ACTIVITY 3: MEASURING LIGHT POLLUTION

The purpose of this experiment is for students to model the effects of different types of light bulbs on the night sky to measure the impact of artificial light pollution.

Materials:
- A dark room (or large a cardboard box to make a dark space)
- Light bulbs of different types (incandescent, fluorescent, LED)
- A light meter or a smartphone app that measures light intensity
- A star chart that shows the positions of stars in the sky (printed with dark background and stars shown in white)

First, inform students that they will be working with a group to model light pollution and measure its effects on a small scale. They will be creating a model night sky and testing the light pollution generated by different types of bulbs using a meter or an app on a mobile device. Once they understand the task, make the materials available to them. Depending on the context in which you are teaching this lesson and doing this activity, you could either:
1. cover all windows in the room and minimize as much artificial light as possible, then give each group a designated area of the room where they can put their star chart on the wall and view it through a slit in a sheet of cardboard or construction paper
2. Set up the large box with a small opening for looking in and through one side to view the star chart while attaching the star chart on the other side of the inside of the box and placing the lamps nearby or in the box so it will shine on the star chart

*Teaching Tip: Test this activity out beforehand to see which version will be most workabale for your students.

Then, once their setup is complete. Have them follow the procedure to measure the amount of light from each bulb and observe how it impacts viewing of the stars on the star chart. A sample procedure you can use is:

1. Set up a dark room or a cardboard box with a small opening for observing the night sky.
2. Place each light bulb one at a time in a lamp or socket.
3. Use the light meter or smartphone app to measure the brightness of the light bulb in lumens (if possible).
4. Turn off all other lights in the room, and observe the night sky through the opening.
5. Using the star chart, record the number of visible stars with each lamp on.
6. Make sure to give a little time between the testing of each light bulb.

Next, on chart paper or large dry erase boards, have students create a chart or graph to compare the brightness of each type of light bulb using the measurement from the light meter or app. Have them create another chart or graph to compare the number of visible stars for each type of light bulb.

Last, have students share their charts and graphs during a debrief of the lab in a poster presentation format by selecting students to summarize their findings. Engage students in a discussion to analyze the results and draw conclusions about how different types of light bulbs affect the brightness of the night sky, produce the most light pollution, and which type of light bulb is the least harmful to the environment?

Extend* the discussion by asking them to consider what happened when several groups had their light bulbs all turned on at the same time, and also what difference it would have made if the lights had shields on them to focus some of the light in a certain direction and block it from going in all directions.

*For an additional extension opportunity, consider having students participate in **the NSF Globe at Night project** in your community.