Names:_____ Date: _____

Module 2C: Build a Spectroscope Lab Sheet

Objectives:
Your team will be able to explain that Visible Light can be split into a spectrum, and that different elements give off different colored spectrum when excited with light energy.

Vocabulary:
- Electromagnetic Spectrum
- Emission
- Light
- Spectra
- Spectroscopy
- Radiation
- Visible

Materials: per team
- Cereal box
- Scissors
- Tape
- Diffraction gradient
- Spectra gas tubes – Helium, Hydrogen, Nitrogen, and Neon & light source (shared with class)

Background Information:
Have you ever seen a rainbow? What exactly is a rainbow and how is it formed? A rainbow is visible white light broken into its color components. Light coming from sources, such as the Sun, can be broken up into its color components and studied. Light emitted by gas that has been excited has its own distinct spectra or color components.

Spectroscopy is the study of light dispersed into various color components, and these specific colors represent specific elements. By looking at the color spectra we can identify elements in stars, nebulae, and galaxies. Astronomers use the technique of spectroscopy to study the universe because Earth is four light years away from its closest star, making it impossible for us to visit and study them. By observing the color spectra from stars, scientists can learn about their composition, temperature, speed and distance, without having to travel to them.

Astronomers generally do not look through their large telescopes themselves. Most of the time these telescopes are collecting light for a spectrograph, which

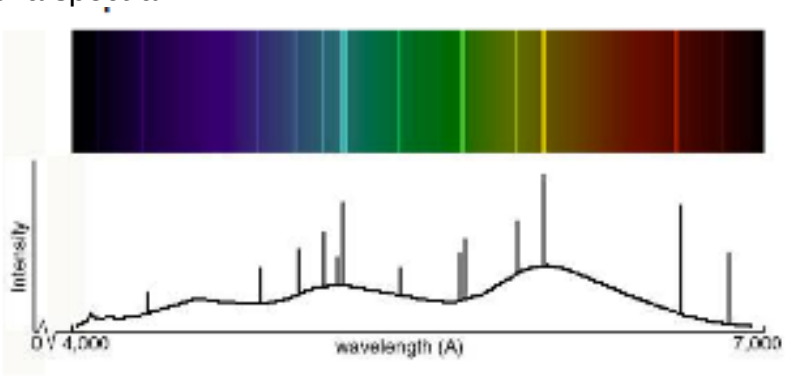
spreads the light out into a rainbow. Each kind of atom or ion has certain special wavelength, which it can absorb or emit. Atoms absorbing energy will create dark lines on the spectra, while atoms emitting energy will produce bright lines on the spectra like those in the image below. These can be used to identify the elements (types of atoms) that make up a star.

Predict:
What allows us to see objects?

How can you learn about an object if you are too far away to reach it?

Astronomers use light to study objects in space using a tool called a "spectroscope". Your team is going to construct a simple spectroscope that will let them study light just like astronomers do.

Sample image of a spectra:



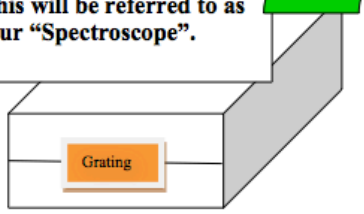
Activity:
Your team will build their own spectroscope, learn about graphing spectra, and then identify mystery elements in gas tubes using the spectroscope to observe and interpret the elements' spectra.

Procedure:

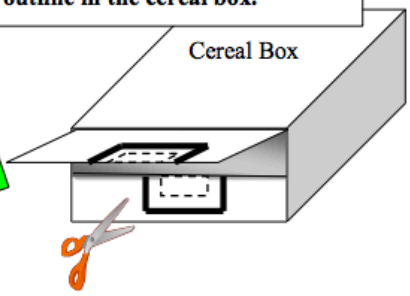
National Aeronautics and Space Administration Our Eye on the Sun

Making your CEREALBOX SPECTROSCOPE

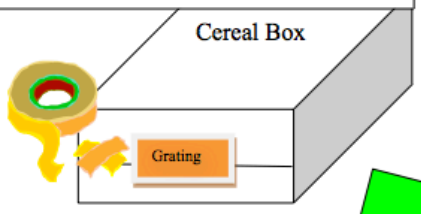
1. Select one end of the cereal box, and close the flaps. Place a diffraction grating on this end and outline it with the sharpie. This will be referred to as the front of your "Spectroscope".



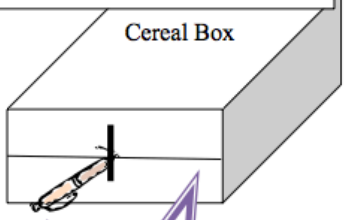
2. Open the flaps and cut a hole smaller than the size of your outline in the cereal box.



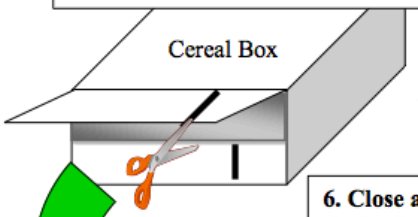
3. Tape the cereal box flaps closed. Arrange your diffraction grating right side up (so you can read the label), then tape it over the hole you just cut. Make sure you can look through the grating and see inside the box.



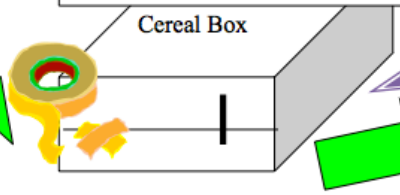
4. Rotate the box around so you are now looking at the opposite end. (This will be the back of your "Spectroscope"). Close the two flaps and draw a line down the center (top to bottom, not side to side). The line should be directly opposite the diffraction grating, and centered.



5. Cut along the mark you just made, making a very, very narrow slit in the box.



6. Close and tape the flaps on the back of your box.



You're done!! Look through the grating in your spectroscope to see the light spectrum!

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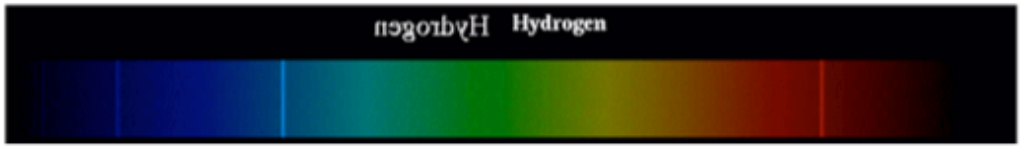
Studying Light: Spectroscopes

Name: _____ **Date:** _____

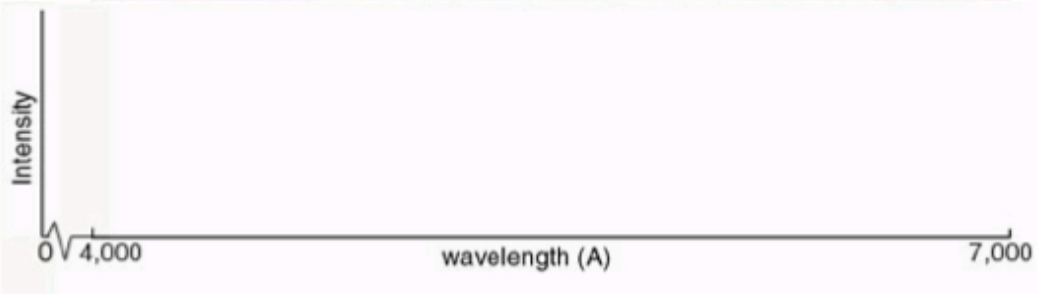
Identify each of the mystery gas tubes your teacher has provided for you using your spectroscope and the spectra below.

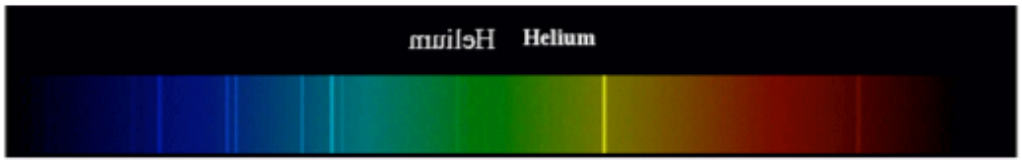
Once you have identified each gas tube, graph it's spectra in the box below.

Remember: "Intensity" or "Brightness" is recorded on the Y axis, and the wavelength is along the X axis.

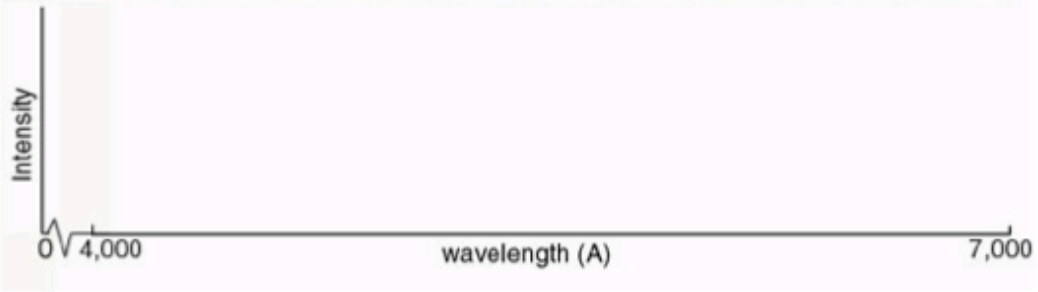


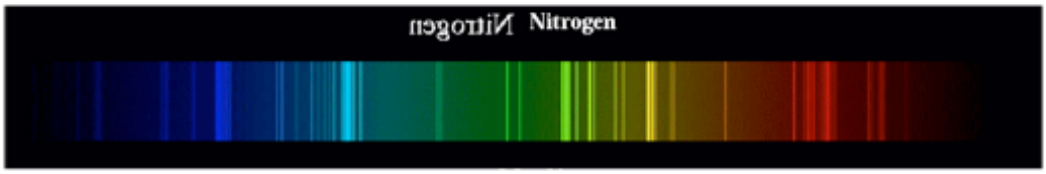
Mystery Tube # _____





Mystery Tube # _____





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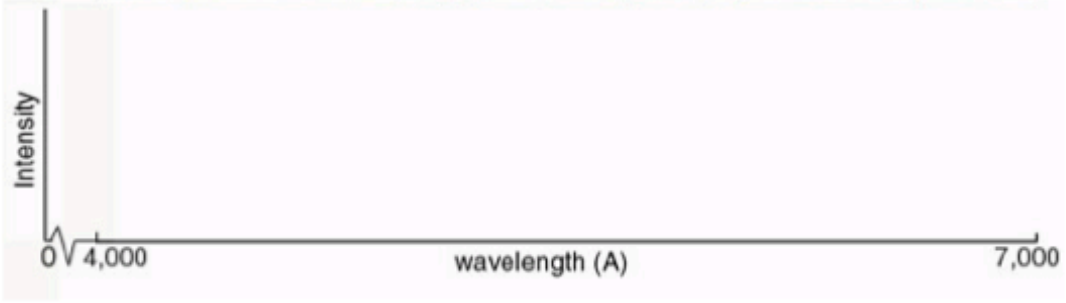
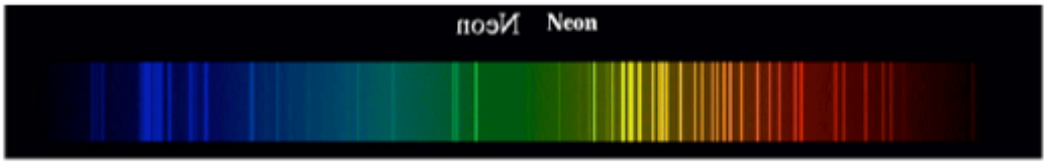
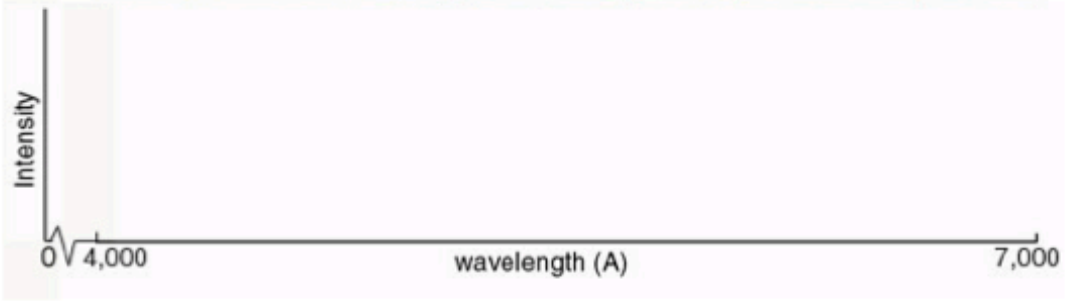




Mystery Tube # _____



Real-World Connection:
What does a rainbow have to do with outer space? Answer the following question in two complete paragraphs. Use diagrams to explain your response, if needed.

Images: NASA
Resources:
Activity adapted from NASA SDO Science of the Sun Secondary Science Learning Unit:
http://sdo.gsfc.nasa.gov/epo/educators/resources.php
Intro to Spectroscopy:
http://loke.as.arizona.edu/~ckulesa/camp/spectroscopy_intro.html
Visible Spectra of the Elements:
http://www.umop.net/spctelem.htm