

Are All Sunglasses Created Equal?

ENSC 162 Solar Energy Lab

Purpose of the experiment

- Use the UV Sensors to measure UVA/UVB light from the Sun.
- Determine the percent UVB light that is blocked by various kinds of sunglasses.
- fyi

^{fyi} Everyone is colourblind at birth.

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Equipment List

- LabQuest Interface
- UVA Sensor
- UVB Sensor
- selection of sunglasses and glasses
- stopwatch or digital watch

Background

Have you ever been sunburned? If so, you are familiar with the fact that ultraviolet (UV) light can damage your skin. But UV light can damage your eyes as well. UV light is absorbed by your eye and can cause a burn just like a sunburn on your skin. This condition, sometimes called snowblindness or welders flash, usually only lasts a few days. But UV light can also cause cataracts – cloudy spots on the lens of your eye that could require surgery or lead to blindness. So how do you protect your eyes? Do sunglasses do a good job of blocking UV radiation? Are expensive sunglasses better than cheap sunglasses? Are sunglasses better than regular eye glasses? These are some of the questions you will investigate in this experiment.

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.

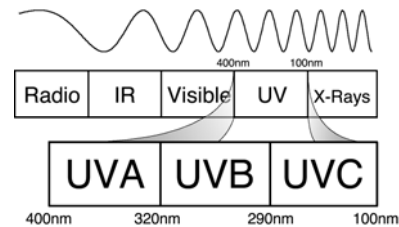


Figure 1

In this experiment, you will measure the UVB-blocking performance of various types of sunglasses and eyeglasses.

The Lab

1. Have your three pairs of glasses ready.
2. Plug the UVB Sensor into Channel 1 of the LabPro.
3. Open the file “Sunglasses” in the *ENSC 162* folder.
4. Familiarize yourself with the sampling procedure.
 - a. Look at the graph on the screen and notice that data collection will last for 60 seconds.
 - b. Over this 60 second run, you will alternate between 30 seconds of monitoring the sun directly and 30 seconds of monitoring the sun through your pair of glasses. One person will be the timer who will call out the 30 second intervals.

5. Use the shadow of the UVB Sensor to aim it correctly without looking directly at the sun.
 - a. Point 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 2.
 - 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.

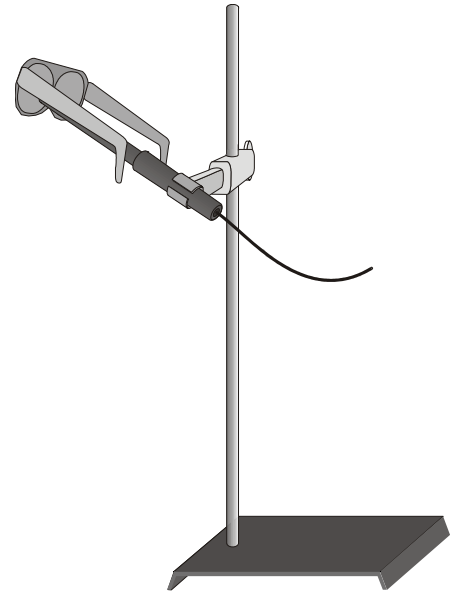



Figure 2

6. Take your readings. When you monitor through a pair of glasses, place the lens directly over the tip of the UVB Sensor as shown in Figure 2.
 2. Try not to bump the sensor. Data collection will stop after 60 seconds.
 - a. Using your mouse, click and drag a box to select the flattest region of the graph while you were testing Pair 1.
 - 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.
7. Repeat Step 6 for the other pairs of glasses.
8. UVA light is not only responsible for tanning your skin, but for wrinkles, cataracts and some types of cancer as well. Use the UVA Sensor to test the same glasses for their degree of UVA protection.

Data Table

	Pair 1	Pair 2	Pair 3	Glass
UV protection claims on label				
Lens material (glass/plastic)				
Lens color				
Approximate price				
UVB Intensity of the sun (mW/m^2)				
UVB Intensity while covered with glasses (mW/m^2)				
UVB blockage (%)				
UVA Intensity of the sun (mW/m^2)				
UVA Intensity while covered with glasses (mW/m^2)				
UVA blockage (%)				

Data Analysis

1. Calculate the percent UVB blockage of each pair of glasses and record in the data table.

$$\% \text{ UVB blockage} = \frac{\text{UVB of sun} - \text{UVB with glasses}}{\text{UVB of sun}} \times 100$$

2. According to your data, did the following factors affect the UVB blocking abilities of the glasses you tested? Answer yes or no and explain your reasoning.
 - a. UV protection claims on the label?
 - b. Lens material?
 - c. Lens color?
 - d. Price?