UV Beads

Summary:

This activity explores the temperature behavior of UV sensitive beads and investigates the effectiveness of sunscreens. UV Beads are a type of sensor that detects ultraviolet light given off from the sun. When UV beads are exposed to sunlight, they react by changing colors. UV beads can do this because they contain certain pigments that change color when exposed to sunlight or other forms of ultraviolet radiation. Exposure to UV radiation is harmful to skin cells. Sunscreens contain substances that absorb UV radiation and their sun protection factor (SPF) indicates how effective they are.

In this activity we will:

- Identify the properties of UV beads as a sensor which switches “on” and “off” with exposure to UV light.
- Recognize the wavelengths of radiation that reach the surface of the earth.
- Discover how sunscreen works and the importance of using it when exposed to the sunlight.

Materials:

- UV Beads
- Access to sunlight (such as a window) or UV light
- Aluminum foil
- Cookie sheet
- Oven
- At least 2 types of sunscreen including: SPF 8, SPF 15, SPF 30, and SPF 45 sunscreen (if only two are available, preferably higher and lower ends of the range)
- Fresh water and salt water
- 3 small drinking glasses
- plastic wrap
- scissors
- white paper
- cotton swabs
- timer (such as a watch)

Pre-Activity:

Before starting the activity, look at the UV beads and identify their properties.

- What color are they?

- Take one UV bead outside (or to a window or UV lamp) to see how light affects the bead. Describe what happens:

- Next, take the UV bead back inside, describe what the UV bead looks like as you bring it back inside:

Now, prepare your UV beads for the activity:

1. Pre-heat the oven to 350 degrees.
   Safety: Make sure your parents are present when you are doing this activity! The oven gets very hot. Have oven mitts handy for taking your UV beads in and out of the oven.

2. Take a cookie sheet and cover it with aluminum foil. Do not put the UV beads directly onto the cookie sheet. Make sure to leave space (at least 1 inch) in-between your UV beads so they do not stick together. UV beads are plastic and could permanently damage the cookie sheet if aluminum foil is not used.

3. Place the UV beads on the oven for 10 minutes or until they flatten to the size of a dime.

4. Remove the beads from the oven and allow them to cool for at least an hour.

Activity:

<u>I: Exposing UV beads to a light source (sunlight)</u>

1. Lay the UV sensitive beads on a piece of white paper. Use 4-5 different colors.

2. Expose the UV beads to the sunlight, write your observations for each disk.
3. Bring the UV beads away from the sunlight and observe the color of each UV bead.
4. Repeat this process 2 more times.
5. Use the table below to record your observations:

UV bead	Color 1:	Color 2:	Color 3:	Color 4:	Color 5:
Color the UV bead becomes					
Time of color change (in seconds)					

Questions:

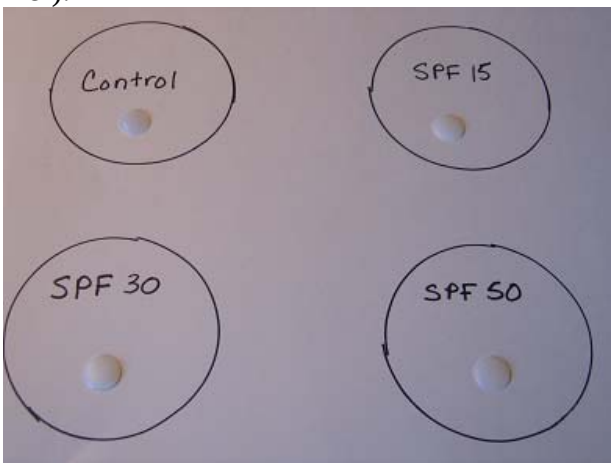
- Are some color changes easier to see than others?

- Based on your observations, which color disk is the most effective at sensing UV light?

  ->Now, we will experiment with one color only. Collect 6 disks of any color (only one color) for the next group of experiments.

II. Using UV Sunscreens to test the effectiveness of sunscreens

1. Draw 4 circles on one piece of white paper.
2. Label one disk "control" and place one of the UV beads in it (use the color that you selected earlier).



3. Take another disk of the same color and use a cotton swap to apply sunscreen to the UV bead. Make sure to cover the entire surface of the UV bead. Label another circle with the SPF number of the sunscreen you used and place the UV bead into the circle.
4. Repeat step "3" two more times with sunscreens of differing SPF values.

5. Expose all four disks to the sun for 2 minutes. Develop a scale of 1-5 to explain the variation of colors of the UV beads when exposed to sunlight. On this scale, 1 is the lightest color, 5 is the darkest color.
6. Repeat the process two more times. Each time you repeat the process, use a new bead and reapply the sunscreen (using the same SPF values. However, keep your control bead the same.
7. Record your results below:

Color bead changed to (Scale 1-5; 1 lightest, 5 darkest)	Control bead	Bead 1: SPF # _____	Bead 2: SPF # _____	Bead 3: SPF # _____
Trial #1				
Trial #2				
Trial #3				

**As an extension, repeat Activity II using another color and compare the data to your results from the first color you used.

<u>Is your sunscreen really waterproof?</u>

When you go swimming, does your sunscreen really stay on your skin? Put the UV bead into fresh or salt water for 2 minutes. Use a cup for each bead and label that cup either as "control" or using the SPF that you used for each bead. You may use the same beads that you used for Activity II. After 2 minutes, take the bead out of the water and repeat Activity II. Record your data using the table below.

Color bead changed to (Scale 1-5; 1 lightest, 5 darkest)	Control bead	Bead 1: SPF # _____	Bead 2: SPF # _____	Bead 3: SPF # _____
Trial #1				
Trial #2				
Trial #3				

References:

Home Made Sunscreen:
Obtain USP grade titanium oxide or zinc oxide (available from compounding pharmacies), almond oil (or other good oil) and beeswax. Use 1 cup oil to 1 oz beeswax and 1-2 Tablespoons zinc or titanium oxide. Heat the oil just enough to melt the wax (grate or chop it first), then add the titanium or zinc oxide.

UV beads:
http://www.arborsci.com/detail.aspx?ID=462

Sunscreens and SPF:
http://www.hintsandthings.co.uk/nursery/twcsun.htm

Light, UV Light and the Electromagnetic Spectrum:
http://imagine.gsfc.nasa.gov/docs/science/know_l1/emspectrum.html
http://csep10.phys.utk.edu/astr162/lect/light/spectrum.html