



Fourth Grade Science

4th Grade Science: Activity 4

How do rainbows form?



Directions: This handout can also accompany a KCSatHome Teacher Video. If you have access to the video, watch the video before doing this activity. You can find the videos at <https://www.knoxschools.org/Page/21816>

Background Information



Did you know that rainbows are made of light? We need to understand light energy to learn how rainbows are formed. Light travels in waves. Light waves move in a straight line until they hit something and then the light waves change direction. We can change the direction of light waves in 2 ways:

- 1) Reflection- the bouncing of light waves off a surface
- 2) Refraction- the bending of light waves as they move through a transparent material

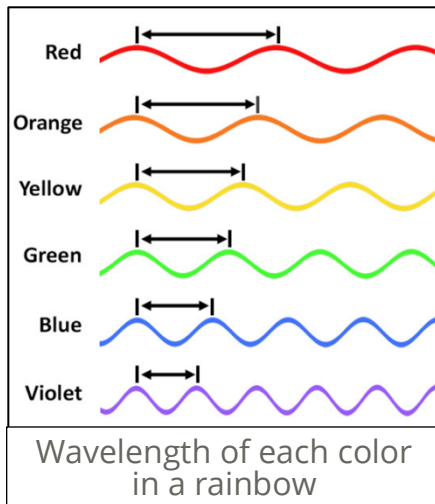
Investigation 1: Reflection vs. Refraction

Sunlight and water are needed to make a rainbow. What could water drops be doing as light waves pass through it? Investigate how light changes direction differently with reflection and refraction.



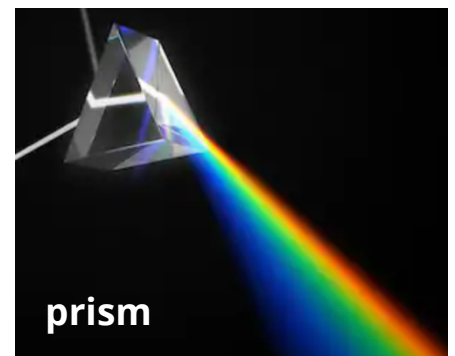
Reflection	Refraction
Place a pencil in a clear, glass cup. Hold the cup in front of a mirror at eye-level. Draw the reflected pencil below.	Fill a clear, glass cup half way with water. Place a pencil inside. Look through the cup at eye-level. Draw the refracted pencil below.

Make a prediction: Does reflection or refraction cause a rainbow to form? Explain why you think this.



We already know light is a wave, but did you know that each color we see has a different wavelength? Sunlight is actually many different wavelengths mixed together. In activity 3, we learned that we hear different sounds depending on their wavelength. Our eyes see different colors depending on their wavelength. We can see 7 different colors in all.

A prism is a triangular piece of clear glass that can separate the 7 different wavelengths of light. The clear glass bends, or refracts, light waves. Each color of light bends a little differently because each has a different wavelength. Red has the longest wavelength and violet has the shortest wavelength.



Compare the diagram of wavelengths for each color to the rainbow created by the prism. **What is the relationship between wavelength and the sequence of colors in the rainbow?**

- A. The colors of the rainbow are sequenced from lightest to darkest.
- B. The colors of the rainbow are sequenced randomly.
- C. The colors of the rainbow are sequenced from longest wavelength to shortest wavelength.
- D. The colors of the rainbow are sequenced shortest wavelength to longest wavelength.

Investigation 2: Make your own rainbow

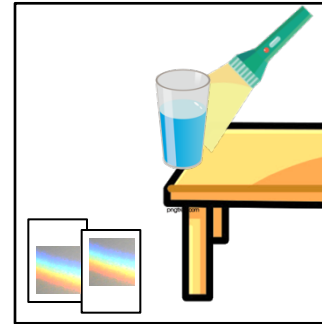
Rainbows appear when light waves from the sun pass through water drops in the air. Each water drop is like a tiny prism. When sunlight enters the water droplet it is refracted. The water drop splits the sunlight up according to its wavelength: red, orange, yellow, green, blue, indigo, violet. **You can separate the colors in light by making your own prism with a cup of water.**

Materials:

Clear, glass cup filled with water
Flashlight (a phone's flashlight works fine)
2 sheets of white paper

Directions: **Adult supervision required**

- 1) Fill the glass with water so that it's a little over half way full.
- 2) Carefully place the glass on the edge of a coffee table or other flat ledge. Gently scoot the cup almost halfway off the edge of the table. Be careful that the glass does not fall over the edge!
- 3) Place the two sheets of paper side by side on the floor next to the table.
- 4) Shine the flashlight through the cup of water so that the light goes through the glass and onto the white paper.
- 5) Adjust your flashlight at different angles and move the paper until you can see a rainbow on the white paper.



Draw your investigation in the box below. Explain why the cup must have water in it for a rainbow to form.