Bright Ideas

OBJECTIVES

Students will gain an understanding of the energy used to operate lights.

SUMMARY

Given information on lighting types, students will compute how much electricity and money it takes to provide lights in their homes and classrooms.

GROUPS

Divide students equally into as many groups as you have sample lighting types.

TIME

30 MIN.

SUBJECTS

Math, science, critical thinking.

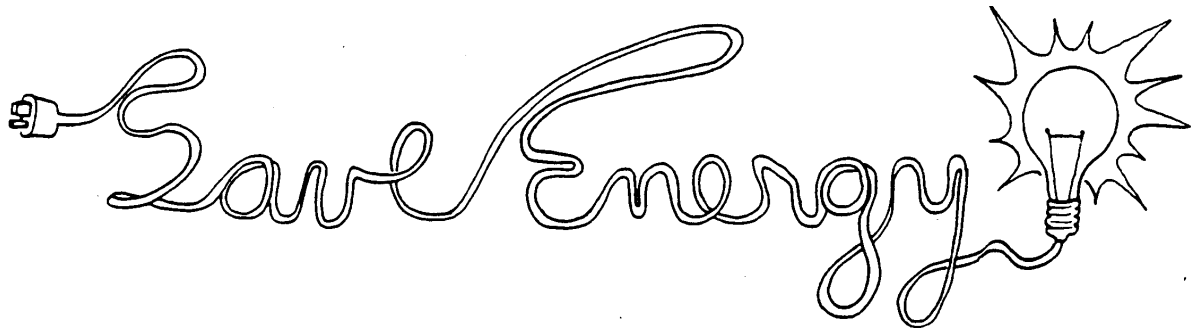
VOCABULARY

Compact fluorescent, lumen, watt, efficient.

MATERIALS

Copies of lighting survey sheet
Overhead transparency of "Anatomy of a Light Bulb." You could draw it on the board or make handouts.
As many of the light bulb types listed on the survey sheet as you can find and borrow, hopefully with the boxes they came in.
The rate charged for electricity in your area.
Light Type Information Guide: use this only if you can't gain access to varied bulb types.

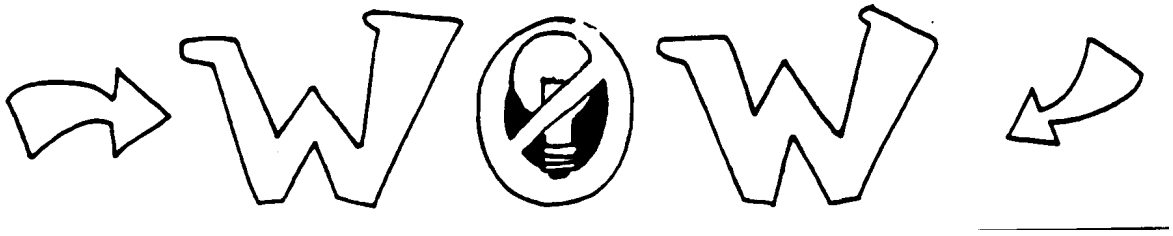
PREPARATION & BACKGROUND: Collect all your materials and familiarize yourself with the diagram of a light bulb and the Light Type Information Guide. Incandescent bulbs work by applying electricity to the filament. The filament slows the progress of the charge, thus emitting light and heat. Fluorescent bulbs apply the electricity to a contained gas; its electrons use electrical energy to jump up, then re-emit that energy as light, when they fall back towards their nuclei. Recently developed compact fluorescent bulbs have the ability to replace ordinary incandescent bulbs and operate much more efficiently. they have been improved so they give good color rendition and don't flicker or hum at all. The compact fluorescent last about nine times as long and use a fourth of the energy as incandescence!
Try to get at least one of these compact fluorescents, a rough-duty incandescent, a fluorescent tube, and a regular incandescent, each with the packaging material so the students can read the information from the real thing. (If you have trouble finding a compact fluorescent, call the S.S.U. Energy Center 664-2577.) Make a note of the various bulb prices on the "Light Type Information Guide."

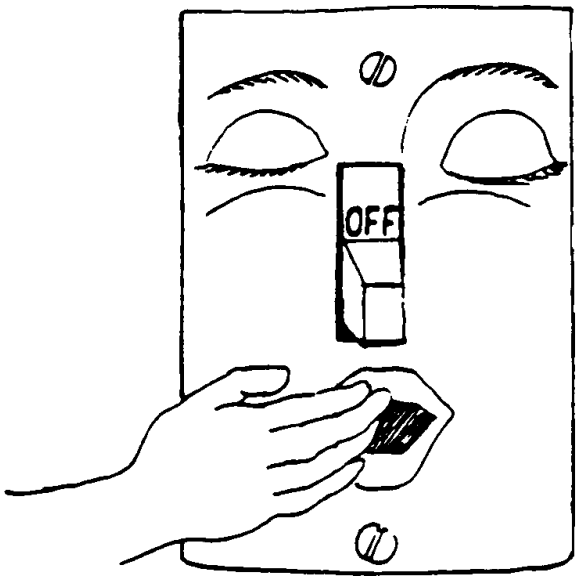


PROCEDURE

1. Use the picture on the light bulb to explain to students how different light bulbs work. Split the class into groups and have a couple of bulb types at several different stations. Have each group move from station to station, filling out the lighting survey sheet for each bulb type. They will complete the type, wattage, lumens per watt, and lifetime columns. Ideally, they will have an actual bulb in its packaging to collect the information from. If the bulbs are not available, you might have students go shopping and look at different bulb types at a building supply or lighting store. As a last resort, you can use the "Light Type Information Guide."
2. Next you can demonstrate for the whole class how to compute Electricity Consumption:
   kWh = hours of use x (wattage of bulb divided by 1000); and
   Lifetime Cost: cost of bulb + (electric rate x kWh).
3. Have students finish the survey sheet by doing the computations with their data.

If everyone in the U.S.A. replaced one, 100-watt with a compact fluorescent, it would save as much energy as is produced by one, Chernobyl sized nuclear power plat! (A. Lovins, Rocky Mountain Institute)





EXTENSIONS: 1. Have students do the same computations on home lighting (don't forget the fridge light!).
2. Do a comparison of cost between existing lighting in the classroom (or home) and what might be spent with different bulbs. If you discover a potential savings, present your findings to the principal and/or board members.
3. Compute how much energy your class can save over the school year by turning off lights next to the windows during bright times of day.
4. Compute how much energy it takes to light the classroom over the lunch hour if the lights get left on every school day. Write about how you can spend the savings if they are turned off!!

FOR DISCUSSION

1. Which bulbs use the most and least energy?
2. Which bulb has the shortest lifetime? The longest?

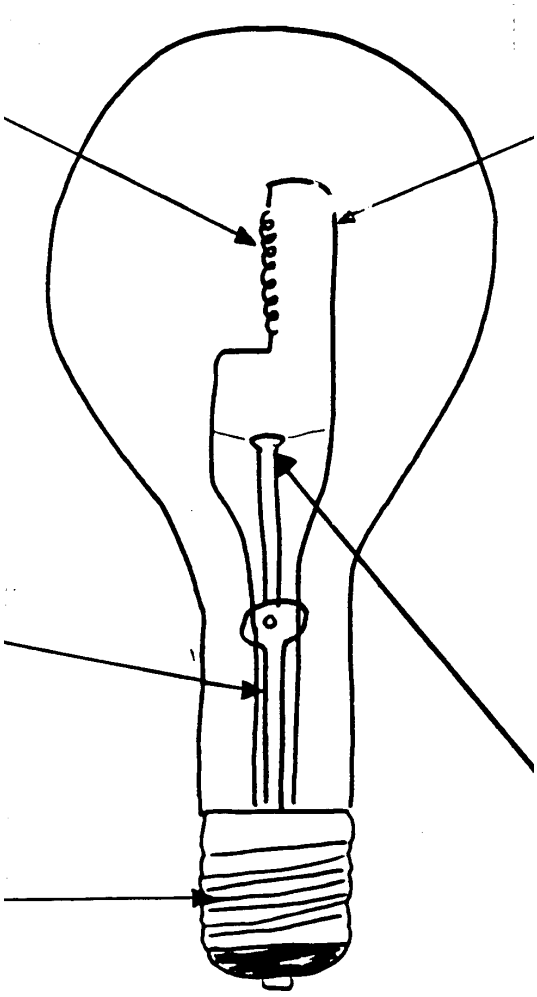
ANATOMY OF A LIGHT BULB

Light bulbs come in many shapes and sizes. Most are made of soft glass. Others are made of a harder glass to make them more durable. Gas is used to fill the bulb so that oxygen can't make the wires deteriorate as quickly. This is a drawing of a typical incandescent light bulb.

FILAMENT
The filament is where electricity is changed into heat and light. The filament is made of wire that is very tiny and coiled very tightly.

FUSE
If there is ever too much electricity in the bulb the fuse will melt and keep that electricity from damaging the lamp or the household circuit.

BASE
Electricity comes through the lamp and is transferred to the bulb by the base



WIRES
The wires carry electricity from the base of the bulb to the filament and then back to the base.

BUTTON
The wires inside the bulb are very thin and need support so they won't shake around too much or fall into each other. The button supplies this support.

LIGHT TYPE INFORMATION GUIDE

BULB TYPE	WATTAGE	AVERAGE LUMENS PER WATT	AVERAGE LIFETIME IN HOURS
COMPACT FLUORESCENT	7W–32W	65	10,000
COOL WHITE FLUORESCENT (4')	40W	46	16,000
WARM WHITE FLUORESCENT (4')	40W	46	16,000
INCANDESCENT	20W–1500W	18	1,025
ROUGH DUTY INCANDESCENT	20W–1500W	10	750
HIGH PRESSURE SODIUM	70W–1000W	104	22,000
LOW PRESSURE SODIUM	18W–180W	100	14,000
MERCURY VAPOR	50W–1000W	33	20,000

LIGHTING SURVEY SHEET

Bulb type	Wattage	Average lumens per watt	Average lifetime in hours	Electricity consumption in kWh = hours x $\frac{\text{wattage}}{1000}$	Lifetime cost = cost of bulb + electric rate x kWh