

# Sunscreens

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ENSC 162 Solar Energy Lab

## Purpose of the experiment

- Use the UV Sensors to measure UV light.
- Determine the amount of UV light allowed through five different sunscreens.
- Analyze the trend of UVB and UVA light vs. SPF values.
- fyi

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fyi It takes 8 minutes for sunlight to travel from the sun to the earth.

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## Equipment List

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- LabQuest Interface
- UVA Sensor
- UVB Sensor
- coin (approximately 2 cm in diameter)
- tape
- ring stand and clamp
- selection of sunscreens
- two 4 × 6 inch index cards
- scissors
- plastic wrap
- stopwatch

## Background

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Sunscreens are available in many different types and with many different levels of protection. The most common measure of protection from UVB light is the SPF factor. SPF, or sun protection factor, describes the increased amount of time you can be in the sun before your skin starts to burn. For example, a sunscreen labeled SPF 8 means that you can be out in the sun eight times longer before burning than you would without using any protection. Products range from SPF 0 to SPF 50 or higher. But is SPF 50 really twice as protective as SPF 25? You will perform an experiment that will help answer that question.

Figure 1 shows the location of UV light in the electromagnetic spectrum. Notice that the ultraviolet band is broken into three types referred to as UVA, UVB, and UVC. The most harmful of these three, UVC light, is absorbed by the atmosphere and does not reach the Earth's surface. UVA light is deep-penetrating and causes tanning, wrinkles, and some forms of skin cancer. UVB light is also responsible for many skin problems such as sunburns and several forms of skin cancer.

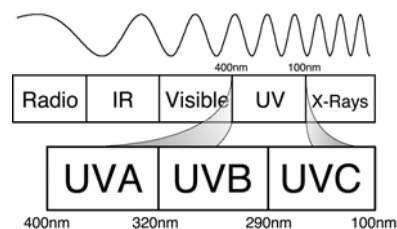


Figure 1

In this experiment, you will measure the amount of UVB light that passes through various sunscreens. You will then compare it with the amount of UVB light from direct sun and analyze the relationship between them.

## The Lab

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1. Obtain the different sunscreens assigned by your teacher.
2. In the spaces provided on the data table, fill in the SPF values, brand names, additional notes, and price per ounce.
3. Prepare your test cards.
  - a. Obtain two  $4 \times 6$  inch index cards.
  - b. Using the coin as your guide, draw three circles on each test card as shown in Figure 2.
  - c. Use scissors to cut out the circles.

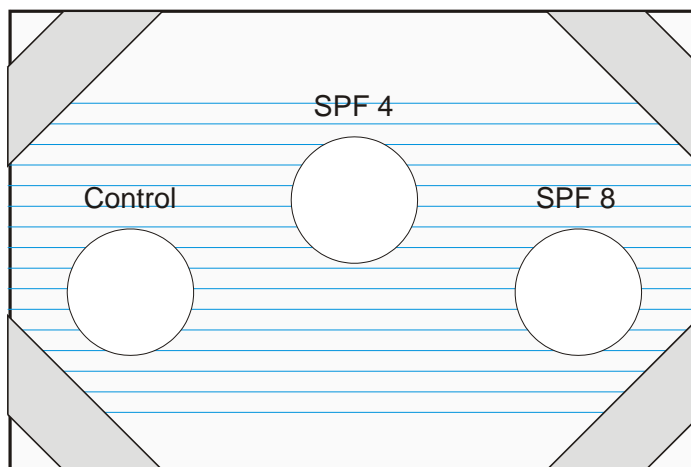


Figure 2

- d. On one test card, label the circle on the left as your control.
  - e. Using both test cards, label the remaining five circles with the SPF values of your five assigned sunscreens. Move from left to right and begin with the lowest SPF value. Note: Your SPF values may be different from those shown in Figure 2.
4. Cover the test cards with plastic wrap.
    - a. Cut out a 4 x 6 inch piece of plastic wrap. The person who does this should have clean hands with no sunscreen or lotions on them.
    - b. Lay the plastic wrap neatly on top of one of the test cards. Try to keep the plastic wrap flat so it is not wrinkled, but do not stretch it.
    - c. Tape the four corners as shown in Figure 2.
    - d. Repeat Steps a – c for the second test card.
  5. Apply the sunscreens to the test cards.
    - a. Place the first test card in front of you with the plastic side facing up.
    - b. The circle labeled “control” should be kept clean. It will be used to measure the effect of the plastic wrap by itself.
    - c. Starting with the sunscreen that has the lowest SPF, squeeze a very small amount of sunscreen on your finger.
    - d. Spread the sunscreen thinly and evenly over the appropriate circle on the plastic wrap.
    - e. Wipe off your finger well with a paper towel.
    - f. Repeat Steps b – e for all the remaining sunscreens.
    - g. Let the sunscreens dry.
  6. Have your test cards ready.
  7. Plug the UVB Sensor into Channel 1 of the LabQuest interface.
  8. Prepare the computer for data collection by opening the file “Sunscreens” in the *ENSC 162* folder.

9. Use the shadow of the UVB Sensor to aim it correctly without looking directly at the sun.
  - a. Pointing the sensor in the general direction of the sun.
  - b. Find the sensor's shadow and observe how it changes shape as you move the sensor around.
  - c. Move the sensor around until the shadow becomes a small round circle. This indicates that the sensor is now pointing directly at the sun.
  - d. Keeping this sensor orientation in mind, clamp the UVB Sensor onto the ring stand as shown in Figure 3.
  - e. Once the sensor is securely on the ring stand, use the shadow again to make final adjustments to assure that the sensor is pointing directly at the sun.



Figure 3

10. Practice holding one of your sample circles over the tip of the UVB Sensor.  
**Important:** The side with the sunscreen should be facing out, away from the sensor. Sunscreen should never come in contact with the UVB Sensor. It is okay if the plastic lightly touches the tip of the sensor.
11. When everything is ready, have the timer start the stopwatch while another person simultaneously clicks the  button. Data collection will begin. Data collection will stop automatically after 30 seconds.
12. Determine the average UVB intensity for each sample.
  - a. Using your mouse, click and drag a box to select the flattest region of the graph where you were testing the control.
  - b. Click the Statistics button, . The mean, or average, value for the selected data is listed in the Statistics box on the graph. Record this value in the data table.
  - c. Close the Statistics box.
13. Repeat Step 10 for the rest of the samples.
14. UVA light is not only responsible for tanning your skin, but for wrinkles, cataracts and some types of cancer as well. Test the same sunscreens for their degree of UVA protection.

## Data Table

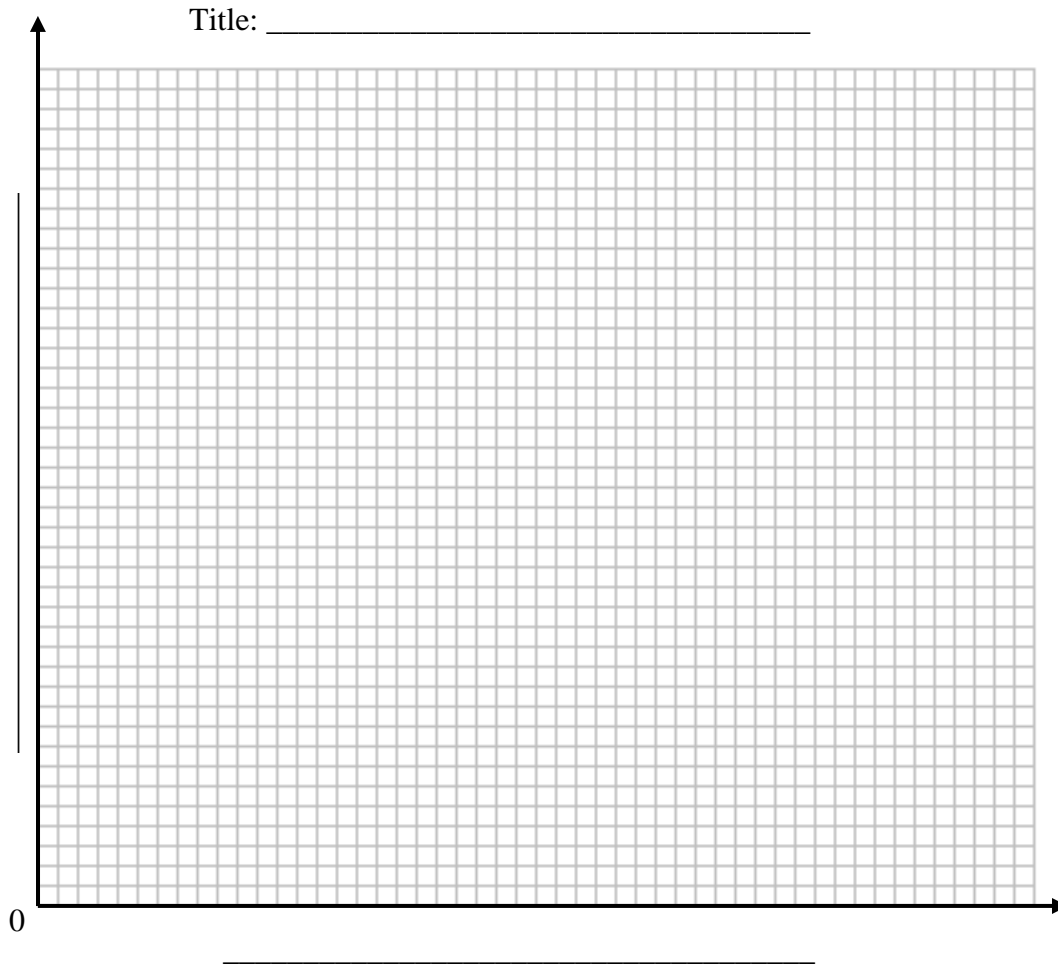
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SPF value on label	UVB intensity (mW/m <sup>2</sup> )	UVB intensity (mW/m <sup>2</sup> )	Brand name (e.g., Coppertone)	Additional notes on label (e.g., waterproof)	Price per ounce (\$)
SPF 0 (Control)			N/A	N/A	N/A

# Data Analysis

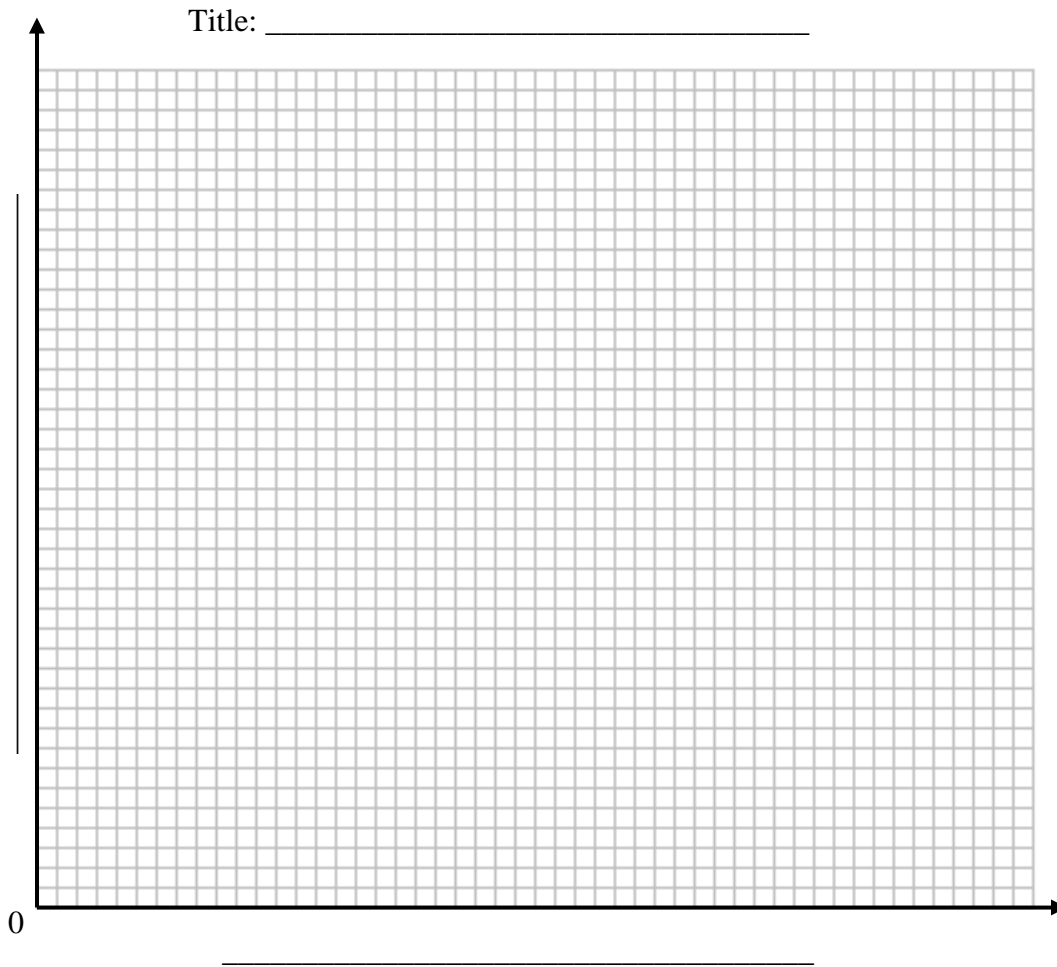
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1. Create a graph of UVB intensity vs SPF number.



2. Study your graph. Describe its shape in relation to how the UVB light intensity changed with different SPF values.
3. According to your data, would a sunscreen labeled SPF 50 block twice as much UVB light as SPF 25? Explain why or why not.

4. Create a graph of UVA intensity vs SPF number.



5. Study your graph. Describe its shape in relation to how the UVA light intensity changed with different SPF values.
6. According to your data, would a sunscreen labeled SPF 50 block twice as much UVA light as SPF 25? Explain why or why not.
7. According to your data, did the price per ounce or any other factors such as being “waterproof” have any effect on the UVB or UVA measurements? Explain.