



Mission: What happens when light bounces off of a bubble?

Age: 5+

Materials: \$5

Time: 20 min

(Set-up: 5 min Activity: 10 min Clean-up: 5 min)

What you need:

Materials:

- 1/4 cup dishwashing liquid (clear is best but any type will work)
- 1/2 cup corn syrup
- 1 cup water
- A blank piece of white paper

Equipment:

- Straw
- A plate
- Flashlight
- A darkened room

What to do:

1. Prepare the bubble mix: combine 1 cup of water and 1/2 cup of corn syrup. Stir thoroughly until the corn syrup is fully mixed in. Then add 1/4 cup of dish washing liquid to the mixture and stir. (Note: The corn syrup helps the bubbles last longer before popping, but you don't need it if you don't have any.)
2. Take your bubble mix, plate, and flashlight into a room that can be darkened (keep the lights on for now!).
3. Pour enough bubble mix onto the plate to completely cover the bottom.
4. Dip your straw into the bubble mix and blow gently to make a bubble. Try to get a stable bubble dome, a few inches wide, to sit on the surface of the liquid. This can take some practice! (Hint: Once you get a small bubble started, lift the straw out of the liquid to blow more air into the bubble and make it bigger. If your bubbles keep popping, try adding more dish washing liquid.)
5. Turn off the room light and shine the flashlight onto the bubble. What do you see?
6. Now move your head or flashlight around the bubble. What changes do you notice?

What to do:

7. Hold the sheet of white paper a few inches behind the bubble and shine the flashlight through the bubble onto the paper. What do you see on the paper?
8. Try moving the flashlight closer or further away from the bubble. What changes do you notice?
9. Explore more! Try blowing more bubbles to explore different patterns of color. Try using a straw to blow a bubble inside another bubble without popping it. Try blowing the biggest bubble you can--a bigger dish can help. Or, try using different colored lights. What differences do you notice?

Clean-up:

Pour the bubble mix into the sink and wash the dish with water. Wash your hands!

What's Happening?

The colors you see come from the interaction of light with the bubble. White light, like the light from your flashlight, contains a mix of all the different colors of the rainbow. The surface of the bubble is a very thin layer of liquid, up to a thousand times thinner than a piece of paper. When the different colors making up the white light encounter the thin bubble layer, the colors are reflected off the surface in different directions. The thickness of the bubble, the angle of the incoming light, and the angle from which you view the bubble can all change the colors that get reflected. Scientists call this type of color "structural color" because the color comes from the shape of the bubble and not from any chemical dyes in the bubble mixture.

So What?

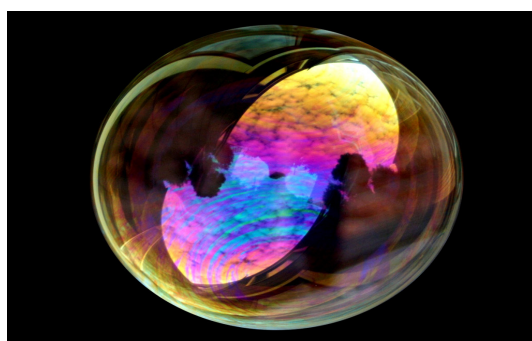


Image credit: Brocken Inaglory

All around us, we can see examples of structural color -- for example, in DVDs, rainbows, and even on some bugs! Unlike colors from dyes, like those used to color fabric for our clothes, structural color is unique in that it will never fade away if the structure stays intact. Structural color is just one example of a property that depends on how a material interacts with the environment. The structural color of a material can change just by a different angle of light. Try looking at the back of a DVD and notice how you see different colors arise when you move your head up and down. Currently, structural color is used on currency to prevent people from illegally printing money as these structures can be difficult to make but are easy to see to determine if the money is fake.

NGSS Alignment of Light & Bubbles Activity

The information below may not include every area that this activity can be linked to NGSS concepts

Disciplinary Core Ideas

PS3.A: Definitions of Energy

- **Grade 4**

- ◇ Energy can be moved from place to place by moving objects or through sound, light, or electric currents.

PS3.B: Conservation of Energy and Energy Transfer

- **Grade 4**

- ◇ Light also transfers energy from place to place.

PS4.B: Electromagnetic Radiation

- **Middle School**

- ◇ When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light.
- ◇ The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.
- ◇ A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media.

Performance Expectations

4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

MS-PS4-2: Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

Crosscutting Concepts:

Energy and Matter

- **Grade 3-5**

- ◇ Energy can be transferred in various ways and between objects.

- **Middle School**

- ◇ Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.
- ◇ The transfer of energy can be tracked as energy flows through a designed or natural system.

Crosscutting Concepts:

Structure and Function

- Grade 3-5
 - ◇ Substructures have shapes and parts that serve functions.
- Middle School
 - ◇ Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.

Engineering and Science Practices

Developing and Using Models

- Grade 3-5
 - ◇ Develop and/or use models to describe and/or predict phenomena.
- Middle School
 - ◇ Develop and/or use a model to predict and/or describe phenomena.
 - ◇ Develop a model to describe unobservable mechanisms.

Planning and Carrying Out Investigations

- Grade 3-5
 - ◇ Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.