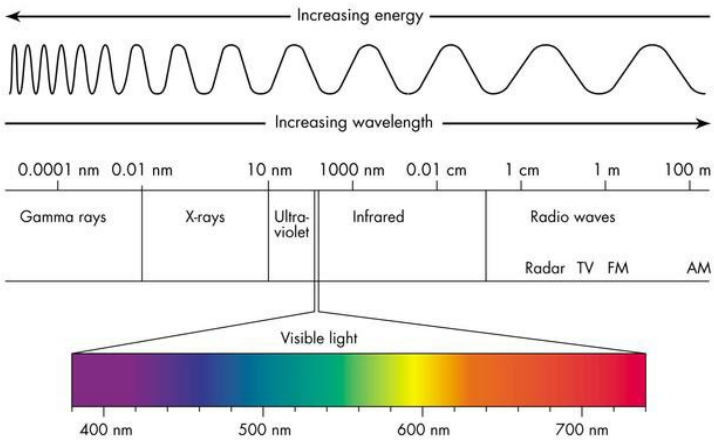
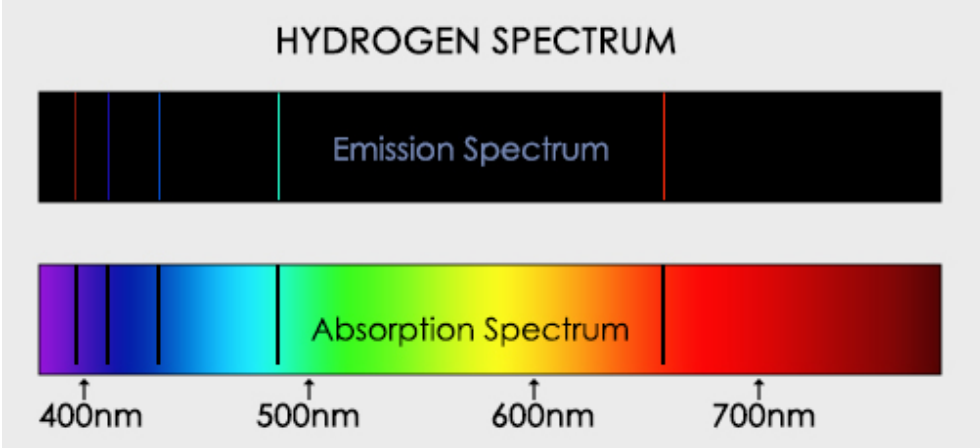
Create Your Own Spectroscope Activity Student Handout

How do you figure out what something is made of? Separating it into different parts is one way. Scientists can do this with the light from a sample to determine what elements it's made of. They use a tool called a **diffraction grating** to accomplish this. Diffraction gratings use many tiny slits to separate light shown through it. Glass prisms are commonly used as diffraction gratings. This rainbow of light is called a spectrum. The different components of light are described by the **Electromagnetic Spectrum**. Humans can see visible light but there are other wavelengths that exist that are invisible to human eyes. These invisible wavelengths of light include radio waves, microwaves, and infrared waves.



A **spectroscope** is a device that allows its users to see the spectrum of light. Analyzing the details of a spectrum allows scientists to determine what elements and molecules are in a light sample. In this activity you will learn how to build a spectroscope and explore using it on different light sources.



Similar to a spectroscope, a **spectrophotometer** sends different wavelengths of light through a sample in order to discover what it is made out of. Depending on the elements within the sample, certain wavelengths will be absorbed. By looking at the combination of everything that was absorbed, the sample's **absorption spectrum**, scientists can determine the elements within the sample.

Materials:

- Small box - must be able to fit a CD inside of it, a small shipping box or shoe box will work
- CD
- Aluminum foil
- Cardboard tube - toilet paper or paper towel roll will work
- Scissors
- Tape
- Ruler

Procedure:

1. Make a hole for your viewing tube
    - On one side of the box place your CD about half an inch from the left-side edge
    - Trace around the middle of the CD
    - Place your cardboard tube over the traced circle and trace around the outside of the tube
    - Move the tube half an inch to the right and trace the outside again
    - The overlapping large circles will create an oval, trace out that oval
    - Using your scissors cut out that oval shape - this is where you will view your spectra



2. Make a viewing slit
    - Rotate the box so the side with your viewing oval is facing towards the right
    - Place your CD in the bottom left corner of the box face now facing you
    - Trace middle circle of the CD

- Draw a small rectangle that is ½ in wide and 2 in tall, with the ½ in base touching the bottom of the CD circle traced a step before
- Cut out this rectangle
- Tape two pieces of aluminum foil parallel to each other on either side of the rectangle, leaving a small gap between them. **Make sure the gap is even and wide enough to only let through a small amount of light. If the gap is too big the spectroscope will not work properly.**

3. Place CD inside the box
    - Stand your box upright so you can see inside of it
    - Tape your CD to the side of the box opposite your viewing slit with the rainbow side facing the viewing slit. Make sure the edge of the CD is in line with the viewing slit

4. Seal your box
    - Tape your box closed
    - Cover your box with aluminum foil so that no undesired light can enter the box
    - Leave your viewing oval and viewing slit uncovered
5. Insert your cardboard tube
    - Place your cardboard tube into your viewing oval with the interior end angled towards the CD
    - Tape the tube in place and cover the edge of the oval to make sure no light leakes in
6. Point the viewing slit at a light source and look through the viewing tube!
    - **NOTE: NEVER POINT OUR SPECTROSCOPE DIRECTLY AT THE SUN!**

Observation Chart:
Observe different light sources with your spectroscope. Draw and describe what you see. Be detailed! What colors do you see? What order do they appear in? How are they spaced?

Light Source	Observations

Discussion Questions:

What differences or similarities did you notice between the spectrum of the light sources you chose?

What is acting as the diffraction grating in the spectroscope you created? How does it work?

Name other wavelengths of light that are invisible to humans. How do humans use these kinds of light?

What information do scientists get from a spectrophotometer?

How does the spectrum from a spectrophotometer differ from the ones you saw in your spectroscope?