Expo Station

Solar Protector Detector

Participants make a wristband out of white, blue, and yellow beads. The white beads change color when exposed to UV light, which is one type of radiation that comes from our sun that can damage our eyes and skin. The brighter the beads, the stronger the UV radiation and the sooner you need to seek cover from the sun.

Ages

5-12

Activity Time

Preparation: 5 minutes
Activity: 5-8 minutes

Group Size

Number of participants:
1 person per station

Ratio of facilitators to participants:
1 facilitator for every 1 to 2 participants

Concepts to Explore

- Ultraviolet light is just outside the range of visible light and can damage our eyes and skin.
- When the white beads are brightly colored, it is a good idea to put on sunscreen and sunglasses or move to the shade to protect our skin and eyes from the sun.
- The beads will return to white indoors where our light sources typically do not include UV light.

Safety Requirements & Other Considerations

- Safety glasses are appropriate for this activity.
- Never shine a regular or UV flashlight or any bright light into the eyes of a person or pet.
- Never look directly at the sun, even for a very short amount of time.

Question to Investigate
Will the beads underneath a dark-colored lens from a pair of cheap sunglasses be white or will they change color?

Materials Required
Per participant

- UV beads
- yellow pony beads
- blue pony beads
- clear plastic cups
- clear plastic trays
- elastic cord cut into either 20 cm or 30 cm lengths
- blue divided tray
- binder clip
- clear plastic lenses
- 2 clear plastic trays
- UV flashlight
- one lens from a pair of cheap sunglasses
- extra batteries, AAA

Preparation Prior to Activity

In Advance

- Cut lengths of elastic cord into 20 and 30 cm lengths.
- Using a candle as a heat source, hold the ends near, but not in, the flame for a very brief moment. The thread at the end will melt and fuse making it easier to string the beads.

On-Site

- Place a layer of UV beads on one clear colorless tray. Then place another clear colorless tray directly on top of it. Place one pair of clear colorless lens on the top tray, along with a darkened lens from a pair of inexpensive sunglasses.
- Fill two cups with white beads, two with yellow beads, and two with blue beads for each table.
- Arrange the wristbands near each facilitator and mark them so that they know which are smaller (20 cm) and which are larger (30 cm).
- Arrange three or four blue divided trays across the front of a 6- or 8-foot rectangular table to indicate the location of each station.

- Place a binder clip on the end of a piece of elastic cord and place this the large area of for each tray. Place a UV flashlight in the small rectangular portion of each tray.
- Participants can use the circular portion of the tray to collect and store beads that they might use.

Instructions & Talking Points

Facilitate the activity		
Step	**Instructions**	**Talking Points**
Invite participants to make a UV detector	Tell participants: • Chose as many blue, yellow, and white beads as you'd like to fit on your elastic cord. • You may choose to arrange them in any pattern you wish. • You will be able to wear your UV detecting wristband for months if you wish.	• What are some ways that people protect their eyes and skin on very bright and sunny days?
Tie knots in the ends of the wristbands and promptly return them to their owners	• As participants complete their strands, hold each strand carefully, remove the binder clip, and make a knot with the two ends of the wristband. • Return the wristbands to the owners.	• Which stencils would you like to use? You can take one of these home with you. • How can you use a stencil to make an image? • Which flashlight does a better job of making an image on this kind of light-sensitive paper?

Give a preview of what the bracelet will look like in the sun	Direct participants to: • Offer to give a preview of what the wristband will look like outside with a UV flashlight. • Remind participants that your little flashlight is not nearly as strong as the sun so will not damage their skin or make the white beads become intensely colored.	• What does it mean when the white beads change to bright colors when you go outside? • What does it mean when the white beads are dimly colored? • What does it mean when the white beads return to their original white color?
Use a UV flashlight to show that some lenses are better than others at blocking UV radiation.	• Tell participants that the two clear colorless lenses are made of different types of plastic. • Shine the UV flashlight over each. • Explain that the UV flashlight can travel through most transparent materials. This means it is possible to get a sun burn inside of a moving car on a sunny day. • However, UV cannot travel through plastic made of polycarbonate. This material is used to make most kinds of glasses that help people see better.	• Will the white beads remain white or turn colors when I shine the UV flashlight on the clear colorless lenses? • Will the white beads remain white or turn colors when I shine the UV flashlight on the dark lens from a pair of super-inexpensive sunglasses? • How do you know that even super cheap sunglasses can protect your eyes from the sun?

Clean Up

- Reset for more participants by placing the binder clip on one end of a new piece of elastic cord. Then place the cord-and-clip in the large area on the tray.
- At the end of the session, collect each pair of clear colorless lenses and place them in their plastic bag. Add the lens from the cheap sunglasses to the bag.
- Pour the yellow and blue beads from the cups into the bags containing the same color. Carefully seal each zip-closing plastic bag and place them in the bin.
- Pour the white beads from the clear colorless trays and cups together into one of the two provided zip-closing plastic bags.
- Place all remaining items, including the plastic tablecloth, into the activity bin and deliver it to the location where the trunks are.

Explore the Chemistry

The UV in the name UV Detector is short for ultraviolet light. We can only see a very tiny bit of sunlight called visible light. Ultraviolet light (UV light for short) has a bit more energy than visible light. We cannot see UV light, but our bodies can detect it. In fact, it is the kind of light that causes sunburns. Because we want our skin to be safe, we protect ourselves when we go out in the sun for long periods of time. What do people do to protect their skin from UV radiation and sunburns? People use sunscreen, wear a hat, put on a long sleeve shirt, or sit in the shade. What do people do to protect their eyes from the sun? They might wear a hat or sunglasses.

Fun fact
Hippos make their own sunscreen that comes out of their skin when they sweat. This sunscreen is thick and is not attracted to water, so it doesn't wash off easily when they play in the water.

Frequently Asked Questions

Where can I buy UV beads?
UV beads are sold by online science education suppliers such as Educational Innovations, Steve Spangler Science, Discount School Supply, or Solar Active. Big box discount stores sometimes sell them as summer-season items.

How many different colors can one bead become?
Each bead is either white or one color. Depending on the amount of UV light, the bead may become a lighter or brighter color, but it will always turn the same color.

Where can I buy the elastic cord?
The elastic cord is available on amazon, is soft and comfortable to wear, and dries quickly when it gets wet.

Is UV light all bad?
Our skin uses UV light to make Vitamin D, which our bodies need.

How does sunscreen work?
Sunscreen works in two different ways. There are some particles in sunscreen that physically block the light. Other particles in sunscreen undergo a chemical reaction when UV light shines on them. By reacting with your sunscreen, the UV light cannot react with your skin.

How do plastic UV beads really work?
Chemicals known as spirocompounds embedded in the polyethylene beads react with ultraviolet light, which we cannot see. The energy of UV light causes a reversible change: A bond in the molecule breaks causing part it to rotate slightly. This change in shape causes the light to be absorbed and reflected differently. Because some of the energy goes into the change in the spirocompound, the light reflected back to our eyes is at a lower energy level. Fortunately for us, this lower energy level, longer wavelength, and shorter frequency is in the range of visible light. Our eyes and brain interpret this lower energy as different colors.

References

- A Committee on Community Activities classic