1. A kid makes a wave in a spring by shaking the end back and forth 5.0 times in 2.0 seconds. The crests created by this action that travel through the spring are 1.2 m apart. Determine the frequency, period, and speed of the wave in the spring.

2. A cork floating in a lake bobs up and down with a period of 0.75 s as a wave goes by. The wave has speed 2.0 m/s. When at the top of a crest the cork is 20 cm higher than it is when at the bottom of a trough. Find the wave's frequency, wavelength, and amplitude.

3. A normal person can hear sounds with frequencies as low as 20 Hz and as high as 20 kHz. What is the corresponding range of *wavelengths* that a typical person can hear?

4. A scuba diver in a swimming pool listens to an opera singer practicing at the pool's edge. If the opera singer hits a note of 1024 Hz. The speed of sound in water is 1500 m/s. (a) Find the wavelength of the sound as it travels in the air (before entering the water). (b) Find the frequency and wavelength of the sound as it travels through the water.

5. "Light" is just the visible range of the electromagnetic spectrum. The normal human eye can detect EMR with wavelengths between 400 nm and 750 nm. Find the corresponding range of *frequencies* that the human eye can detect.

6. A radio is tuned to WIVK 107.7 MHz and during a particular song a note of 440 Hz is played. (a) What is the wavelength of the radio wave? Is it transverse or longitudinal? (b) What is the wavelength of the sound of that particular note? Is it transverse or longitudinal?

7. Produce a standing wave in a spring and determine the wavelength, frequency, and speed.

8. Hold a tuning fork in front of a tube with a plunger. Adjust the plunger until the sound is loudest and mark the position of the plunger. (a) Based on the spacing of the plunger positions that were marked, what is the wavelength? (b) What is the frequency of the tuning fork? (c) Explain why the sound is loud when the plunger is in just the right spot.

9. A standing wave is produced using microwaves of frequency 10.525 GHz. (a) Determine the distance from one node to the next. (b) Determine the distance from one antinode to the next.

10. Create standing waves in an elastic cord. Measure the length of the cord and the frequency of the third harmonic. Based on these measurements find:
    (a) the speed of the waves in the cord,
    (b) the frequency of the fundamental, and
    (c) the frequency of the second harmonic.

11. Measure the length of a pipe organ pipe and determine the frequencies of its harmonics.

12. Repeat the above but close off the end of the pipe.

13. Measure the length of a pipe that is open at both ends. Determine the two lowest frequencies that will resonate with the pipe.

14. Monochromatic light passes through two slits that are 8.00 μm apart. (a) Find the angle to the third order image if the wavelength is 500.0 nm. (b) Find the angle to the third order image if the wavelength is 700.0 nm. (c) What wavelength would have a third order image at an angle of 12.0°?

15. Light of an unknown wavelength passes through double slits with separation 2.60×10^{-4} m. An interference pattern appears on a screen 4.00 m from the slits. The distance from the central bright line to the 1st order bright line is 1.00 cm, measured along the screen. Find the wavelength.

16. A laser with wavelength 633 nm is directed through a diffraction grating with 5500 lines/cm. Find the angle to the 1st order image.

17. White light is passed through a diffraction grating with 600 lines/mm. Find the angular width of the spectrum produced. Use 400 nm to 760 nm as the range of wavelengths.

18. In a classroom demonstration microwaves of frequency 10.525 GHz are passed through two slits that are separated by 5.9 cm. Determine the number of "bright" lines that will occur and the angular separation(s) in the pattern.

19. Two speakers in a room working in phase produce 500.0 Hz tones. (a) If you stand 2.000 m from one and 3.372 m from the other, what type of interference do you observe? (b) At what frequency or frequencies would the opposite type of interference occur at the same point in the room?

20. While listening to AM 990 you pull up to a stoplight located 5.03 km from the broadcast antenna. However, signals from the same antenna travel 4.00 km to a mountain, bounce off the mountain, and travel 1.48 km to the same stoplight. Assuming the phase of the signal is unaffected by the reflection off the mountain, what happens to your reception? What if the phase is inverted by the reflection?

21. Light of wavelength 650 nm falls upon two slits separated by 0.11 mm. The resulting bright fringes are viewed on a screen that is 2.0 m away from the slits. (a) Determine the angle between the central bright line and the 1^{st} order bright line. (b) Find the width of the central bright line on the screen.

22. A laser shines through two slits separated by 66 μm producing bright dots separated by 1.2 cm appearing on a wall 1.5 m from the slits. (a) Find the frequency of the laser. (b) What different values of frequency, separation, or distance from the wall would double the spacing of the dots?

23. A metal plate with slots that are separated by 5.7 cm is placed over the emitter of a microwave generator with wavelength 2.85 cm. (a) What is the angle between the central "bright" line and an adjacent "bright" line of microwave? (b) How many lines are there?

24. In a spectrometer it is desired to separate white light into its component wavelengths. A grating with how many lines per cm would create a spectrum of width 10.0°?