Light: The Astronomer's Friend!

Earth Science Mr. Traeger

Name: _____ Period: ____ Date: _____

Purpose

The purpose of the following activities is to acquaint the student with the aspects of light and the electromagnetic spectrum that are necessary for studying stellar astronomy.

Materials

▪ Fluorescent and Incandescent Light Bulbs	▪ Colored Pencils	▪ Spectroscopes
▪ Prism	▪ Projector	▪ Light Boxes (unknown elements)

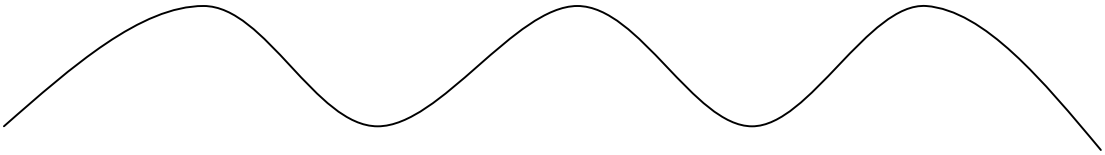
Part 1: Visible Light

1. The teacher will shine white light through a prism using a slide projector.

2. Draw what you see. Include the light source, the prism, and the resulting colors in their correct order. State the ordering of colors.

3. Light has dual properties. What are these properties?

4. Draw a light wave. Label the crest, the trough, the wave height, the wave length, and the amplitude.



5. What are some other ways that visible light can be divided into its separate colors?

6. Mr. Traeger has a good friend named ROYGBIV from the visible part of the electromagnetic spectrum. Who is ROYGBIV and what does each letter in his name signify in terms of color?

Part 2: Infrared Radiation Video

1. What is infrared radiation?

2. What kinds of things in the video give off infrared radiation? List at least 3.

3. How might we use infrared radiation to "see" things in the universe?

4. What are some other technological items that you know of that are used to sense infrared radiation?

Part 3: The Electromagnetic Spectrum

1. Sketch the diagram of the Electromagnetic Spectrum as seen on page 555 of your textbook. Make sure to include the wavelengths of each type of radiation and also give an example of something that you use in every day life that uses each part of the spectrum. (ex. Your eyes use visible wavelengths.)

2. Albert Einstein found that the energy of a photon (packet of light) goes up when the wavelength of light goes down and the energy goes down when the wavelength of light goes up. What happens to the energy of a light wave that has short wavelength (ə) like Gamma radiation? What happens to the energy of a light wave that has long wavelength (ə) like radio radiation?

Energy of light with short wavelength?	Energy of light with long wavelength?

Part 4: Spectra of Stars

1. Using your spectroscope, look at each one of the light boxes. **Do not touch the light boxes! You will get zapped with 5,000 Volts of electricity!** Draw and **color** the spectral lines that you see for each type of light on the attached page.

2. How do your spectra compare? How might astronomers use this spectral difference to find a star's chemistry?

3. How do daylight and the incandescent bulb compare? Why are these spectra called "continuous"?

4. What chemical element(s) are fluorescent bulbs and compact fluorescent bulbs made out of? Point your spectroscope at a fluorescent bulb, record the colors seen, and then compare to element #4.

5. Really hot stars near 12,000 Kelvin burn a blue color, somewhat hot stars around 8,000 Kelvin burn a white color, stars near 6,000 Kelvin burn a yellowish color, and stars around 3,500 Kelvin burn an orange-red color. What color are the three stars named below?

Star Name	**Rigel**	**Sol (Our Sun)**	**Betelgeuse**
Temperature (Kelvin)	11,000	5,800	3,600
Most likely color of the star in the visible part of the spectrum (blue, white, yellow, red)?			

6. Define the following:

Continuous Spectrum	Emission Spectrum	Absorption Spectrum

7. Describe the Doppler Effect and then fill in the chart regarding a star's motion relative to Earth.

What is the Doppler Effect? How have you experienced it before?			
Object Motion	**Toward Earth**	**Away from Earth**	**Sideways to Earth**
Change in Wavelength (shorter or longer or nothing)?			
Change in Frequency/Pitch (higher or lower or nothing)?			
Change in Color Spectra (more red or more blue or nothing)?			

Drawing Spectra

Red	Orange	Yellow	Green	Blue	Violet

Element 1: Hydrogen

Red	Orange	Yellow	Green	Blue	Violet

Element 2: Helium

Red	Orange	Yellow	Green	Blue	Violet

Element 3: Neon

Red	Orange	Yellow	Green	Blue	Violet

Element 4: Mercury

Red	Orange	Yellow	Green	Blue	Violet

Element 5: Fluorescent Light Bulb

Red	Orange	Yellow	Green	Blue	Violet

Element 6: Daylight or Incandescent Light Bulb
(Do not point directly at sun!)