Resistance of Thermistors

Introduction:

Resistance is a force which opposes the flow of an electric current around a circuit so that energy is required to push the charged particles around the circuit. The circuit itself can resist the flow of particles if the wires are either very thin or very long. E.g. the filament across an electric bulb is quite thin as needs to resist the flow of particles for the bulb to glow.

Whenever current flows through a resistance it gives off heat. This idea is used in the filament of a light bulb; it is also used in the heating elements of appliances such as toasters and kettles. These elements normal contain nichrome wire.

Resistance is measured in ohms.

A thermistors resistance is high when cold and low when hot.

If voltage doubles, current will also double, and so on, Voltage divided by the current always has the same value.

George Ohm discovered that the emf of a circuit is directly proportional to the current flowing through the circuit. This means that if you triple one, you triple the other. He also discovered that a circuit sometimes resists the flow of electricity. He called this resistance. He then came up with a rule for working out the resistance of a circuit:

$V/I = R$

V - Volts
I - Current
R - Resistance.

Aim:

The aim of my experiment is to test the effects of different temperatures on a thermistors resistance. I am going trying to find whether temperature effects a thermistors resistance or not and if there is any relationship between temperature and the resistance of a thermistor.

Prediction:

I predict that as the resistance decreases the temperature will increase. I also predict that if I double my temperature, the resistance of my thermistor will decrease by half.
Another prediction of mine is that the more resistance there is in a circuit, the lower the current. I predict this as I know from my own scientific knowledge that:
The resistance of a thermistor is high when cold and low when hot.
Also bulbs do not conduct as well as connecting wire. Scientists say that they have more resistance to electricity. Energy has to be spent overcoming this resistance. The bulb gives off this energy as heat and light.

Method:

I am going to test a thermistors resistance at different temperatures.
I shall test the thermistors resistance three times so that my conclusion will be reliable, this will also give me an opportunity to calculate an average. I will keep the amount of water I use constant at 150cm3.

- **Variables** The variable that I will be using will be temperature, this is because it is an easy variable to measure**,** and it also has a number value so that it is easy to measure.
  The temperatures that I will be testing are:
  90oc, 80oc, 70oc, 60oc, 50oc, 40oc, 30oc, 20oc, 10oc.
  I will measure the temperature using a thermometer.
  The temperature my factor will affect my phenomenon (outcome) as it heats up my phenomenon will decrease. My Phenomenon is the resistance of a thermistor.

- **Equipment** Water (150 cm3)
  Beaker x2
  Thermometer
  Set of Wires (circuits)
  Battery pack
  Ice
  Kettle
  Ammeter
  Voltmeter
  Variable resistor

I shall firstly heat up my water, using the kettle this will save time, and then I will measure the temperatures at a constant rate of 10oc using the thermometer. So that my water will cool quickly, I will speed up the cooling process by adding ice and cold water to an outside beaker this will hold the beaker with warm water and the thermistor in a bath of cold water and ice. I will use two beakers, for this process as it will help cool my water without changing the units that I am keeping constant, this being 150cm3.
I will use an ammeter to measure the current, and a voltmeter to measure the voltage. I will use an ammeter as current is measured in amps. The ammeter is a very important piece of equipment in this experiment because, as resistance changes it affects the current.

I shall test the thermistors resistance three times so that my conclusion will be reliable, this will also give me an opportunity to calculate an average.
Once I have collected my results for each temperature reading, I will then put them into a table, showing my readings for current, voltage and temperature. From these results I can then work out the resistance (ohms) by doing the calculation voltage divided by current.

$V/I = R$

V - Volts
I - Current
R – Resistance

As I have taken three readings for each temperature I will then be able to work out the average, by finding the total of the voltages and currents of each temperature and the dividing them by three, this being the number of readings for each temperature.

Safety:

During the experiment several safety factors will occur, that I must then address. The majority of these will be involving water and electricity. As during this experiment I will be using both of these hazardous products when together, so that I will have to take great care. When boiling the kettle I will have to make sure that it is plugged into an electrical socket away from water. I will have to make sure that my surface area is dry when making the circuit, for the main reason that electricity and water when together are extremely hazardous. As I am using water throughout the experiment I will have to dry my hands regularly as I will be touching electrical components such as the thermistor and the circuit. I will have to be very careful when pouring the water from my kettle into the beaker as if I spill the kettles contents it could be very dangerous, as boiling water can burn, and this is very

dangerous as I will be working in class full of other students.