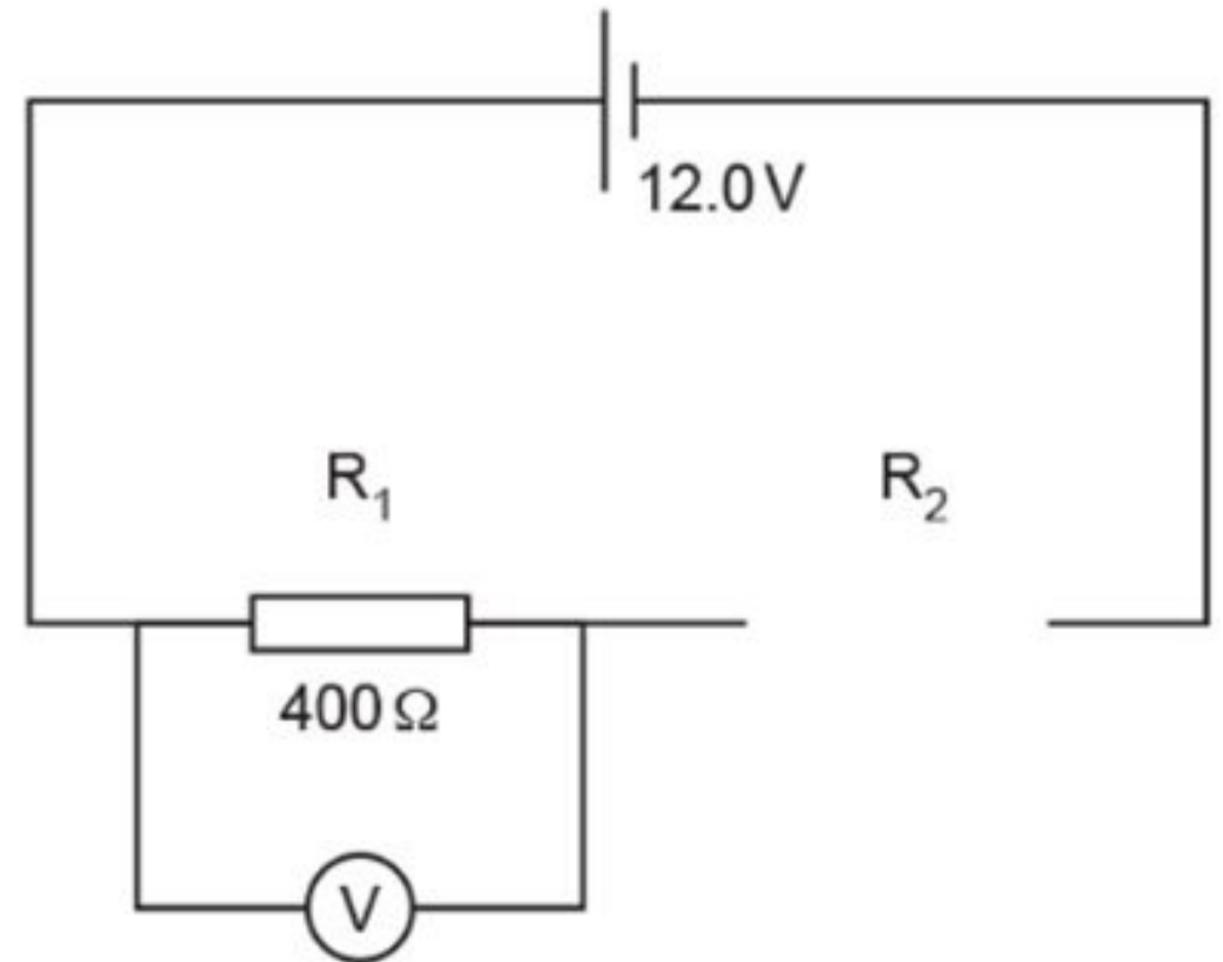


# Q1.

(a) Alex wants to use a thermistor as a temperature sensor.

He sets up the circuit shown below.

Draw the symbol for a thermistor in the space labelled  $R_2$ . **[1]**

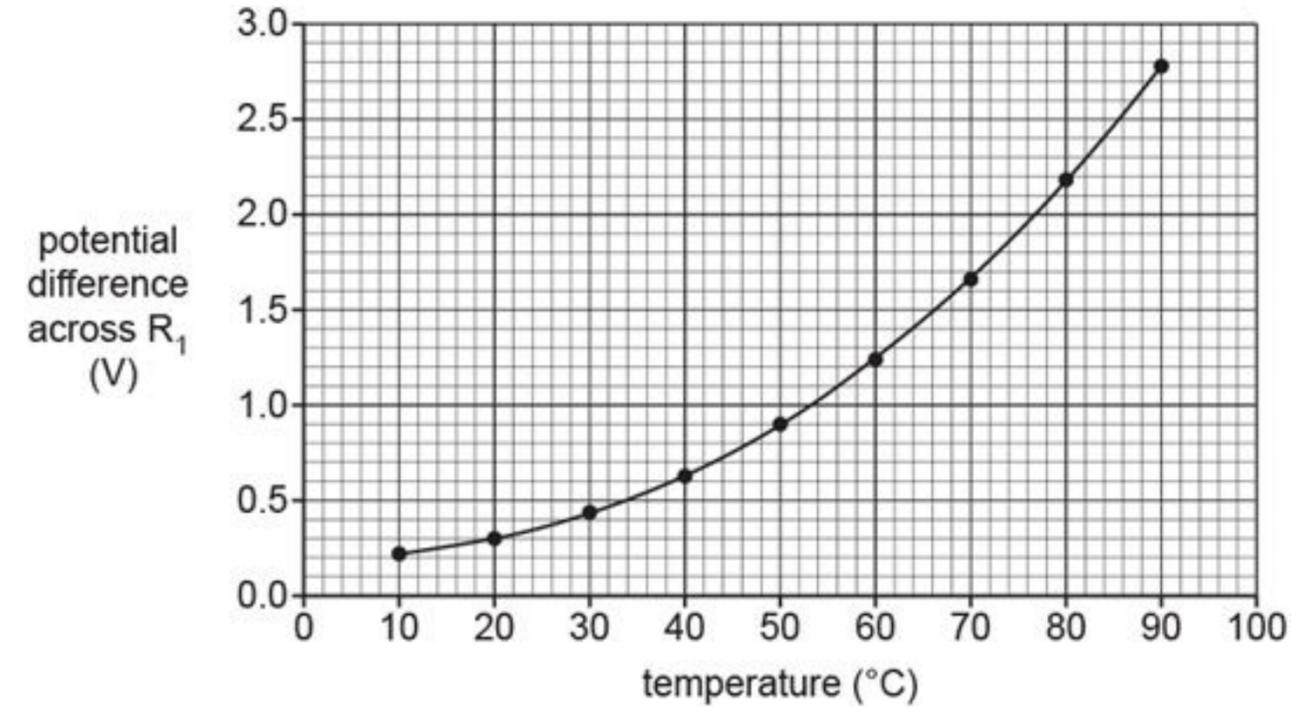


OCR, Twenty First Century Physics B, PaperJ259/03, June 2018



# Q1.

(b) To investigate the sensitivity of the thermistor, Alex places it in a water bath with a temperature control.



He records the potential difference across  $R_1$  for different temperatures set by the water bath.

His results are shown in the graph.

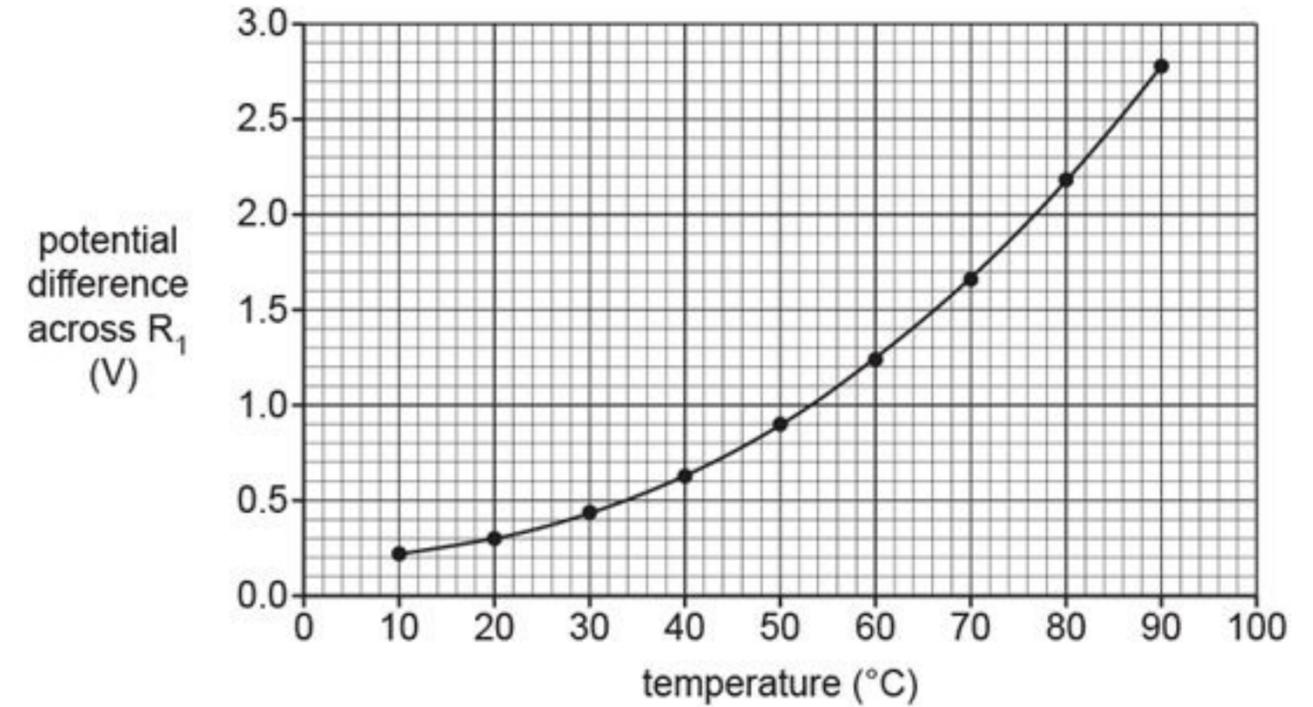
i. Describe and explain the relationship shown in the graph.

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# Q1.

(b) To investigate the sensitivity of the thermistor, Alex places it in a water bath with a temperature control.



He records the potential difference across  $R_1$  for different temperatures set by the water bath.

His results are shown in the graph.

i. Describe and explain the relationship shown in the graph.

[3]

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# Q1.

(b) ii. ii. Alex plans to use the sensor to monitor temperature in a greenhouse. To find the temperature, Alex will measure the potential difference across R1.

He will then read the temperature off the graph.

**Alex**  
My temperature sensor will be more sensitive at lower temperatures.



Evaluate Alex's statement using evidence from the graph.



# Q1.

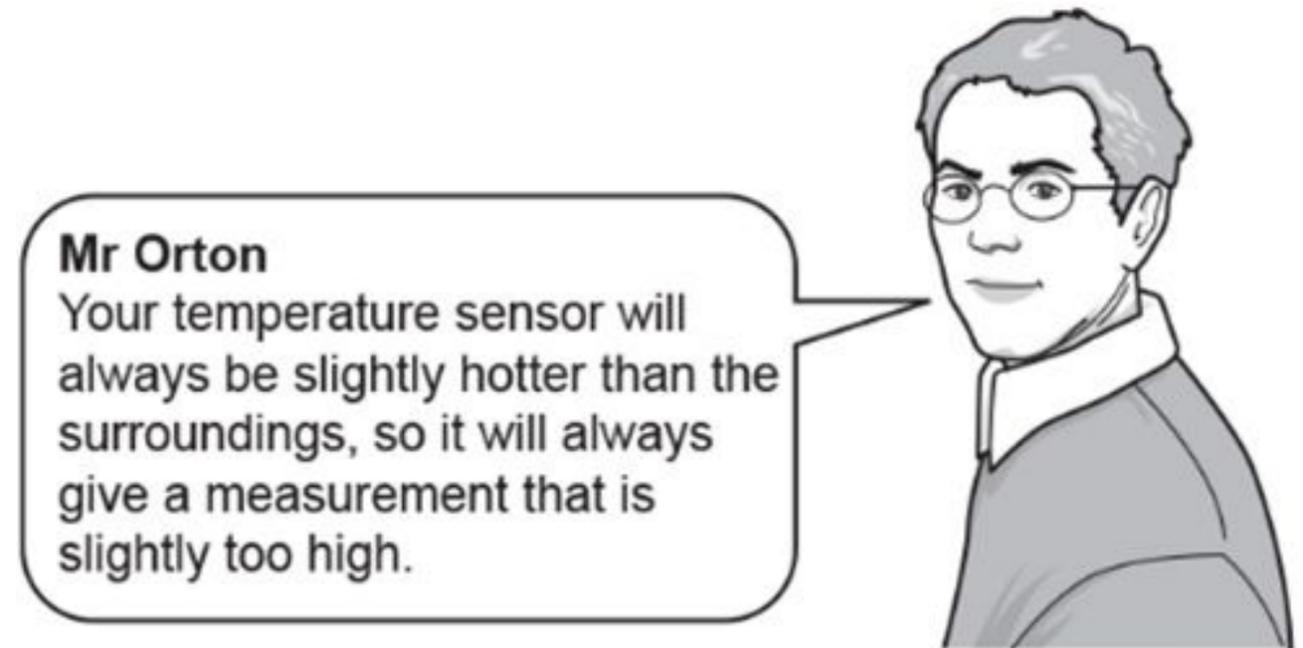
(c) Mr Orton, Alex's teacher, says that his temperature sensor will not work properly.

i. What is the name of this type of error?

**[1]**

ii. Explain why Mr Orton is correct, and suggest how this problem could be reduced.

**[2]**



# Answers



# Q1.

- (a)  1
- (b) i. as temperature increases, potential difference increases 1  
as temperature increases, resistance of thermistor decreases 1  
p.d. across the thermistor falls. 1
- ii. At lower temperatures there are smaller changes in p.d.  
**Or** at higher temperatures there are larger changes in p.d. 1
- (c) i. Systematic 1  
ii. Current heats the thermistor 1  
Use a lower current **or** increase resistance of fixed resistor **or**  
measure the effect and take it into account. 1

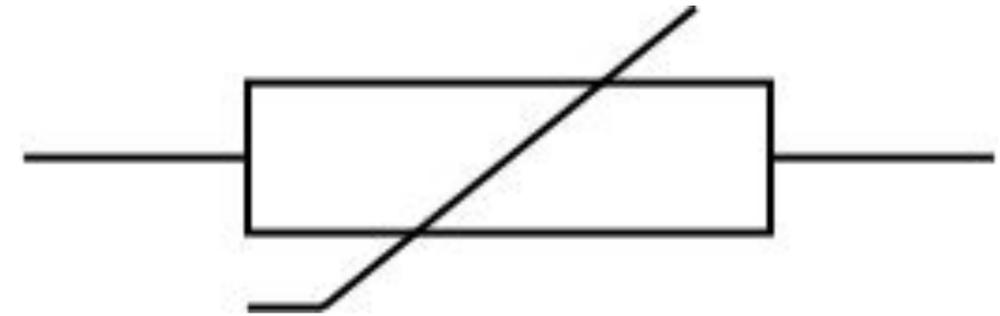


# In lesson questions



# Independent Task: Thermistor

1) Copy the circuit symbol for a thermistor



2) Complete the sentences below:

*As the temperature increases ...*

*As the temperature decreases ...*



# Review - Investigating Thermistors part 1

- 1) Name the independent variable in this investigation.
- 2) Name the dependent variable in this investigation.
- 3) Write down a safety consideration



# Review - Investigating Thermistors part 3

- 1) Explain what happens to the current through the thermistor when the temperature decreases.

*As the temperature decreases the current ...*



# Independent Task - Calculate the mean resistance values

Temperature in °C	Resistance in kΩ			
	Trial 1	Trial 2	Trial 3	Mean
0	47	49	46	47.3
10	30	23	33	31.5
20	19	20	21	
30	12	10	11	
40	8	8	9	

These resistances were collected using an ohmmeter.



# Investigating Thermistors part 4

Sketch the graph on the right.

Describe the relationship shown on the graph.



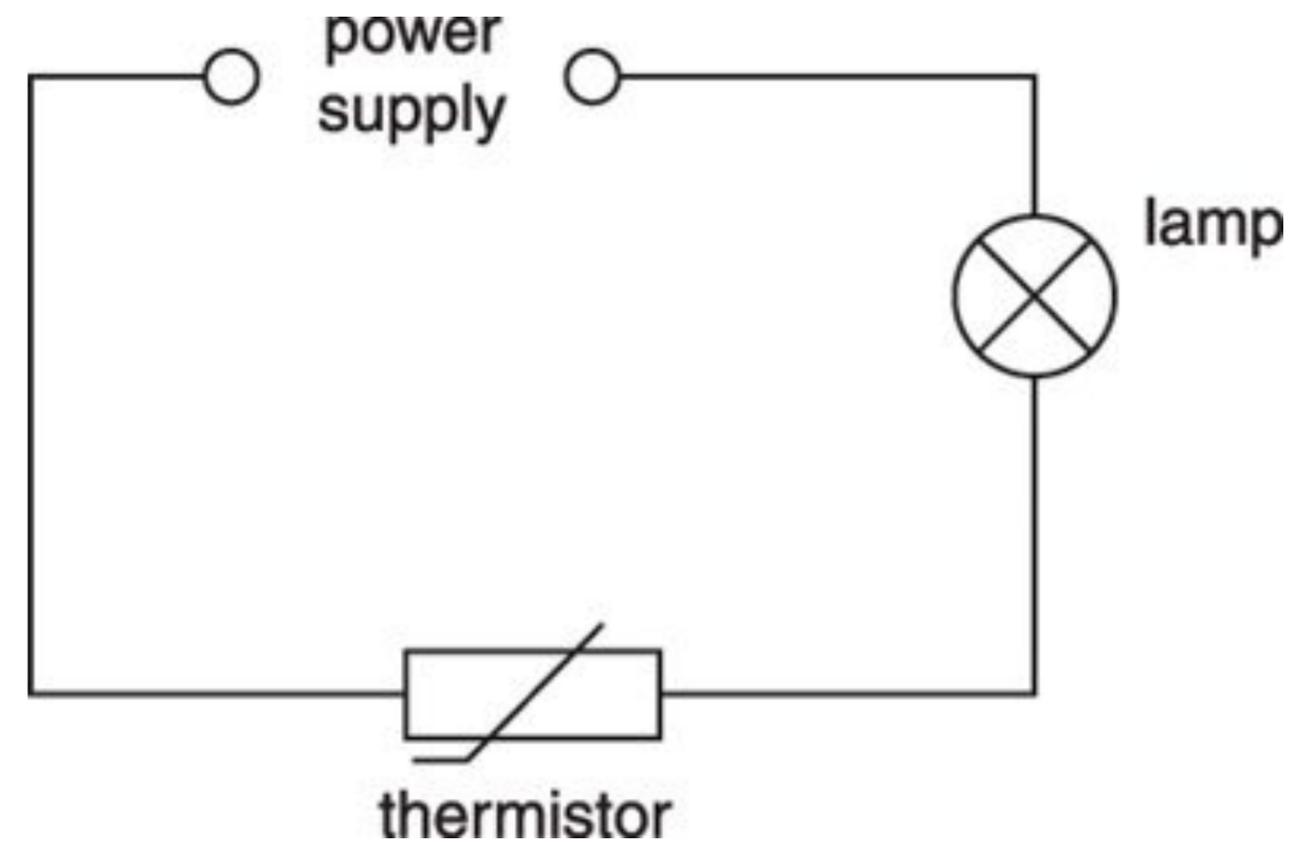
## Worked Example

Answers as discussed in the next slide have not been seen or verified by OCR.

1. Look at the circuit Trevor connects.

He gently heats the thermistor.

Describe and explain how heating the thermistor affects the brightness of the lamp.



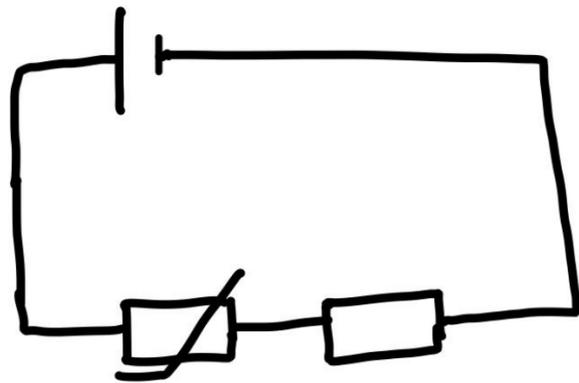
[2]

OCR, Gateway Physics A, Paper B752/02, June 2013



# Independent Task - Thermistor

Explain why the potential difference across the fixed resistor decreases as the temperature decreases.



*As the temperature decreases the resistance of thermistor...*



# Worked Example: Calculations

- a) Calculate the resistance of the thermistor.
- b) The temperature increases, and the thermistor now has a potential difference of 12V. Calculate the new resistance of the thermistor.

Image, Miss Walrond



# Independent Task - Calculations

- a) Calculate the resistance of the thermistor.
- b) The temperature increases, and the thermistor now has a potential difference of 6V. Calculate the new resistance of the thermistor.

Image, Miss Walrond

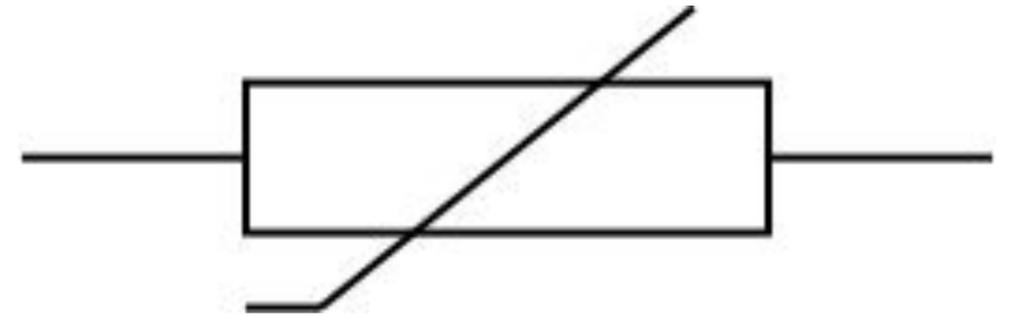


# Answers



# Review - Independent Task: Thermistor

1) Copy the circuit symbol for a thermistor



2) Complete the sentences below:

*When the temperature of a thermistor increases the resistance **decreases**. When the temperature decreases the resistance **increases**.*



# Review - Investigating Thermistors

**Independent variable:** Light intensity or distance of a lamp from the LDR

**Dependent variable:** Resistance of the LDR.

**Safety Consideration:** Make sure that the thermistor is well insulated. Make sure that no water splashes out of the water bath.



# Review - Investigating thermistors part 3.

- 1) *As the temperature decreases the thermistor's current **decreases** this is because the resistance **increases**.*

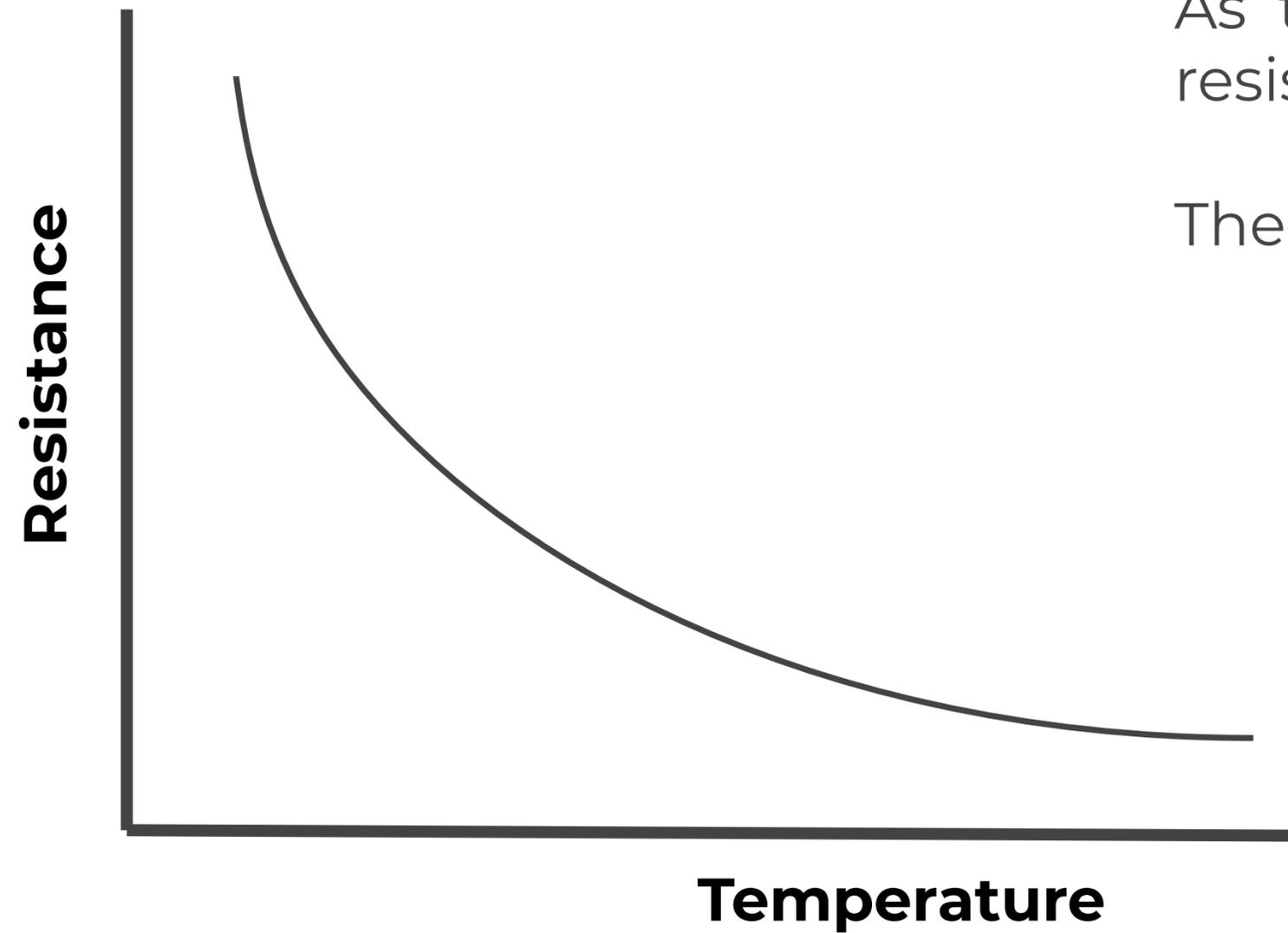


# Data analysis

Temperature in °C	Resistance in kΩ			
	Trial 1	Trial 2	Trial 3	Mean
0	47	49	46	47.3
10	30	23	33	31.5
20	19	20	21	<b>20.0</b>
30	12	10	11	<b>11.0</b>
40	8	8	9	<b>8.3</b>



# Review - Investigating Thermistors part 4



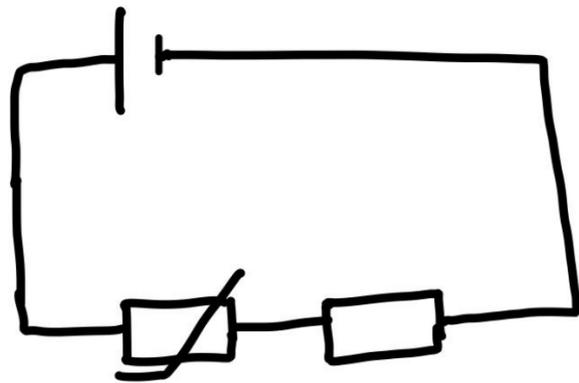
As temperature increases,  
resistance decreases.

The graph is non-linear.



# Independent Task - Thermistor

Explain why the potential difference across the fixed resistor decreases as the temperature decreases.



*As the temperature decreases the resistance of thermistor **increases**. This means that the **thermistor takes the greater share of the potential difference**, and the potential difference across the fixed resistor decreases.*



# Review: Independent Task - Calculations

- a) Calculate the resistance of the thermistor. **600  $\Omega$**
- b) The temperature increases, and the thermistor now has a potential difference of 6V. Calculate the new resistance of the thermistor. **200  $\Omega$**

