1. Traveling Waves

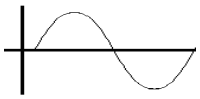
You will first need to download Wolfram CDF Player on your computer. To do so, select the "Student" option in the roll down menu and follow the directions on the website: http://www.wolfram.com/cdf-player/

Once this is complete, please go to the following website: http://quantum.bu.edu/CDF/101/01-TravelingWaves.cdf

When loaded, you will see a graph with a travelling wave moving along the x-axis. You can start this simulation by pressing the play button at the top. The simulation can be paused, sped up, or slowed down using the buttons at the top. The sliders below allow you to change the frequency and the wavelength of the traveling wave. You will notice that both wavelength and velocity are given with the unit nm ($1\ nm = 10^{-9}\ m$). This is because you will be working with light during this semester, and light has such a small wavelength that nm is more commonly used. Once the animation starts, the velocity of the wave and the time will be presented on the graph. Please use this simulation to answer the following questions.

Wavelength and Frequency

Waveform: A full waveform is the completion of one cycle of a wave.



The frequency of an oscillation (ν) is the number of waveforms that pass through one point on the x-axis in one second. The unit for frequency is Hertz (Hz), 1 Hz = 1/s.

The wavelength (λ) is the length of one complete waveform. The unit for wavelength is meters (m)

1) Using the online simulation, set the wavelength equal to one of the values in the table below. Change the frequency of the wave until the velocity reads 1 nm/s. Record this frequency in the table below. Repeat this process for each of the wavelengths given in the table.

λ [nm]	**ν [Hz = s^{-1}]**
1.0	
1.5	
2.0	
2.5	
3.0	
3.5	
4.0	
4.5	
5.0	
5.5	

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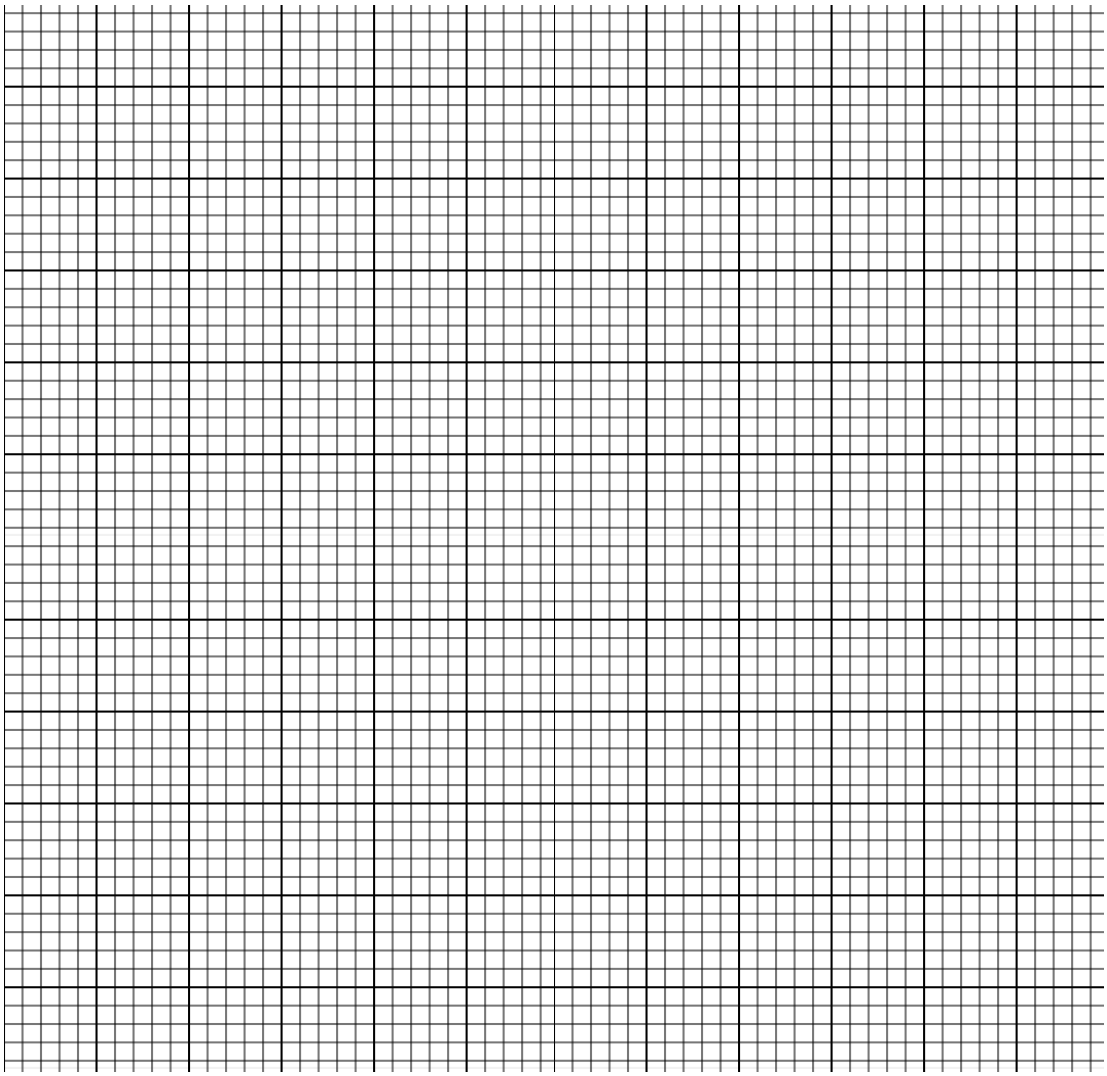
2) You will now repeat this process for a velocity of 2 nm/s. Record this frequencies corresponding to each wavelength in the table below.

λ [nm]	**ν [Hz = s^{-1}]**
1.0	
1.5	
2.0	
2.5	
3.0	
3.5	
4.0	
4.5	
5.0	
5.5	

3) On the graph paper below, please graph frequency as a function of wavelength for the two different velocity tables above. (You will be plotting two lines on the same set of axes.) Make sure to label which line corresponds to which velocity.



Relationships

From the tables and graphs you created above, determine the appropriate relationships between each of the following variables. Example: "A" is directly proportional to "B", "A" is inversely proportional to "B", etc.

1) Frequency and Wavelength

2) Velocity and Wavelength

3) Velocity and Frequency

4) From these relationships, see if you can come up with an equation for the speed of a wave:

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