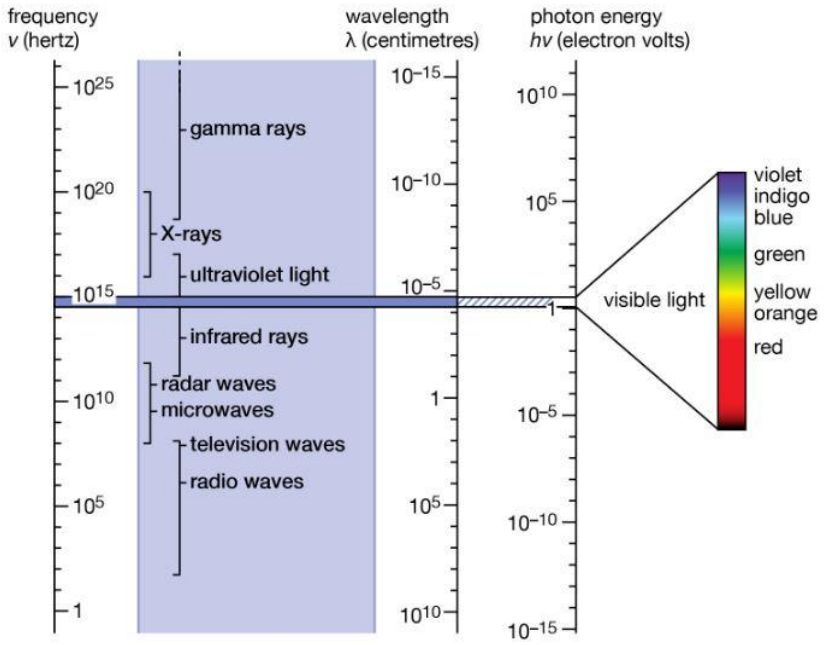
Diffraction Grating Activity Student Handout

What unusual phenomenon will you see on a rainy yet sunny day outside? A rainbow, of course. This natural event happens because our white light from the sun shines on raindrops which break up the light. This reveals that the white light from the sun is not white at all, but a combination of many different colors. Other substances can break apart white light including prisms, soap bubbles, oil, and other everyday items around your house. Different sources of light like lasers, birthday candles, flashlights, and neon signs give off different spectrums or colors of light when split apart using diffraction grating. **Diffraction grating** is an optical component that consists of tiny, parallel lines that split and diffract light into several beams travelling in different directions. These light colors fall on the visible spectrum on the electromagnetic spectrum because we can see them with our naked eyes. The **electromagnetic spectrum** is the range of frequencies of electromagnetic radiation and their wavelengths. Different wavelengths of light register in our eyes as different colors. The short, more frequent (higher energy) wavelengths are a color violet. The longer, less frequent (lower energy) wavelengths are a color red.

But how can we study invisible light like ultraviolet and infrared? A spectrophotometer was invented by scientists to study wavelengths on the electromagnetic spectrum more closely. A **spectrophotometer** is an instrument used to measure the intensity of the light waves absorbed. Scientists use these tools like the spectrophotometer to study medicine like penicillin and vitamins, test new materials including rubber, break down DNA structures, investigate light emitted from distant galaxies, and assess dissolved oxygen in a local marine ecosystem.



Let's see what happens when we break apart light that you see every day around your house, schools, and camping. Today you will use diffraction grating slides to split and separate incandescent light bulbs, fluorescent light bulbs, and one light source of your choice. **Incandescent** bulbs are traditionally found around your home and consist of a small piece of metal inside the glass that creates light. These bulbs get very hot so be careful when you touch them. Unfortunately, this heat is wasted electricity and this old light source is not energy efficient. **Fluorescent** light bulbs are a new design of light bulbs and are shaped like a swirled coil. They use mercury-vapor gas to produce visible light. These types of lightbulbs do not create as much heat and are more energy efficient.

Directions:

1. Hold the diffraction grating slide in front of the incandescent light bulb with your white paper in the background. Turn on the incandescent light bulb. It may be best to turn off the classroom lights as well.
2. Sketch your observations in the table below being very specific with color shades, the color order, and the exact distance apart of the slits of light being emitted.
3. Repeat the activity utilizing the fluorescent light bulb and your personal light source from home making sure to be as detailed as possible.
4. Complete the questions below.

Light Source	**Sketch of Light Source through Diffraction Grating** Draw a detailed picture of what you see through the diffraction grating. Record the exact color shades, color order, and distance apart of the slits of light being emitted. Use colored pencils and rulers for accuracy.
Incandescent White Light	
Fluorescent White Light	
Your personal light source: **_____**	

Questions:

1. What colors were emitted when white light was shown through the diffraction grating?

2. What was the difference between the fluorescent and incandescent light bulbs through the diffraction grating?

3. Does a diffraction grating slide work the same way as a prism? Explain.

4. Why are diffraction gratings important in science?

5. What is the electromagnetic spectrum?

6. What are examples of waves from the electromagnetic spectrum that are invisible to humans?

7. What information do you receive from a spectrophotometer?

8. What careers would use a spectrophotometer? Explain.