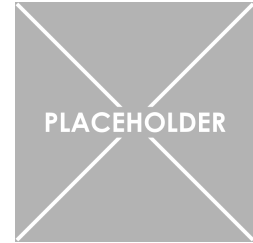


## Temperature Dependence of Resistance

Key words: Temperature, Resistance, Electricity, Liquid Nitrogen



### **Equipment List:**

1. Wire coil
2. Wires (3x banana jack cables + 2x crocodile clamps)
3. Power supply
4. Multimeter
5. Liquid nitrogen and container

### **How to assemble and operate:**

- Hook the wire coil up to the power supply in series with the multimeter set to current mode
- Adjust the power supply until the current reads about 500 mA.
- Lower the resistor into the liquid nitrogen carefully
- Observe large drop in resistance (so increase in current) before vs after the liquid nitrogen

### **Description/Theory:**

This demonstration illustrates the temperature dependence of resistance. The effect is caused by the fact that the electrons moving through the wire collide with vibrations (phonons) created in the material by thermal noise. At lower temperatures this will happen less, and thus the resistance goes down. In semiconductors and insulators an opposite effect occurs, where resistance decreases with temperature due to the lowering of the fermi level, and thus less electrons being in the conduction band.

### **Comments/Notes:**

Liquid nitrogen is available from the Physics Lab team and should be requested in advance. Gloves and goggles should be worn when using liquid nitrogen to protect from burns.