

Thermocouples and Thermistors

Apparatus

a sample of semiconductor, a sample of metal, one or two ohm meters and a container of hot water to heat the samples in

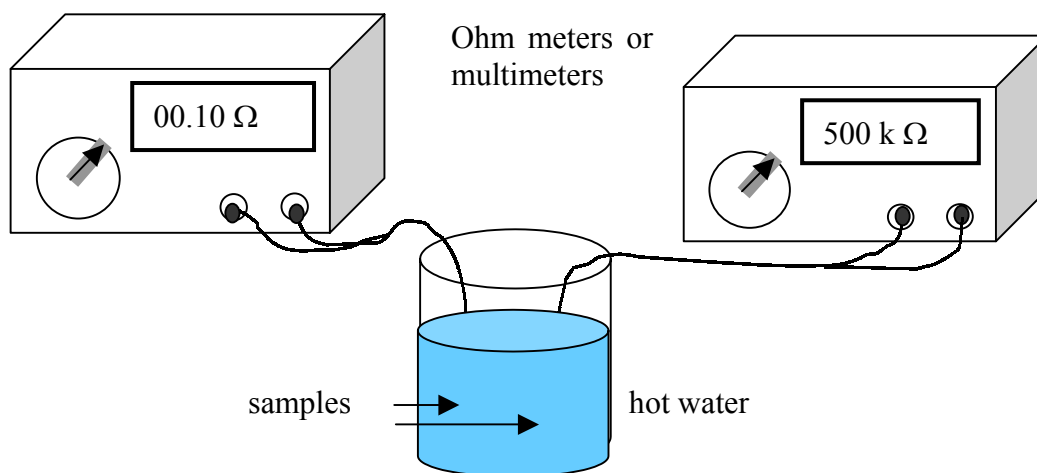
A neat way to set this up is to have the samples each wired directly into the connectors of a multimeter with a large display, with the meter already set on an appropriate range.

Action

The students measure the resistance of each sample then heat it in the hot water and measure the resistance again.

The Physics

When a semiconductor is heated some of the electrons from the valence band are thermally excited into the conduction band, thus giving more charge carriers and a lower resistance. When a metal is heated it already has plenty of charge carriers in the conduction band, and the heat causes random oscillations of the lattice, leading to a shorter mean free path for the electrons and hence a greater resistance. So the sample with increasing resistance with heat is the metal, a thermocouple, the other is the thermistor.



Accompanying sheet:

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Measure the resistance of one of the samples.

Now heat it using the hot water and measure the resistance again.

Do the same for the other sample.

Which one is made of metal and which is made of a semiconductor?
Explain your answer.