Curiosity Guide #604
Electric Lights

Accompanies Curious Crew, Season 6, Episode 4 (#604)

Making a Light Bulb

STEM Challenge

Description

Make your own light bulb! Shine on…

Materials

- Glass jar
- Alligator clips
- Glass cup, or cut cardboard tube small enough to fit through the mouth of the jar
- Tape
- 6 D-cell batteries
- Nichrome wire
- Graphite lead from a mechanical pencil
- Strands of steel wool
- Separated strands of picture wire. 2, 3, or 4 twisted strands
- Light meter

Procedure

1) Tape 6 D-cell batteries together so that the positive ends touch negative ends, making a long battery stick.
2) Turn the small cup upside down.
3) Position one alligator clip so the wire runs up the side of the cup and the clip extends above the base of the cup. Tape the wire in place.
4) Repeat with the second clip on the opposite side of the small cup.

5) Securely tape both wires in place so the clips can still open and close.
6) Choose what source to use for the filament and connect this material between the two alligator clips like a bridge.
7) Cover the cup with the large jar.
8) Dim the lights and connect the free ends of the alligator clips to each side of the stick battery assembly.
9) What do you notice?
10) Measure the luminescence of the light with the light meter.
11) Disconnect the battery and let the filament cool.
12) Try a different filament material and use the light meter to compare the lumens.

My Results

Explanation

As the filament material gets hot from flowing electricity, the electrical energy is transferred into both heat and light. Materials that carry electricity are referred to as conductors, but some conductors carry electricity better than others. For example, silver is a better conductor than gold, and copper is better than aluminum. Carbon, which isn't a metal, conducts electricity, too.

To make the conductor carry more efficiently, make the traveled distance shorter and the path larger. Therefore, long thin pathways have more resistance to carry the flow of electricity, so the particles heat up a lot and give off more light. In a typical incandescent bulb, about 95% of the energy it uses is transferred into heat. Your bulb has oxygen inside, which is different from commercial bulbs that have nitrogen or argon inside to prevent the filament from burning up.

Think about this. The tungsten filaments in today's incandescent bulbs are amazing. If we could look at them closely, we would see a coiled wire made up of even smaller coiled loops. When the filament is made, the straight tungsten wire is 20 inches long and incredibly thin. Then the wire gets wound 1,130 times, so its length is then only three inches. Finally, the coiled wire gets wound into larger coils, ending up only $\frac{3}{4}$ of an inch long. The more wire used in the filament, the more material there is to glow and internally reflect, which makes a much brighter bulb. That's one fine filament!

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