

Change is Colorful with UV Beads

At-Home

Detect light from the sun using UV-sensitive beads!

Question to investigate

Do sunglasses protect your eyes? Use UV detecting beads and sunlight to find out.

Chemistry concepts

- Sunlight is made up of many different types of radiation.
- The wavelengths of UV light are shorter than the wavelengths of visible light.
- Molecules in the UV beads are sensitive to the energy and wavelength of UV light

Activity logistics

- **Ages:** As written, this activity is suited for ages 5–12.
- **Time:** 20–30 minutes

Be Safe

- Beads are a choking hazard and should not be given to children under the age of three.
- The ends of pipe cleaners can be sharp, so children should be careful when handling them.
- If UV flashlights or black lights are used, do not to look directly into the light.
- Work with an adult.
- Read and follow all directions for the activity.
- Be sure to clean up and dispose of materials properly when you are finished with an activity.
- Wash your hands well before and after the activity

General Safety Guidelines

- Ask an adult for permission to do the activity and for help when necessary.
- Read all directions and safety recommendations before starting the activity.
- Wear appropriate personal protective equipment (safety glasses, at a minimum), including during preparation and clean up.
- Tie back long hair and secure loose clothing, such as long sleeves and drawstrings.
- Do not eat or drink food when conducting this activity.
- Clean up and dispose of materials properly when you are finished with the activity.
- Thoroughly wash hands after conducting the activity.

What you'll need

- UV-sensitive beads
- Pipe cleaner or piece of string
- Pair of sunglasses
- UV flashlight, black light, or sunshine

Procedure

1. Choose a piece of string or pipe cleaner and make a bracelet by stringing the beads on it, in any order, and then tie the ends.
2. Note the color of the beads.
3. Take the bracelet to a sunny area or use the UV flashlight.
4. Observe the color of the beads again.
5. Bring the bracelet to a shaded area. What happens to the beads' colors?
6. Hold a pair of sunglasses over the UV beads to see if they can protect the beads from the sun's UV rays.

What did you observe?

What color are the beads when they are in a shaded area?

What color are the beads in a sunny area or when you shine a UV flashlight on them?

Can sunglasses protect the UV beads from the sun's UV rays?

Do you think sunglasses protect your eyes from UV rays? Why or why not?

How does it work?

Sunlight is more complex than it looks. The light coming from the sun also has other types of radiation that are not visible. Sunlight is made up of visible light, ultraviolet (UV) light, and infrared light. Our eyes cannot see UV light because UV wavelengths are shorter than the wavelengths of visible light, and the light detectors in our eyes are not sensitive to this shorter wavelength. The Sun emits a variety of UV radiation, with three basic types: UV-A, UV-B, and UV-C. UV-B and UV-C are the most dangerous kinds for humans. Fortunately, the atmosphere absorbs most of the UV-B and UV-C radiation. If we cannot see UV-B radiation, how can we detect it? Today you will learn how — by making a wristband with UV-sensitive beads!

Whether or not we can see the various types of radiation in sunlight depends on its wavelength. For example, our eyes cannot see ultraviolet (UV) light because UV wavelengths are shorter than the wavelengths of visible light. The light detectors in our eyes aren't sensitive to this shorter wavelength. The Sun emits a variety of UV radiation, with three basic types: UV-A, UV-B, and UV-C. UV-B and UV-C are the most dangerous kinds for humans. Fortunately, the atmosphere absorbs most of the UV-B and UV-C radiation.

The UV-B radiation that passes through the atmosphere can be dangerous to living organisms. For example, it can cause sunburn and skin cancer. We protect ourselves from UV-B radiation by seeking shade, wearing sunglasses, and using sunblock whenever possible.

We cannot see UV-B radiation, but we can detect it with UV beads! When the beads are exposed to the sun, they change color because of the UV part of the light from the sun. If you go inside again, the beads change back to white (normal house lights do not produce UV light). This happens because the dyes in the beads are sensitive to the energy and wavelength of UV light. The UV light makes the dye molecules change their shape, and this results in a visible color change. If you take away the source of UV light, the dye goes back to its normal shape. If the UV light is strong, like on a sunny day, the beads change to bright colors. On overcast days when the UV is weaker, the colors are less vibrant.

This activity is adapted from an activity that originally appeared in the Celebrating Chemistry issue for National Chemistry Week 2018, written by Alexa Silva, Ph.D.