

# Cereal Box Spectroscopes

**Estimated Time: 45 minutes**

## SUMMARY

Much like the human fingerprint, which is unique to the individual, every source of light has a distinct and identifiable spectrum that is observable. For example, when looking at a rainbow in the sky, sunlight is being broken down into a continuous spectrum: the visible light spectrum. If a light source is not white light, however, the spectra will only consist of small pieces of visible light. An emission spectrum displays the light given off by a particular compound or atom. In fact, scientists concluded that the sun's light is the result of hydrogen fusion, to produce helium gas, because of helium's unique emission spectrum. In this activity, you can view the emission spectra of various household light sources by creating your own spectroscope.

## WHAT YOU'LL LEARN

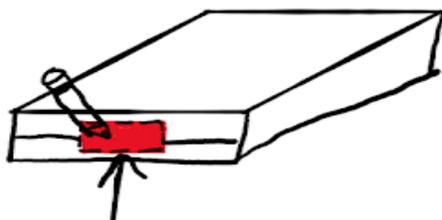
- Light consists of a combination of light waves of varying wavelengths and frequencies that can be broken down into its components.
- A spectroscope is a device that displays emission spectra for visible light waves.

Materials Used	Resources Used
<ul style="list-style-type: none"> <li>• Empty cereal boxes</li> <li>• Diffraction grating slides with <math>\leq 500</math> lines/mm (check out <a href="http://www.rainbowsymphonystore.com">www.rainbowsymphonystore.com</a> for affordable products, only \$0.35/slide)</li> <li>• Scissors</li> <li>• Tape</li> <li>• Pen for marking cereal box</li> <li>• A variety of light sources!</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="https://www.girlscouts.org/content/dam/girlscouts-gsusa/forms-and-documents/for-adults/volunteer/GSUSA_Eclipse-Box-Activity-Guide.pdf">https://www.girlscouts.org/content/dam/girlscouts-gsusa/forms-and-documents/for-adults/volunteer/GSUSA_Eclipse-Box-Activity-Guide.pdf</a></li> <li>• <a href="http://chemistry.bd.psu.edu/jircitano/periodic4.html">http://chemistry.bd.psu.edu/jircitano/periodic4.html</a></li> </ul>

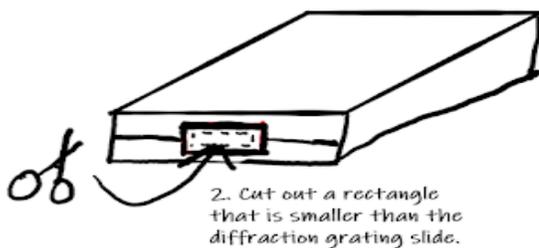
## WHAT TO DO

1. Check out the drawings for the construction of the spectroscope below.
2. To construct the spectroscope, close the flaps on one end of an empty cereal box. Take a diffraction grating slide and use a pen or pencil to outline its shape into the center of the bottom of the cereal box. This side will become the front of your spectroscope, which you will point towards light sources to view.
3. Open the flaps on the "front" of your spectroscope. Using scissors, carefully cut out a piece of cardboard smaller than that of the diffraction grating slide.
4. Now you will tape the "front" flaps of the cereal box closed. Center the diffraction grating slide over the hole you have cut and secure it with tape. Ensure that when you look through the diffraction grating slide, you can see inside the cereal box (of course, it will be dim, but you should be able to see light on the other, open end of the box!)
5. At this point, it will be helpful to measure the distance from one end of the cereal box to the center of the diffraction grating slide. On the opposite end of the cereal box—the "back" of the spectroscope—make a vertical line the same distance from the center of the diffraction grating slide. Next, take scissors and carefully cut a slit at this point for viewing through the spectrometer.

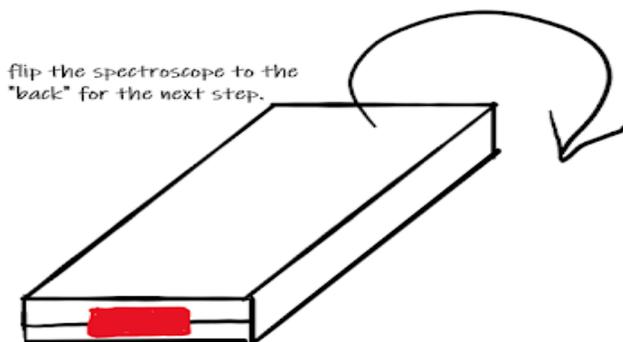
6. Close the “end” flaps and tape them shut! Your spectroscope is ready to be used. You can view any source of light through the narrow slit in your spectroscope and see that light sources spectra.
7. When you examine a light source through the spectroscope, you will see a series of vertical and colorful lines and black in between the lines. The colorful lines indicate all of the light waves that are being emitted by a light source. Check out [Penn State’s Periodic Table of Emission Spectra](#) in the Resources Used for the known emission spectra of the 118 elements! A quick Google search can also provide other emission spectra that you are curious about.



1. Outline the shape of the diffraction grating slide onto the “front” of the spectroscope.



2. Cut out a rectangle that is smaller than the diffraction grating slide.



flip the spectroscope to the “back” for the next step.

3. Secure the diffraction grating slide to the opening with tape.

