Candidate 4 evidence (Thermistors)

Thermistors

AIM

The aim is to investigate what happens to the resistance of a thermistor in water when the temperature of the water increases.

UNDERLYING PHYSICS

A thermistor is a specific type of resistor that uses sensors to help regulate cold and heat. They can do more than simply regulate temperature. They are also used for voltage regulation, volume control, time delays, and circuit protection. (1) Thermistors are made of a semiconductor material. Pure semiconductors have a large resistance because there is a big gap between the valence band, where most of the electrons are, and the conduction band, where the electrons would have to be for the resistance of the semiconductor to be low. In a pure semiconductor, it takes a lot of energy for an electron to get from the valence band to the conduction band, so not very many electrons can do this, so the resistance is high.

But in an LDR, the semiconductor isn't very pure and the impurities make it so the gap between the valence band and the conduction band is not so big. So it takes less energy to get electrons from the valence band to the conduction band. So heating the thermistor gives the electrons the energy to get to the conduction band.

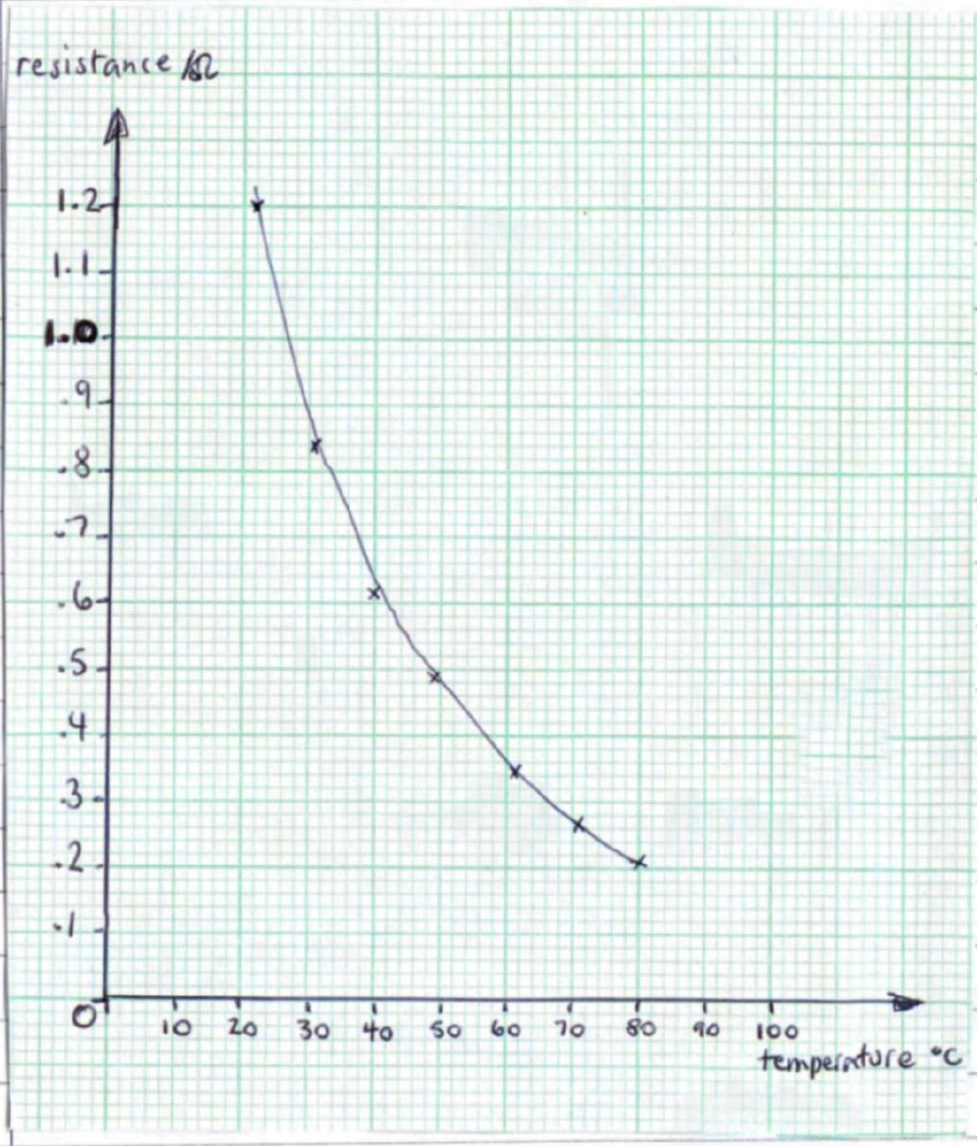
EXPERIMENT

I got a thermistor and put it in a beaker of water which was being heated by a Bunsen burner. I connected a multimeter to the LDR to measure its resistance. I measured the temperature of the water with a thermometer. After the water got to 80°C, I emptied it out and got some cold water and did it again.

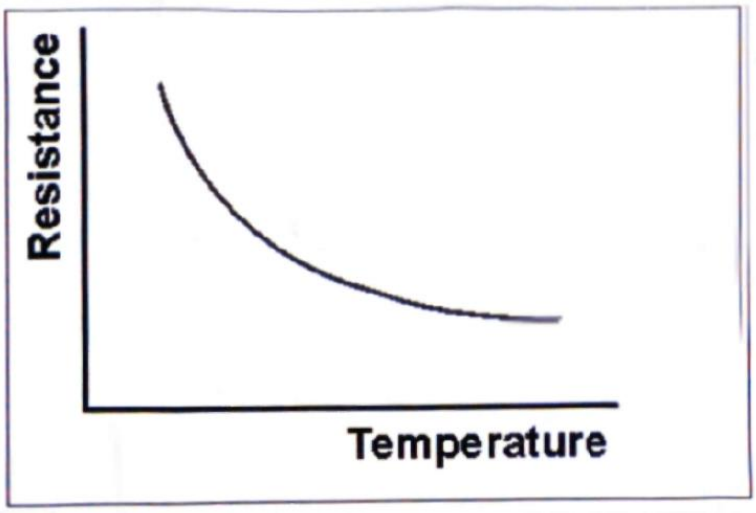
DATA

Temperature (°C)				Resistance (kΩ)			
First Run	Second run	Average	Random uncertainty	First run	Second run	Average	Random uncertainty
20	23	22	1.5	1.24	1.15	1.20	0.05
30	31	31	0.5	0.87	0.81	0.84	0.03
40	40	40	0	0.63	0.61	0.62	0.01
50	48	49	1	0.47	0.51	0.49	0.02
60	61	61	0.5	0.36	0.34	0.35	0.01
70	71	71	0.5	0.27	0.26	0.27	0.005
80	79	80	0.5	0.21	0.21	0.21	0

GRAPH



The graph below comes off the internet and is about thermistors



Uncertainties

The reading uncertainty in the multimeter was ± 0.005 Ω and in the thermometer was ± 0.5°c.

The random uncertainties are in the table.

ANALYSIS

The graph from the internet isn't on graph paper but the shape of the graph is quite like mine and shows the resistence of a thermistor going down when it gets hotter.

CONCLUSION

When the temperature increases the resistance of the thermistor goes down.

EVALUATION

Because it was difficult to get the temperature exact during the second run, it might have been better to use electric heating and a thermostat to keep the temperature steady for readings to be taken. The thermometer might not have been accurate, so a digital thermometer would have been better.

The graph from the internet was reliable because it came from www.radio-electronics.com, which is a professional site.

Reference

1. https://www.bing.com/search?q=use+of+thermistors&src=IE-TopResult&FORM=IETR02&conversationid (Accessed January 2018)