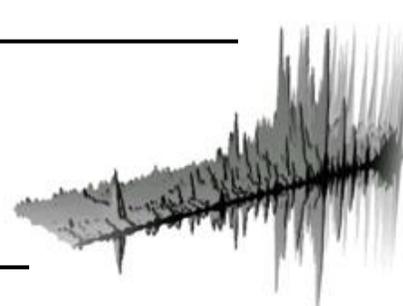# WAVES & SOUND

1. Mr. Knote,a piano tuner, taps his 440-Hz tuning fork with a mallet. What is the period of the vibrating tuning fork?
    Ans: 0.0023 s

2. Denny jumps up and down on his bed, taking 0.75 seconds for each jump. What is the frequency of Denny's jumping?
    Ans: 1.3 Hz

3. Inside most ball-point pens is a small spring that compresses as the pen is pressed against the paper. If a force of 0.1 N compresses the pen's spring a distance of 0.005 m, what is the force constant of the tiny spring?
    Ans: 20 N/m

4. Avril Lavigne is trying to predict the period of a mass hung on a spring. She has a spring of negligible mass and four weights to hang on the end. Avril collects the following data as she observes the stretch of the spring:

Force (N)	Displacement (m)
2.5	0.05
5	0.102
7.5	0.149
10	0.199

    Plot a graph of the force (on the y-axis) vs. displacement (on the x-axis).   Find the slope of the graph. What does this slope represent? Use the information you have obtained to find the period of the spring when a 3.0 kg mass is hung on the end.
    Ans: 50.0 N/m, represents k, 1.5 seconds

5. Muhhamad drives his empty dump truck over a berm (also called a speed bump) at the construction site. The truck has a mass of 3000. kg and the force constant for one of the trucks springs is 100 000. N/m. (Remember, truck has 4 wheels). What is the resulting period of the bouncing truck as it goes over the bump? If Muhhamad leaves the construction site with a load of dirt in his truck, what will this do to the period of his dump truck as it crosses the bump?
    Ans: 0.5441 seconds, more mass means longer period

6. What is A monkey swings from a jungle vine by his 0.30 m long tail. What is the period of swing of the monkey? With what frequency does the monkey swing?
    Ans: 1.1 seconds, 0.91 Hz

7. A wrecking ball used to demolish buildings swings from a 10.0 m long cable. What is the period of the wrecking ball as it swings?
    Ans: 6.28 seconds

8. A peacock attempts to land on a small bird feeder, causing it to swing back and forth with a frequency of 0.350 Hz. How long is the wire from which the feeder hangs?
    Ans: 2.07 meters

9. Find the wavelength of the wave emitted by a bat if it has a frequency of 4.0 E4 Hz?
    Ans: 0.0085 m

10. A Radio Station KSON in San Diego broadcasts at 1240 kHz (AM) and 97.3 MHz (FM). What of these signals, AM or FM, has the longer wavelength? How long is each?
    Ans: AM, AM: 242 m, FM: 3.08

11. What is the wavelength of a B note (frequency 494 Hz) played by a flute? If the flute and a sax play the same note, which of the following will be different, quality, pitch, or loudness?
    Ans: 0.688 m, quality, loudness could, but doens't have to

12. As an anchor is being hoisted out of the water, it hits the hull of a ship, causing the anchor to vibrate with a frequency of 150 Hz. If the speed of sound in the sea water 1520

m/s, how many wavelengths of sound will fit between the boat and the ocean bottom 395 below?

Ans: 39 wavelengths

13. A popular pastime at sporting at sporting events is "the wave", a phenomenon where individuals in the crowd stand up and sit down and sit down in sequence, causing a giant ripple of people. If a continuous "wave" passes through a stadium of people with a speed of 20 m/s and a frequency of 0.5 Hz, what is the distance from "crest" to "crest")in other words, the wavelength)?

Ans: 40 m

14. Determine the wavelength, amplitude, frequency, velocity, period, # of nodes, # of antinodes, and velocity of the wave below. It takes 3.2 seconds for the wave to pass.
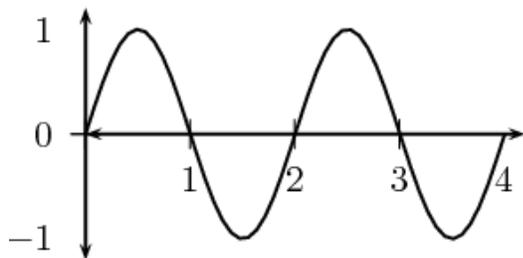

15. If the peaks and troughs of the wave below are moving from left to right, state the direction each point is moving.
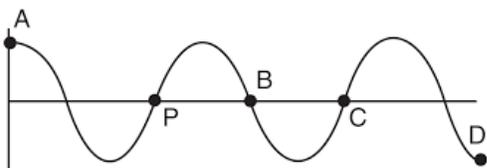

16. Redraw this wave twice on your problem set. On the first drawing, draw the same wave that is 90-degrees out of phase, and on the second, draw a wave that is 270-degrees out of phase:
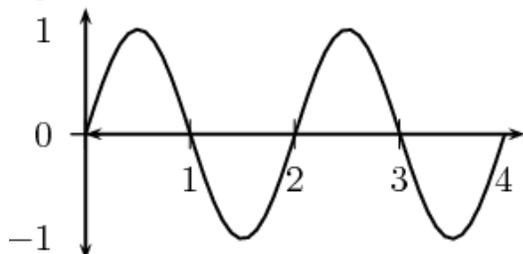
17. Copy the diagram to your problem set and draw points that are 90, 180, 270, and 360 degrees out of phase with the point below
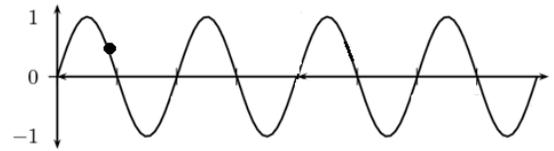

18. Complete the column at the right in the diagram below based on the example in the left column. For practice, use the left column first by covering it up, trying it, then checking your answer.
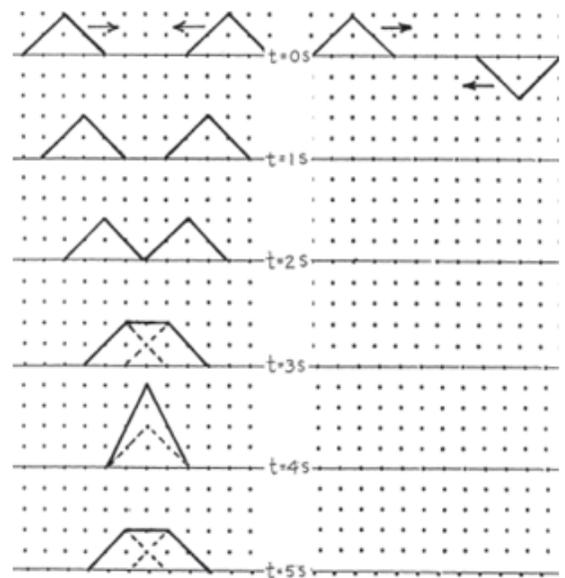
19. Draw two diffraction patterns, #1 with waves coming in and hitting an opening. #2 with waves coming in and hitting a larger opening than in #1. Be sure to show the difference in wave fronts after each wave passes through each opening.

20. Draw a wavefront transitioning from shallow to deep water and show how it changes.

21. Draw a wavefront transitioning from deep to shallow water and show how it changes.

22. Determine the wavelength, amplitude, frequency, velocity, period, # of nodes, # of antinodes, and velocity of the wave below. It takes 3.2 seconds for the wave to pass.

METERS 2   4   6
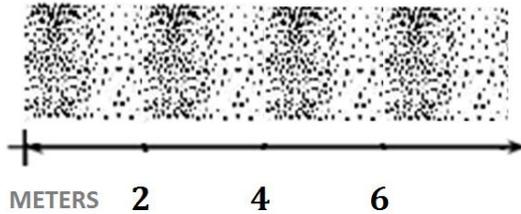
23. From his bedroom, Garth Brooks can hear the distant sound of a train horn as the train travels through the mountains on its way from Chattanooga to Nashville. The horn has a frequency of 800.0 Hz as the train rolls along at 20.00 m/s. Is the frequency does Garth hears as the train travels away higher or lower than 800 Hz? Draw a picture of the soundwave being eminated from the train as it moves.
Ans: Lower than 800 Hz

24. Erin is late to physics class and is coming down the hall as the bells are ringing. There are two bells in the hall, one at the far end she's running away from, and one in front of the classroom she is approaching. Each bell rings with a frequency of 500.00 Hz. As Erin comes down the hallway how does she hear each bell differently? Draw a picture of the soundwaves as she hears them.
Ans: In class is higher, hallway is lower

25. Sonar detectors work by bouncing high-frequency sound of about 0.100 MHz off ships and detecting the frequency of the return signal. If a sonar detector receives a return signal of 0.101 MHz from a sub, how fast is the sub going? (sonar travels in sea water at 1520 m/s)?
Ans: 15 m/s

26. Walter is a bass and can his a low E that has a frequency of 82.4 Hz. Millie is a soprano and can sing as high as the third overtone of this note. What is the highest frequency that Millie can sing?
Ans: 330 Hz