

Experiment 4: **Light Bulb Design**

Purpose:

To design a light bulb based on basic material and design parameters. Both the materials and the method of fabrication will be explored by the students. This experiment should be done in teams of 3 - 5 students.

Materials Needed:

1. Creative brain
2. Pencil and paper

Procedure:

In this experiment, students will design a light bulb and describe the construction steps necessary to fabricate a light bulb using the information below.

1. Materials glow brighter at higher temperatures and must be heated to above 2000 C to produce significant amounts of visible light. Materials that can withstand these high temperatures are expensive. Some candidates are shown in the table below.

| Filament Material | Melting Point (C) |
|--------------------------|--------------------------|
| Platinum | 1773 |
| Osmium | 2700 |
| Tantalum | 2900 |
| Tungsten | 3380 |
| Carbon | 3600 |

2. The more power dissipated in a material, the brighter it will glow.

3. The resistance of a material is proportional to its length and inversely proportional to its cross sectional area.

4. Most materials that conduct electricity oxidize and disintegrate at high temperatures in the presence of oxygen or air.

5. Glass can be easily formed to different shapes, and can be sealed to itself and to other metals by heating to relatively low temperatures.

Teacher's Guide to Experiment 4

This experiment has many possible answers. The students should write up a design and fabrication sequence for a light bulb that meets the following goals:

1. It is clearly written.
2. The filament material operates in a vacuum or inert gas.
3. A glass bulb contains the filament and its inert or vacuum atmosphere.
4. The filament should be the most resistive part of the circuit.
5. The filament consists of a material with a high melting point.
6. The fabrication steps are clearly described or diagrammed and are arranged in order.

See the GE booklet about the light bulb for the actual method and materials used to fabricate light bulbs.