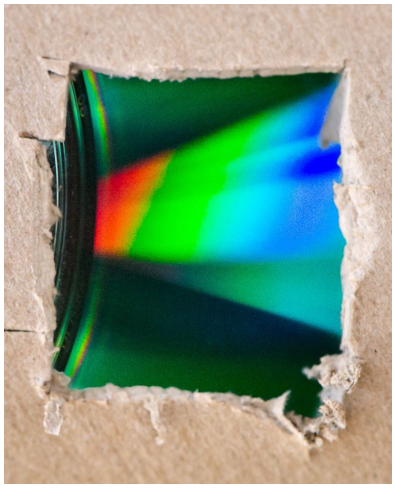
DIY SCI: Spectacular Spectroscope



What is it?

In this fun project you will make your own **Spectroscope**, an instrument that splits light into different wavelengths. All you need is a few simple materials and you'll be able to hold your very own rainbow in your hand!

Theory

Astronomers use powerful Spectroscopes to study the composition of stars and planets millions of light years away. In this experiment you will use a CD to examine bands of lights just as astronomers do. The grooves in the CD allow light to **diffract,** or spread out which will create the rainbow light that you see. Astronomers use this technique to figure out if the chemical compounds are being emitted or absorbed.

What you'll need

- One empty paper towel roll
- A CD
- A knife
- A pair of scissors
- A pencil
- Tape
- Paint (optional)
- Cardstock
- A ruler

How to make it:

1. If you are choosing to paint your paper towel roll you'll want to do that first in order to ensure that it has enough time to dry.
2. Use a knife to cut a curved slit at a 45 degree angle towards the bottom of one end of your tube. (Ask an adult to help you with steps 2-3)
3. Directly across from your hole use a knife to make a small peephole big enough for you to see through.
4. Trace the end of your tube onto the cardstock and cut out the circle using scissors.
5. Use a ruler to trace and cut out a one cm wide slit across the center of your circular cardstock.
6. Tape the cardstock on the opposite end of your tube from the slit and peephole.
7. Insert your CD into the 45 degree angled slit with the shiny side facing upwards.

8. Take it outside and aim it towards the sky to see the rainbow that appears inside. (Don't point your Spectroscope directly at the sun.)
9. Use different lights to observe how the rainbow changes.

What do you notice?

- ➔ Some colors appear brighter or darker when using different light sources. This is because different sources of light emit different colors.
- ➔ When you look into the peephole you see a rainbow. This is because the grooves on the CD make light spread out when it hits the CD.
- ➔ When using a fluorescent light you can only see a handful of colors. This is because fluorescent light only emits a handful of colors with areas of shadow in between. Fun fact: Astronomers examine bands of light and the dark bands splitting them to study space. They were able to use Spectroscopy to figure out that stars are made out of hydrogen and that comets contain lots of water.

Takeaway

1st-6th

Your CD has tiny grooves on the surface which cause light to **diffract,** or spread out. The split at the top of your spectroscope is so small that when light passes through it causes it to split. When the light splits you are able to see the multiple colors. White light is made up of many different colors, however you are not able to see these colors until the light is split which is why you can see a rainbow when you hold your spectroscope to your eye. When a light splits it's called **refraction**. An example of refraction is when sunlight psses through raindrops and the light splits to form a rainbow.

1. What do you notice?
2. How did the rainbow colors change when you used different light sources?

7th-12th

The light that streams into our eyes everyday are made up of multiple **wavelengths**, which we see as different colors. Violet has the shortest wavelength we can see while red has the longest. Your spectroscope splits the white light that you see into wavelengths or colors. The narrow slit at the top of your spectroscope is called **diffraction grating.** Diffraction grating allows astronomers to measure the length of wavelengths because it spreads the light into different wavelengths and amounts through **refraction**. Some substances emit light to produce an **emission spectrum**. Each element also absorbs light to produce an **absorption spectrum** that allows scientists to identify elements. Using the absorption spectrum, astronomers are able to determine the chemical compositions of stars and other distant objects.

1. All the light sources were white light. Why did they make different patterns on the CD?
2. What do you think would happen if you didn't add a narrow slit to the top of your spectroscope?

Next Generation Science Standards:

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