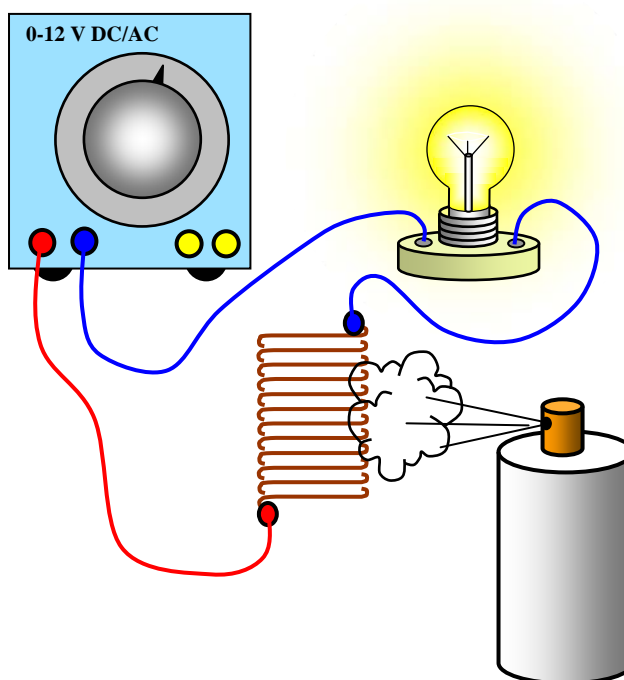


## TAP 110-1: Metal resistance decreases as temperature falls.

You could simply use a freeze spray on a coil of constantan wire and show that the resistance decreases as temperature falls. However, it is more satisfying (and makes a bigger impression) if you show how current increases when a metal resistor is cooled.

### Apparatus:

- ✓ Coil of constantan wire.
- ✓ Filament lamp.
- ✓ Power supply.

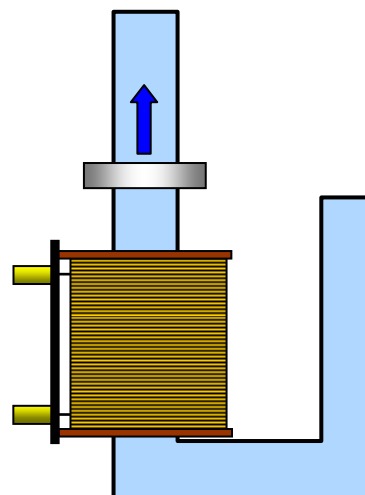


You will need to try this first. Connect all three components in series. Make sure the constantan wire is tightly coiled up (but that its coils don't touch each other) and that the lamp lights dimly when the wire is at room temperature.

If the freeze spray is applied directly onto the constantan wire the light should noticeably increase in brightness.

If you have some liquid nitrogen available the effect is even greater but request the CLEAPSS Special Risk Assessment for safety procedures when using liquid nitrogen. You could use a coil of fine copper wire instead of the constantan.

(Another neat demonstration involving reduced resistance at low temperatures is the famous 'jumping ring experiment'. This involves the induced emf and current in an aluminium ring suspended above an electromagnet. When the electromagnet is switched on there is a sudden induced emf and current which, by Lenz's law, results in a repulsive force. The ring 'jumps'. If the ring is then cooled in liquid nitrogen and used before it warms back to room temperature the jump is much bigger. The drawback of using this at this stage is that weaker groups will not appreciate the role of electromagnetic induction.)



(Diagram: resourcefulphysics.org)