Chemistry **Name _____**
Wave Characteristics of Light (Text Reference: 5.3) **Date_____**

Light travels in waves that are similar to the waves caused by a moving boat. One significant difference, however, is that light waves are composed of two fields that are perpendicular to each other – an electric field and a magnetic field, that "push" one another along. This is why light is called **electromagnetic** radiation. All waves, whether they are water waves or light waves, can be described in terms of four features: **amplitude, wavelength, frequency,** and **speed**. After completing this activity you should have an understanding of how these factors are related.

Obtain the following materials:

Ruler White Printer Paper Colored Pencils

Holding your paper horizontal (landscape), mark 2 points, A & B, at opposite sides of the piece of paper exactly in the middle of the paper, and connect them with a straight line. This line represents the origin (baseline), which is an imaginary line around which the wave oscillates. We will think of this as the distance your wave travels in 1 "***t***" unit of time.

1) Measure **5 cm** above the previously drawn line, as well as **5 cm** below the line, and use this as your **amplitude** for the wave graphs.

2) On the 'origin' line, begin at Point A and make marks every **2 cm**; this will indicate a **wavelength of 2 cm** across the paper. Continue to make marks until you reach Point B.

3) You will draw a **wave-line**, which will first curve above the 'origin' line and then below the 'origin' line, and will end of the first **2 cm mark**. You will do this until you reach Point B at the opposite end of the paper. *Hint: It may be helpful to make marks at 0.5 cm on the upper Amplitude line, 1.0 cm on the middle line where the wave should cross at the half-way point, and at 1.5 cm on the lower Amplitude line as a way to 'connect-the-dots' for the first wave. Each wave will follow a similar pattern across the paper.*

4) Count the number of wave cycles, or **frequency**, of this wave pattern. (A 'cycle' is one complete pattern, from point to identical point on the next wave.) Frequency represents oscillations of the electric and magnetic fields. Estimate the fractional wave cycles (3.3 cycles, 3.5 cycles, etc.). Trace the wave with a marker/pencil/pen, and label the features listed above.

5) Repeat the process for a **wavelength of 4 cm**. Record the frequency. Trace and label this wave with a different marker.

6) Repeat twice more for wavelengths of **7 cm** and **10 cm**. Record the frequencies of these waves also.
   a. What do you notice about the mathematical relationship between **wavelength** and **frequency**?

   b. What is the calculated "c" constant from the wave equation ($c = \lambda f$)?

Data Table:

Wavelength	**2 cm**	**4 cm**	**7 cm**	**10 cm**
Frequency				

7) **Predict the wavelength** of a wave that has a frequency of **40 cycles/t**. If you have found the mathematical constant that unites the wavelengths and frequencies of your waves, this calculation will be easy. SHOW YOUR WORK BELOW:

8) Prepare a simple graph – label the **y-axis as wavelength**, and the **x-axis as frequency**. Estimate a suitable scale for the measurements you have made. Graph the ordered pairs from the table. Draw a **best-fit curve** through these 5 points.
   a. What does the shape of this curve tell you about the relationship between wavelength and frequency?

   b. What direction is the curve going?

   c. What is the mathematical formula for this kind of curve?

9) Does a wave's amplitude have any apparent significance in the formula for wavelength and frequency?