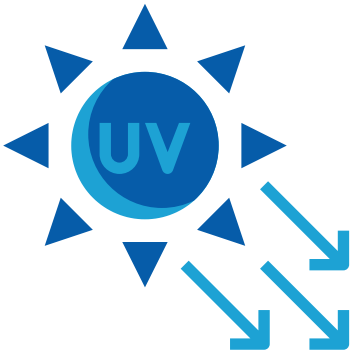
ACTIVITY 4: HOW LIGHT AFFECTS AIR TEMPERATURE



The purpose of this activity is for students to observe and measure how the temperature of the air near an incandescent bulb changes with different levels of brightness.

Materials:

- Incandescent light bulb (preferably unfrosted for better visibility)
- Lamp socket with a variable dimmer switch
- Thermometer with a digital probe or an infrared thermometer
- Ruler or measuring tape
- Safety goggles / sunglasses (optional but recommended)
- Cardboard box large enough to fit the lamp without it touching any side

Note: this can be done as a whole group experiment, or (if you have enough setups) in small groups.

Setup: orient the box with the open end facing you. Set up the lamp socket with the incandescent bulb in a stable position inside the box without it touching any side. Take the temperature of the air inside the box, before the bulb is turned on, and measure the distance between the temperature probe and bulb. Record these baseline measurements. Connect the lamp socket to the variable dimmer switch and plug in the lamp/switch, ensuring the switch is on the lowest setting initially.

First, inform students that they will be investigating how light affects air temperature.

Next, demonstrate how to set up the experiment. If conducting the experiment as a whole group, involve students in each of the setup steps; otherwise, you can set it up to show them and narrate your steps along the way.

Then, have students set up their own apparatus, or prepare to collect data from your setup.

Data Collection Procedure:

1. Record the initial temperature of the air near the bulb using the thermometer and measure the distance between the thermometer probe and the bulb (for consistency in subsequent measurements).
2. Turn on the lamp at the lowest setting on the dimmer switch and let the air stablize for 2-3 minutes before recording observations of the bulb itself and taking the next thermometer reading at the same distance as the initial measurement.
3. Gradually increase the brightness by adjusting the dimmer switch in small increments (e.g., 10% increase in brightness each step), allowing the same amount of time for the air temperature to stabilize at each brightness level before taking temperature measurements.
4. Note qualitative observations of the bulb.
5. After stabilizing at each brightness level, record the air temperature near the bulb using the thermometer, ensuring the thermometer probe remains at the same distance from the bulb for consistent readings.
6. Create a table to record the brightness setting (% of maximum) and the corresponding air temperature readings.
7. Plot a graph of relative brightness setting (%) versus air temperature (˚C) to visualize the relationship.

Post-Lab Discussion:

Last, facilitate a whole-group discussion about the results. Ask students to note any observations about changes in the bulb's brightness or color as the dimmer switch is adjusted. Analyze the data to observe how the air temperature changes with increasing brightness levels of the bulb. For groups who did the experiment at different distances, how did their temperature data compare? What conclusions can you draw for the relationships? What do these findings reveal about sunlight?

Teaching Tip: Set this up and test this experiment out ahead of time, possibly even recording a video of your set up steps to use if you teach more than one class in a day.