## TWO-MINUTE PROBLEMS

**Q1T.1** As one approaches the bottom of a body of water, the circles shown in figure Q1.3 for water waves moving along the water's surface become increasingly vertically flattened ellipses. This means that the waves near the body's bottom are more (A) transverse or (B) longitudinal than those near the surface?

**Q1T.2** Imagine a series of mutually repelling ring magnets strung along a nearly frictionless horizontal rigid rod. If one jostles a magnet near one end of the rod, it can cause a wave of disturbance to move down the rod through the other magnets. Will this be a (A) transverse or (B) longitudinal wave?

**Q1T.3** As a sinusoidal wave's wavenumber increases, the wave's wavelength (in a non-dispersive medium)
A Increases.
B. Decreases.
C. Does not change.

**Q1T.4** A sinusoidal wave's angular frequency is (A) larger, (B) smaller, or (C) the same as its frequency in cycles/s.

**Q1T.5** Equation Q1.11 implies that a sinusoidal wave's phase speed depends on its wavelength. T or F?

**Q1T.6** Consider wiggle formula $w(t, x) = f(bx + ct)$ for a transverse wave, where $b$ and $c$ are constants and $f(\ )$ is some arbitrary function. Is this a *traveling* wave model? If so, in what direction does it travel?
A. In the $+x$ direction.
B. In the $-x$ direction.
C. The wave does not move.
D. In the $y$ or $z$ direction because the wave is transverse.

**Q1T.7** In a specific non-dispersive medium, a sinusoidal wave's angular frequency is proportional to its wavenumber. T or F?

**Q1T.8** In a specific non-dispersive medium, a sinusoidal wave's period is proportional to its wavelength. T or F?

**Q1T.9** If one sound is 20 dB louder than another sound, its intensity is
A. 2 times greater.
B. 20 times greater.
C. 100 times greater.
D. 200 times greater.
E. We need to know the actual sound level: 30 db to 50 db represents a different factor of intensity increase than 60 db to 80 db (for example).

## HOMEWORK PROBLEMS

### Basic Skills

**Q1B.1** Sound waves move through air at a speed of about 343 m/s. Compute the wavelength of the following sinusoidal sound waves:
**(a)** waves from an organ pipe playing middle C (260 Hz)
**(b)** the highest audible pitch (≈20,000 Hz)
**(c)** the lowest audible pitch (≈20 Hz)

**Q1B.2** Electromagnetic waves move at the speed of light ($c = 3.0 \times 10^8$ m/s). What are the approximate wavelengths of the following types of electromagnetic waves?
**(a)** radio waves on the AM band (≈1000 kHz)
**(b)** radio waves on the FM band (≈100 MHz)
**(c)** EM waves in a microwave oven (≈30 GHz)

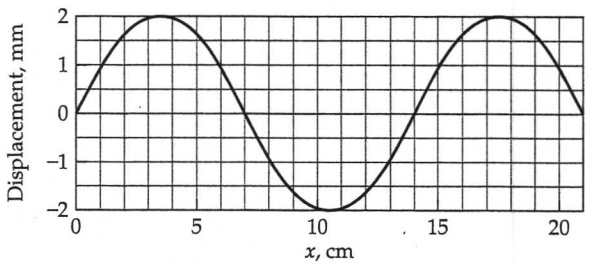
**Q1B.3** Sound waves move through air at a speed of about 343 m/s. What would be the frequency of a sound wave that has a wavelength of 1 m? 1 inch? 1 mm?

**Q1B.4** Visible light has wavelengths between 700 nm and about 400 nm. If light really is an electromagnetic wave, then what are the corresponding frequencies of these waves?

**Q1B.5** A sinusoidal traveling water wave has an observed wavelength of 25 cm and a frequency of 0.60 Hz. What are $k$ and $\omega$ for this wave? What is this wave's phase speed?

**Q1B.6** A sinusoidal wave moving down a taut rope has an observed wavelength of 2.0 m and a period of 0.5 s. What are $k$ and $\omega$ for this wave? What is this wave's phase speed?

**Q1B.7** Consider the sinusoidal traveling wave shown in the figure below (this is a snapshot at a certain instant of time). Assume the wave travels at 1.0 m/s.




**(a)** What is the wave's amplitude?
**(b)** What is its wavenumber $k$?
**(c)** What is its angular frequency $\omega$?
**(d)** What is its period $T$?
**(e)** What is its frequency $f$?

**Q1B.8** Mars is about 1.52 times farther from the sun than the earth is. Ignoring atmospheric effects, the intensity of sunlight falling on Mars's surface should be about what factor smaller than that falling on the earth?