Name: _____ Date: _____

PHSYICS

Waves and Their Relationships

f = frequency: number of waves or cycles per second. Reported in units of Hz.

T = period: the amount of time to complete one cycle or one wave. The time between consecutive waves.

# of cycles = number of waves or back-n-forth motions.

v = wave speed. How fast the wave moves through the medium. Wave speed is reported in units of m/s.

d = distance, how far the wave moved. Distance is reported in units of meters (m).

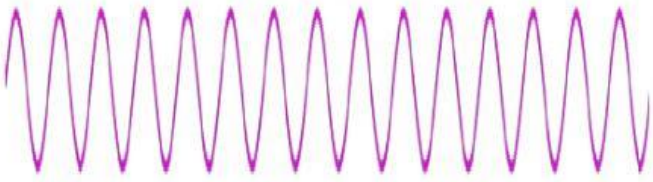
λ = wavelength: the distance between two identical positions on two side-by-side waves. The length of one wave. Wavelength is reported in units of meters (m)

A = amplitude: the maximum displacement of the wave from its equilibrium position.

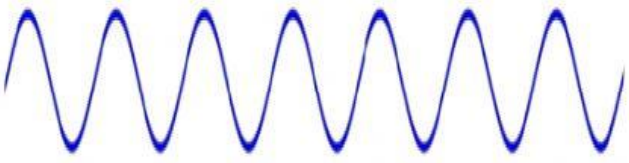
Part 1: Counting Wavelengths. How many wavelengths are shown for each wave function? Type a whole number into the box. Use the five waves below.

Wave #1

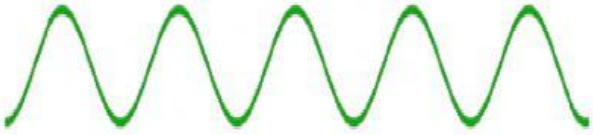
Wave #2



Wave #3



Wave #4



Wave #5

Wave #1

Wave #2

Wave #3

Wave #4

Wave #5

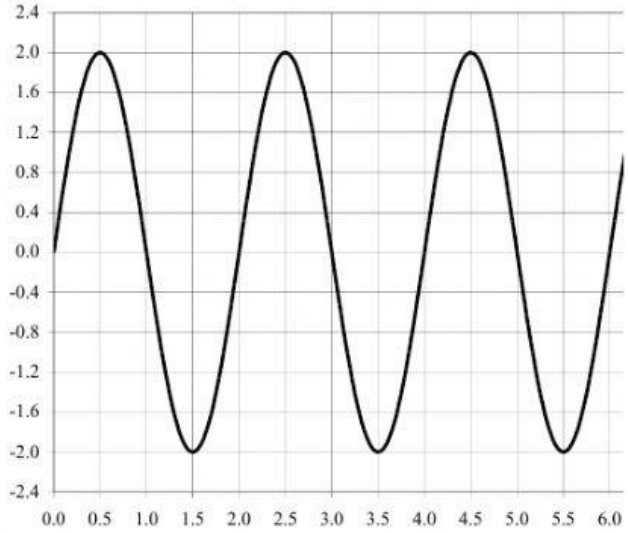
Part 2. Wave Properties. Answer the questions. Look at the wave diagrams (#1 to #6) on the NEXT PAGE. There may be more than one answer per question.

	Which wave has the greatest frequency?
	Which wave has the lowest frequency?
	Which wave has the greatest wavelength?
	Which wave has the shortest wavelength?
	Which wave has the greatest amplitude?
	Which wave has the lowest amplitude?
	Which two waves have the same frequency?

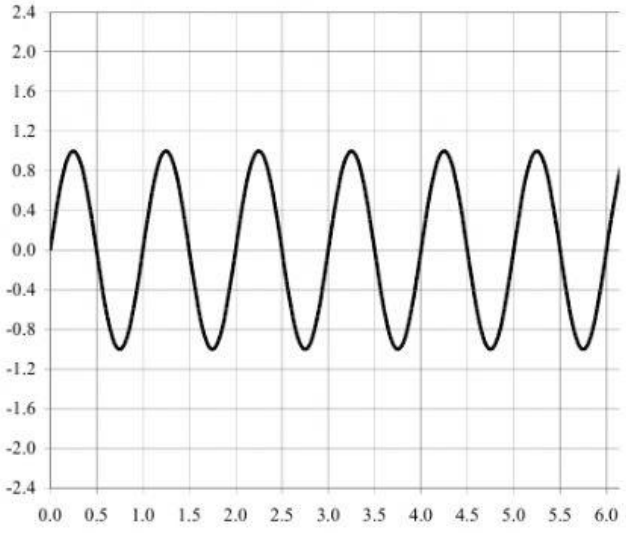
Determine the values of the wavelength and the amplitude of Waves #1-#6. Estimate the wavelength and amplitude from the graph.

	Amplitude	**Wavelength**
Wave #1		
Wave #2		
Wave #3		
Wave #4		
Wave #5		
Wave #6		

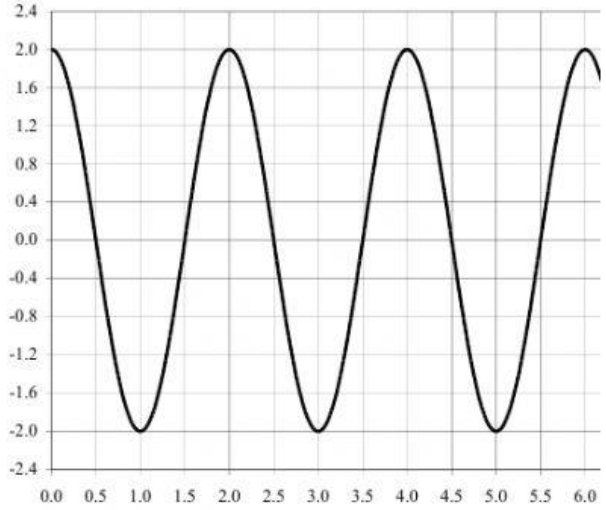
Wave #1



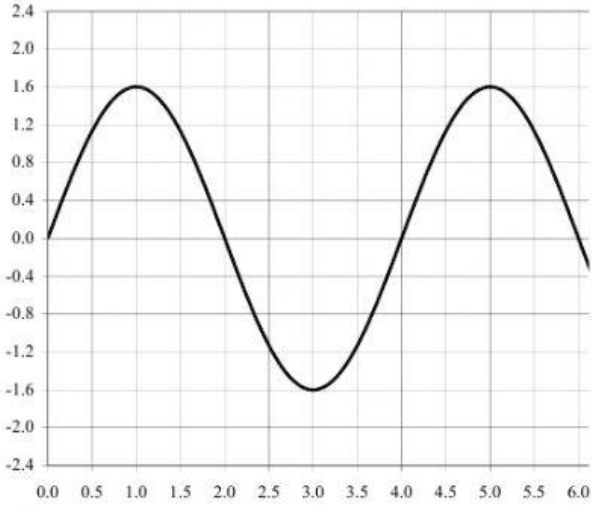
Wave #2



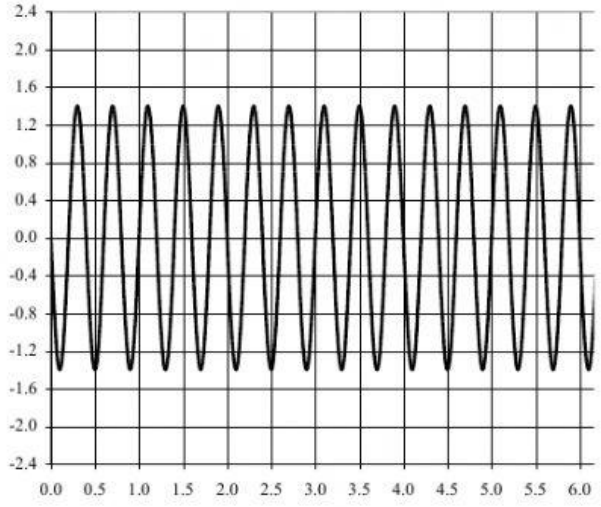
Wave #3



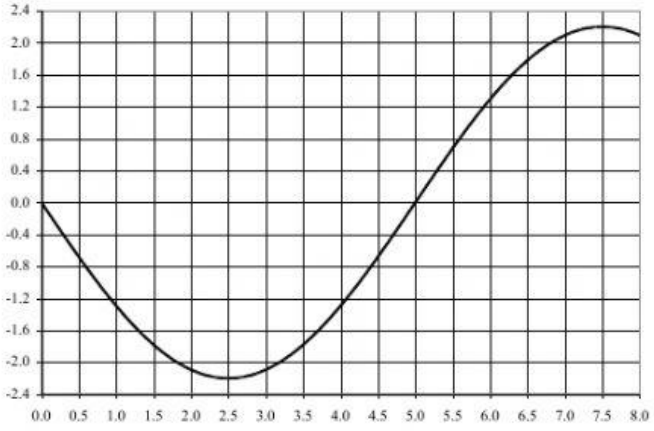
Wave #4



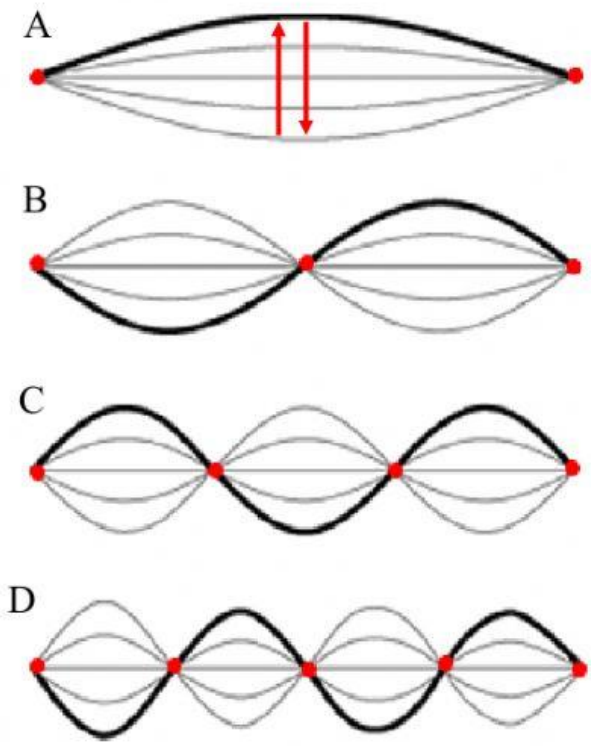
Wave #5



Wave #6



Part 3. Standing Waves. The picture shows a series of standing waves on the same string with different harmonics. Choose the correct answer.



1. Which wave is 1 full wavelength?	
2. Which wave is 2 full wavelengths?	
3. Which wave has 2 nodes and 1 antinode?	
4. Which wave is the 2nd harmonic?	
5. Which wave is the 3rd harmonic?	
6. Which wave has 4 nodes and 5 antinodes?	
7. Which wave has the highest vibration frequency?	
8. Which wave has the slowest vibration frequency?	

Part 4. Standing Waves and Harmonics. Identify the frequencies of the vibrating strings to produce the different harmonics. Harmonics are created by integer-multiple frequencies of the fundamental frequency (first harmonic). Complete the chart below. Type the correct frequency of the string (number only).

Series	Fundamental Frequency	2nd Harmonic	3rd Harmonic	4th Harmonic
#1	50			
#2		240		
#3			120	
#4				280

Part 5. True or False. The statements apply to waves—some statements are true, some are false. Type **T** for True. Type **F** for False. Only type one letter, T or F.

_____ 1 An example of a wavelength is trough to trough on consecutive transverse waves.

_____ 2 An example of a wavelength is crest to crest on consecutive transverse waves.

_____ 3 An example of a wavelength is crest to trough on the same transverse wave.

_____ 4 The shorter the wavelengths, the lower the frequency.

_____ 5 The greater the frequency, the shorter the wavelengths.

_____ 6 The greater the frequency, the shorter the period.

_____ 7 The longer the wavelength, the longer the period.

_____ 8 The longer the wavelength, the bigger the amplitude.

_____ 9 The bigger the amplitude, the greater the energy carried by the wave.

_____ 10 The bigger the amplitude, the greater the work performed on the medium as the wave passes through.

_____ 11 Mechanical waves can pass through solids, liquids, gases, and a vacuum.

_____ 12 Mechanical waves can move through space.

_____ 13 Mechanical waves move because molecules in the medium must bump into each other.

_____ 14 Longitudinal waves move as a series of compressions and expansions.

_____ 15 Longitudinal waves cause the medium to deform in the same direction that the wave moves.

_____ 16 Transverse waves move as a series of up and down displacements.

_____ 17 Transverse waves cause the medium to deform perpendicular to the direction that the wave moves.

_____ 18 Standing waves form when a series of reflecting waves exactly overlap in phase with the series of new, incoming waves.

_____ 19 When waves are in phase, they will create constructive interference as they superimpose.

_____ 20 When waves are out-of-phase, they will create constructive interference as they superimpose.