**“Light Bulb or Heat Bulb?”** WATTS the Efficiency?

**Purpose:**

To investigate the energy efficiency and energy conservation of the three types of light bulbs on the market.

**Part 1: Efficiency of each Bulb**

**Efficiency** is a measure of how much work or **energy** is conserved in a process. In many processes, work or **energy** is lost, for example as waste heat or vibration. The **efficiency** is the **energy** output, divided by the **energy** input, and expressed as a percentage. A perfect process would have an **efficiency** of 100%.

A. Design an Experiment that will be able to measure the efficiency of an incandescent light bulb, CFL and LED light bulb.

* You will need to measure temperature in Celsius – with Vernier probe
* You will need to create an environment from boxes – to keep a closed system
* You will need to measure the light output of your bulb in Lux ( similar to Lumens with a probe) and convert it into Watts.
* Make sure the temperature probe and light meter are at the same distance away from the bulb EACH time!!

**Equations to be used:**

B. Create a Data Table that will collect the Initial and Ending numbers.

Make sure the table contains room for Wattage **INTO** the Lamp (what the box states) and the Wattage coming **OUT** ( from the light meter in Lux and then in Watts ) and the efficiency % .

**And** create a data table that includes the amount of Heat lost (temperature change) over time.

The change in temperature will then be plugged into the above equation for the final Joules of energy.

C. Questions to think about:

* Discuss the changes in temperature each light emitted. Why would that be the case? Dose the way the bulb works/produces light make a difference? ( may need research).
  + Based on the results from this lab, which light bulb is more energy efficient? Describe why. Could one bulb really be called a “heat” bulb instead of a light bulb?
  + Why would measure the wattage produced from the light and the wattage from heat lost to the environment aide us in exploring the inefficiencies of each bulb?
  + Explain how this shows both the first and second laws of thermodynamics.
  + How can efficiency be increased ? What benefits does that bring?

**Part 2: Cost Comparison are these efficiencies beneficial?**

A. Create a chart “CFL vs. Incandescent Cost Comparison Sheet” to input and calculate cost. Review the following vocabulary as appropriate and use it to create the data table:

* + **Life Cycle Cost**: The actual cost to operate an appliance over its life. It includes the initial cost of the appliance (in our case the light bulb) + the operating (electricity) costs over the appliance life.
  + **Watt**: Unit of power. The rate at which an appliance or bulb uses energy.
  + **Kilowatt**: 1,000 watts. It is more useful to talk about kilowatts when discussing electricity because we use thousands of watts.
  + **Kilowatt-hour (kWh)**: The unit in which we buy electricity. It is equal to 1,000 watts used for one hour.
  + **Lumens**: A measure of the brightness of light.
  + **Life Expectancy**: The average time a light bulb has been tested and expected to operate under normal use. Measured in hours.
  + **Cost per kWh in Illinois** = The average cost of electricity in Illinois is $. 12 per kWh.

B. Comparing the 3 Bulbs

* Compare the lumens between the three bulbs. Are they comparable? Which one is actually a little brighter?
* Compare the life expectancy of the two bulbs.
  + - If we are comparing 12,000 hours of light, how many CFL’s will we need?
    - How many incandescent bulbs will we need?
    - Calculate the cost of light bulbs for 12,000 hours of light
    - SHOW ALL WORK for calculations!

C. Questions to think about:

* + Which light bulb do they think is better? Why?
  + Why do they think people still buy incandescent bulbs?
  + Have the students estimate how many light bulbs they have in their home. Would it be significant to replace all the incandescent bulbs in your home?
  + Why is COMED and other energy companies’ pushing for energy efficient appliances and lighting? ( may want to research)

Formal Lab Write Up:

I. Abstract

II.Purpose

III. Background on Topic

IV. Materials and Procedure

V. Data tables ( I – Efficiency and 2- Cost comparison) with calculations ( Show work or formulas)

VI. Data analysis – Discuss the data ( Efficiencies) and (Cost comparison) results, implications, errors, further exploration?

VII. Conclusion – Discuss the questions presented – put into paragraphs and relates it to what we understand about efficiency.