

In Class

- Mineral Resources Lecture
- In Class Exercise – How to Make a CFL Light Bulb
Minerals Education Coalition - <http://www.mineralseducationcoalition.org/>
USGS Minerals Information - <http://minerals.usgs.gov/minerals/>

In Class Exercise: How to make a lightbulb?

Objective: An important element in promoting stewardship of our earth resources is to educate students about what earth resources are involved in the making of everyday things. We will use manufacturing of a lightbulb to illustrate this point.

Exercise: You are an environmentally conscientious entrepreneur who want to build a compact fluorescent lightbulb factory in Minnesota. One of the most important decisions is to figure out what materials you need and where to get them. Cost is a function of distance and the country supplying the material. Third world countries provide cheaper prices, but are notorious for poor environmental standards in mining and low wages.

Procedure: You will be assigned an earth resource that is needed to manufacture a CFL light bulb.

Using the USGS and MII websites, research the following information on your assigned resource.

Commodity - _____

CFL component - _____

Properties - _____

Common Uses - _____

Geologic Occurrence - _____

U.S Suppliers - _____

Principal Global Suppliers - _____

Imports (% of US consumption) _____

Alternative Materials _____

Other interesting Information _____

What's in a Compact Fluorescent Light Bulb?



- **Barite (for phosphor).** Mined in China, India, United States, Morocco, Iran, Turkey, Mexico, Kazakhstan, Vietnam, Germany, Russia, Algeria, United Kingdom and Pakistan.
- **Bauxite (alumina for phosphor; aluminum for end caps & filaments).** Mined in Australia, China, Brazil, India, Guinea, Jamaica, Russia, Venezuela, Suriname, Kazakhstan, Guyana and Greece.
- **Copper (end caps; filaments).** Mined in Chile, United States, Peru, China, Australia, Russia, Indonesia, Canada, Zambia, Poland and Mexico.
- **Lead (soda-lime glass; ballast; adapter unit).** Mined in China, Australia, United States, Peru, Mexico, Canada, India, Bolivia, Poland, Russia, Sweden, Ireland and South Africa.
- **Limestone or Dolomite (finely-crushed stone to make soda-lime glass).** Mined in United States.
- **Mercury (vapor in glass tubing).** Mined in China, Kyrgyzstan and Peru.
- **Nickel (end caps; filaments).** Mined in Russia, Canada, Australia, Indonesia, New Caledonia, Philippines, Columbia, China, Cuba, Brazil, Botswana, South Africa, Dominican Republic, Greece, Venezuela and Spain.
- **Phosphate Rock (phosphor).** Mined in China, United States, Morocco & Western Sahara, Russia, Tunisia, Jordan, Brazil, Syria, Israel, Egypt, Australia, South Africa and Canada.
- **Rare Earth Oxides (Lanthanum or Yttrium for phosphor).** Mined in China, India and Brazil.
- **Silica (glass).** Mined in United States, Italy, Germany, United Kingdom, Australia, France, Spain, Japan, Poland, Hungary, South Africa, Mexico, Austria, Iran, Republic of Korea, Slovakia, Canada, Belgium, India, Bulgaria, Norway, Chile, Gambia, Turkey and Czech Republic.
- **Soda Ash (soda-lime glass).** Mined in United States, Kenya and Botswana.
- **Manganese (phosphor).** Mined in South Africa, Australia, China, Gabon, Brazil, India, Ukraine and Mexico.
- **Tin (end caps; filaments; glass coatings).** Mined in China, Indonesia, Peru, Bolivia, Brazil, Congo-Kinshasa, Vietnam, Malaysia, Australia and Russia.
- **Tungsten (electrodes; filaments).** Mined in China, Russia, Canada, Austria, Bolivia and Portugal.
- **Zinc (end caps; filaments).** Mined in China, Peru, Australia, United States, Canada, India, Kazakhstan, Ireland and Mexico.



To learn more about minerals and mining visit
www.MineralsEducationCoalition.org

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SOURCES

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INTERESTING FACTS

- CFLs are known as *compact fluorescent lights* or *compact fluorescent light bulbs*. In a CFL, an electric current is driven through a glass tube containing argon and a small amount of mercury vapor. This generates invisible ultraviolet light that excites a fluorescent coating (called phosphor) on the inside of the tube, which then emits visible light.
- CFLs are made of soda-lime glass, similar to that used throughout the glass industry for bottles and other common products.
- Phosphor in a CFL is a phosphate mix that may contain manganese, rare elements such as lanthanum, and yttrium as either an oxide or a phosphate, along with a barium/aluminum oxide. Phosphor components may vary slightly depending on the color of the lamp.
- While a regular (incandescent) light bulb uses heat to produce light, a fluorescent bulb creates light using an entirely different method that is 4 to 6 times more energy-efficient. This means that a 15-watt CFL produces the same amount of light as a 60-watt regular incandescent bulb. CFLs last up to 13 times longer and use 2/3 to 3/4 less electricity than incandescent bulbs with similar lumen ratings.
- CFLs contain a very small amount of mercury sealed within the glass tubing – an average of 4 milligrams. By comparison, older thermometers contain about 500 milligrams of mercury – an amount equal to the mercury in 125 CFLs. Mercury is an essential part of CFLs; it allows the bulb to be an efficient light source. No mercury is released when the bulbs are intact (not broken) or in use. Because the CFLs contain mercury, the U.S. Environmental Protection Agency encourages their recycling after they burn out. In some states, CFL recycling may be mandatory.
- China supplies 97% of the world's supply of rare earths, which are used in a variety of products.
- The U.S. possesses the largest non-China rare earth resource in the world at the Mountain Pass Mine in California.