Globisens

Labdisc
activities

for Elementary School Science

Labdisc Activity:
Light Absorbance

Supporting Labdisc Data Logger, GlobiWorld and GlobiLab Software

For Elementary School Science

Light Absorbance

Introduction

Our world is filled with light. We need light in order to see - it carries information from all around us to our eyes and brains. Seeing colors and shapes is second nature to us and yet when we take a closer look, light is a perplexing phenomenon.

Here are some things to think about:

- Sunlight causes plant growth - the sun's energy is stored in plants. In fact, ancient plant life provided the earth's supply of fossil fuels: All the coal, natural gas, and oil deposits that we use until today.

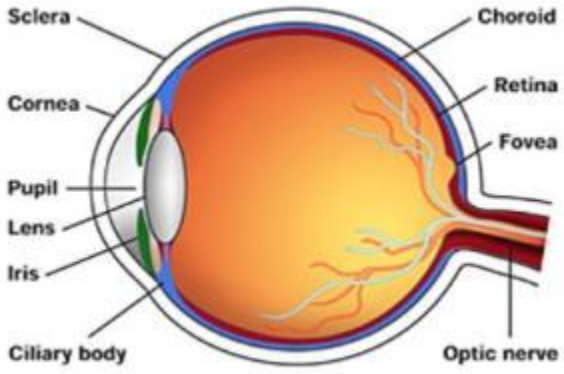
- Our brains and eyes act together to make extraordinary things happen in our perception. Movies are simply sequences of still pictures. Magazine pictures are just an array of dots.

- Light acts like particles - little light bullets called photons - that stream from the light source. This explains how shadows work.

- Light also acts like waves - ripples in space, rather than bullets. This explains how rainbows work.

- In fact, light is both a particle and wave. This "wave-particle duality" is one of the most confusing and wonderful principles of physics.

Despite the fact that the sun is over 93 million miles away, its rays also pose important health and ocular dangers to our eyes. Sunlight photon absorbed in our eye lens reduces its transparency and create diseases like Cataract.



Sunglasses play a major role in protecting our eyes and absorbing dangerous sunlight radiation such as UV and blue light.

What is light absorbance? Light absorption occurs when atoms or molecules of the sunglass lens take up the energy of a photon of light, thereby reducing the transmission of light as it is passed through the lens to reach our eye.

The Experiment

In this activity we will check and compare the absorbance of different pairs of glasses and sunglasses to discover which one provides the highest protection for our eyes.

Equipment Needed

- Flash lamp (not needed if working in direct sunlight)

Labdisc Setup

1. Turn on the Labdisc by pressing the On/Off key 
2. Rotate the Labdisc plastic ring to expose the light sensor
3. Place a flash lamp 25 cm away from the Labdisc facing the light sensor.
4. Connect the Labdisc to the computer, either with the USB cable or through the wireless Bluetooth channel.
5. Click the LAB icon  to open the Lab software.
6. Click on the SENSOR icon  and select Light sensor.  Make sure that this is the only selected sensor.

7. Click on the SAMPLING RATE icon triangle and select manual sampling. 

8. Click on the DISPLAY OPTION triangle  then select the Bar Graph option. 

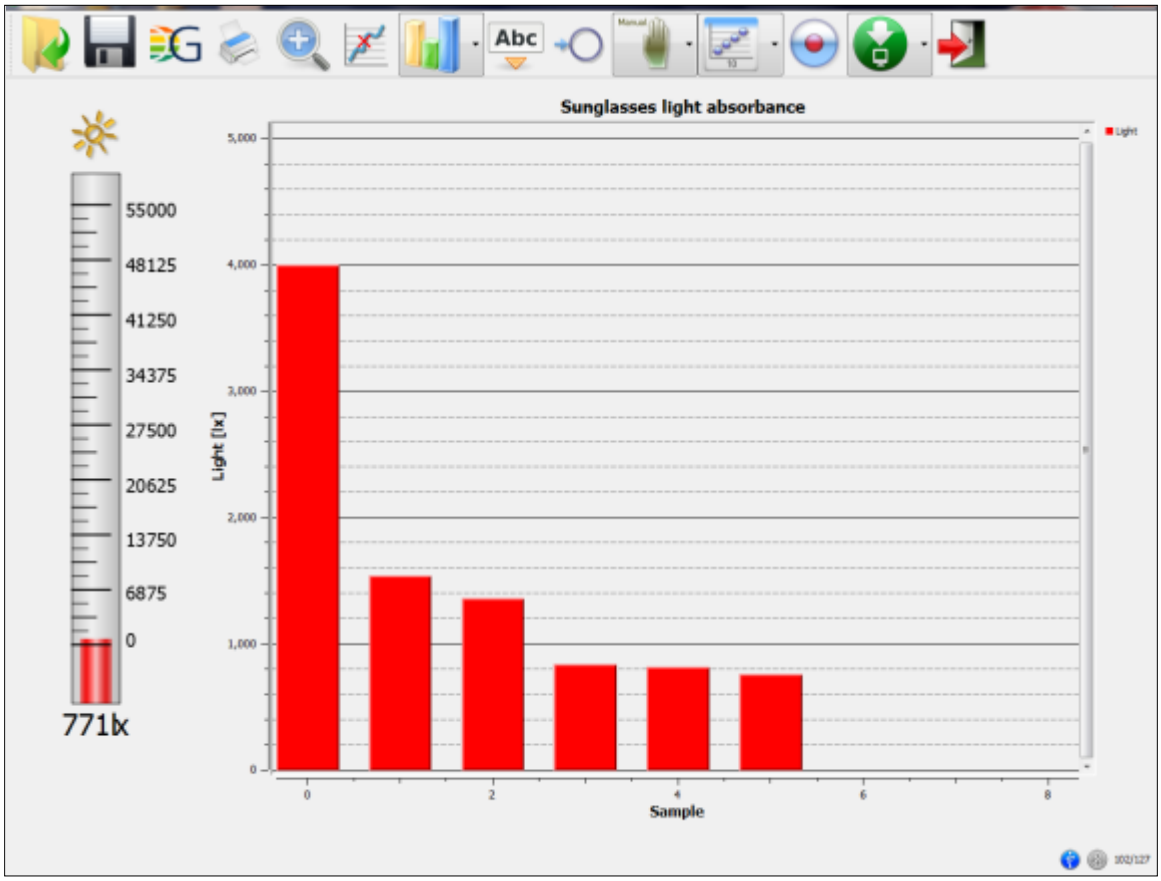
9. Click on the RECORD icon  to start the experiment.

Experiment Procedure

1. Place a flash lamp 25 cm away from the Labdisc facing the light sensor.
2. Take a manual sample by pressing the Labdisc SCROLL key. 
3. Place one of the pairs of sunglasses as close as possible to the light sensor and press the SCROLL key again.
4. Each time the SCROLL key is pressed, the software will display another red bar. The bar height represents the measured light level.
5. Repeat the above to measure many different pairs of sunglasses.
6. When you have finished recording click the STOP icon. 

Data Analysis

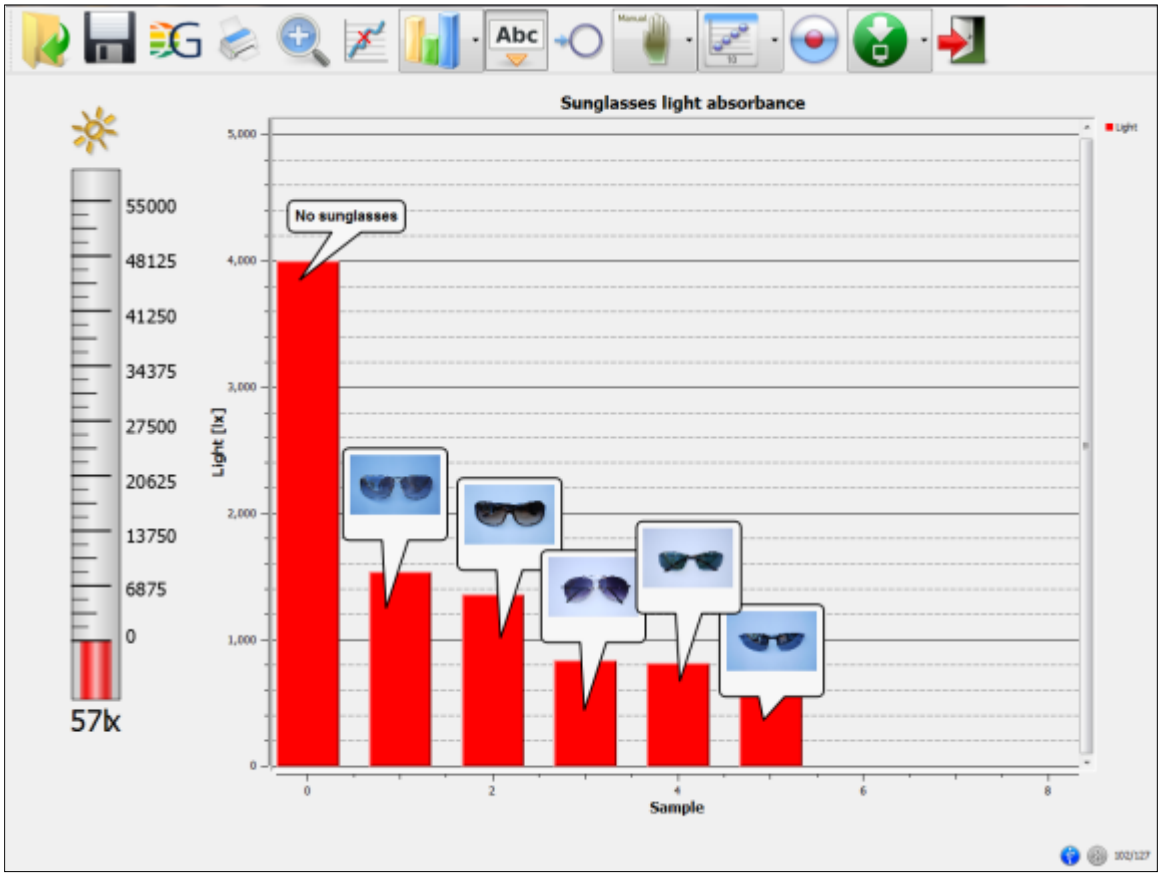
1. Double click on the graph title and a dialog box will open. Write "Sunglasses light absorbance" and click ok. The software will display the following screen.



7. You can take pictures of the different pairs of sunglasses with a digital camera and then use annotation to add them above the relevant bar graph. Click on the ANNOTATION icon.  Move the mouse over one of the red bars and make a left click. A dialog box will open, allowing you to type text and add pictures to the graph.

After adding text and the picture, click OK and use the mouse to drag the annotation to any point on the graph. You can also click on the annotation tip and move it over the graph window.

After annotation you'll see the graph below:



8. Save your project by clicking on the SAVE icon. 

Investigation and Questions

View your measurements and try to answer the questions below.

1. When did you measure the maximum light absorbance?
   - ☐ When using the darkest pair of sunglasses
   - ☐ All the sunglasses absorbed the same amount of light
   - ☐ The highest light absorbance was measured without any sunglasses

2. If we repeat the experiment using two sets of sunglasses placing one pair after the other, we will measure:
   - ☐ More light at the light sensor
   - ☐ The highest light absorbance
   - ☐ The lowest light absorbance

3. When using funny glasses with blue lenses:
   - ☐ The lenses absorb all other colors and only pass the blue
   - ☐ The lenses absorb the blue color
   - ☐ The lenses are painted blue, but absorb all the colors

4. What light levels would you measure if the flash lamp was placed 50 cm from the Labdisc?
   - ☐ The light level would be twice as high
   - ☐ The light level would be half the amount
   - ☐ The light level would be four times lower

Further Suggestions

1. Compare the light absorbance of sunglasses and reading glasses
2. Place the flash lamp at a 90 degree angle to the Labdisc. Use different shiny materials (e.g. metal foil, mirror) to measure light reflections.
3. Repeat the same experiment while using a simple color filter (also known as gel) to measure the different absorbance of various light colors
4. Repeat the experiment and instead of using the flash lamp, perform it outdoors in direct sunlight, for best results compare sunlight in both the winter and summer.