



## UV Detecting Beads

### Summary

Children string white, yellow, and blue beads on a plastic cord to make a UV-detecting wristband. The white beads each become a different color in sunlight. Two clear colorless circular disks are shown. The beads change color under one and remain white under the other. Will the beads underneath a dark-colored lens from a pair of cheap sunglasses be white or will they change color?

### Main idea

Too much sunlight can cause sunburn and damage our eyes. 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.

### Each child will select

- 5 white beads, actually UV-color-changing beads
- 2 yellow beads
- 2 blue beads
- 1 plastic cord, 22 cm length
- 1 small binder clip

### Each presenter will have

- Diagram of the electromagnetic spectrum
- Ordinary and UV-filtering lenses
- Lenses popped out of sunglasses
- 4 wide clear plastic cups
- Tray with a thin layer of white UV beads

### Procedure for children

1. Place a small binder clip on one end of the plastic cord.  
This will prevent the beads from falling off when children string their beads.
2. Arrange the 9 beads in a pattern you choose.
3. String all 9 beads in order to keep your pattern.
4. Hand your string of beads to the presenter.

### Procedure for volunteer

#### *Tie knots and wear wristbands*

1. Remove the binder clip, taking care to keep the beads on the plastic cord.
2. Hold the two ends together and tie a knot. Position the knot close to the ends for larger wrists and further from the ends for smaller wrists. The wristband is best when it fits somewhat snugly.
3. Return the wristband to the children and have them stretch it over their hands and onto their wrists.

#### *Reveal beads hidden beneath a sunglass lens*

4. Tell children that the brighter the color of the beads, the more they need to protect themselves from the part of sunlight that can hurt our skin and eyes. If the beads are light-colored or even white, they are protected from the sun. Maybe they are inside a building where the building blocks the light from the sun.
5. Tell children: UV light is a part of sunlight that can damage our eyes. Sunglasses are dark-colored to help block UV light. Most sunglasses are either made of polycarbonate or have a special coating on them so that the UV light will not go through. Are the beads under this lens white or colorful?
6. Lift the lens to show children whether or not their prediction is correct.

## Deepen Understanding

Your eyes can see lots of colors (ROYGBIV), but there are types of colors that you can't see. One of them is called ultraviolet or UV, and it comes from the sun. Even though you can't see UV light, it definitely affects you—it's the UV light that can give you a sunburn! Some days the UV light is very strong, and other days, it is less strong. You can use your UV bead bracelet to tell you how much UV light is hitting your skin.

### Questions to Ask (that may seem obvious, but go with it):

- Have you ever had a sunburn?
- What do you do to protect yourself from a sunburn?
- How long does it take for your beads to change color in the sun?

### Here's 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 and protect ourselves when we go out in the sun for long periods of time. What do people do to protect their skin from UV light 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? *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.

## FAQs

**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, and 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 be a lighter or brighter color, but it will be the same color.

**Where can I buy the plastic cord?** This plastic cord is sold at craft stores as "pony bead lacing." The plastic is a soft, flexible, hollow tube that can fit over memory wire. It is also sold as "soft plastic tubing."

**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 those 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.