

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Quantifying Light Intensity as the Seasons Change

### Equipment:

- a globe
- a light source
- a photodiode (or other photosensor)
- a voltmeter

### Setup:

Place a globe on the table with a light source at least 1 meter away so that it is at the same height as the center of the globe. Connect the photosensor to the voltmeter and make sure it is connected correctly by watching the voltage change when you block it from the light. Find the approximate range of values by holding it pointed at the light and then covering it up (mine ranged from about 0 – 400 mV).

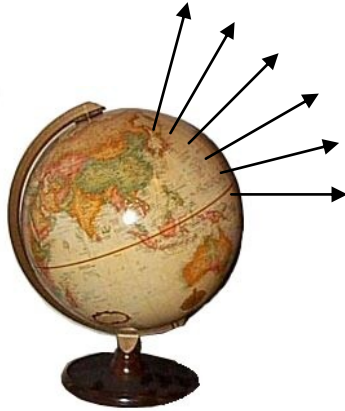


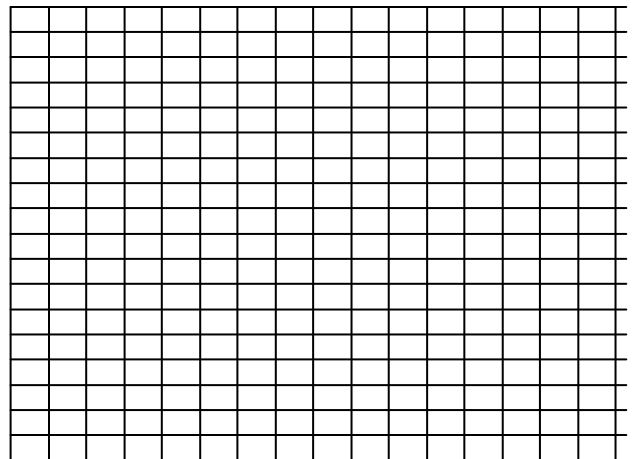
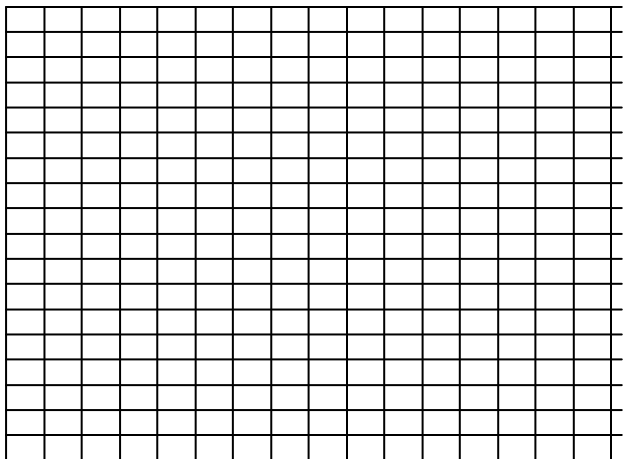
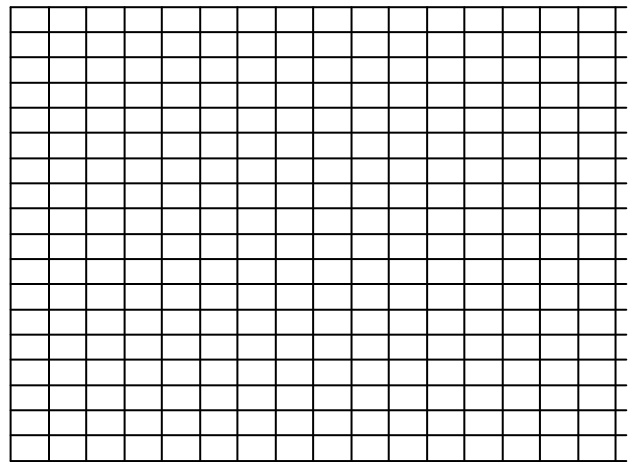
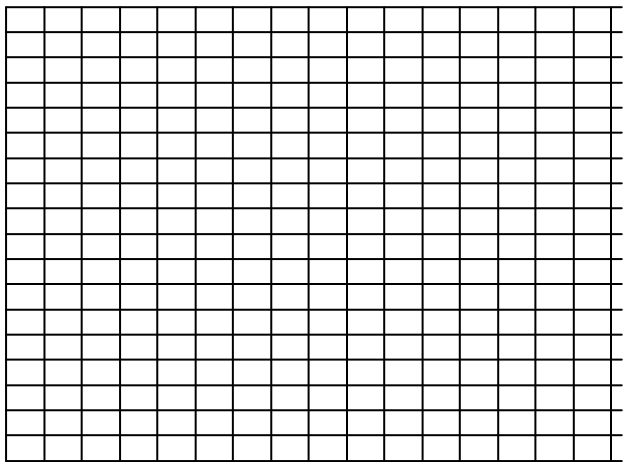
Image by KMJ from Wikipedia

### Experiment:

Start with the globe facing the light as shown in the diagram. Find the latitude lines on the globe (for example  $0^\circ$ ,  $15^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ , and  $75^\circ$ ). Start at the equator and place the photosensor on the surface of the globe facing outward. Record the measurement from the voltmeter in the following table. Move up to the next latitude line, still holding the photosensor flat against the surface. Moving the photosensor north, continue these measurements for the rest of the northern hemisphere.

Rotate the base of the globe  $90^\circ$  and repeat the same set of measurements. Continue this so that you should have a total of four sets of measurements. Plot your measurements on the four graphs provided. Label the seasons based on what you think correspond to Fall, Winter, Spring, and Summer.

Latitude	Season 1	Season 2	Season 3	Season 4



**Discussion:**

1. Do the light intensity levels make sense for the different seasons? How so?
2. What do you think is the main reason for the changing amounts of light that hit the photosensor?
3. What would you expect the results to be if we repeated the experiments for the southern hemisphere?
4. Do your measurements for Fall and Spring match up? What could be some causes for experimental error in this setup?
5. You might have seen light bulbs in the store rated for a certain lumen value. However, the photosensor is giving you a measurement of voltages. Describe an experiment that would allow you to convert these voltages into the more common lumen value, which measures *illuminance*, which corresponds to how our eyes perceive brightness.