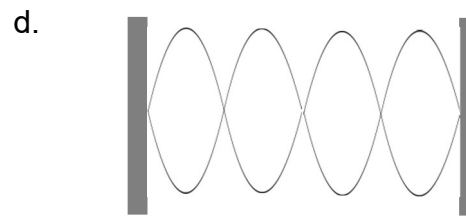
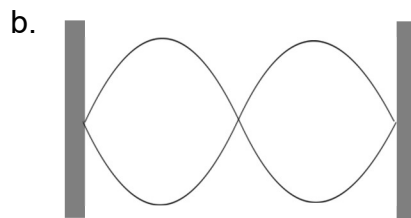
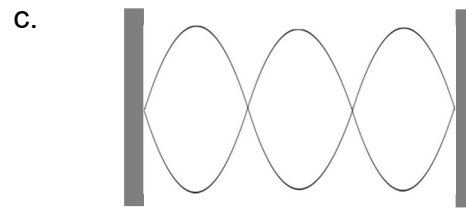
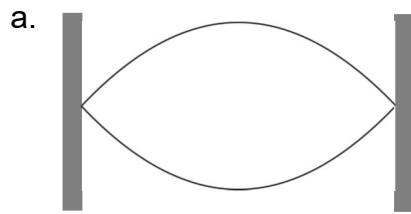


1. Write the definitions:
  - a. Transverse wave
  - b. Longitudinal wave
2. You hear two sounds. The first one is quiet; the second one is loud. The pitch of both sounds is the same.
  - a. Compare the amplitudes of the waves.
  - b. Compare their wavelengths.
3. You hear two new sounds. The first one has a low pitch and the second has a high pitch. They both have the same intensity.
  - a. Compare the amplitudes of the waves.
  - b. Compare their wavelengths.
4. An alarm clock is placed inside a vacuum chamber and all the air is pumped out, then the alarm is activated. Describe what you would hear.
5. Calculate the speed of sound in air that has a temperature of:
  - a.  $58^{\circ}\text{C}$
  - b.  $40^{\circ}\text{C}$
6. A sound wave has a velocity of 435 m/s and a wavelength of 0.75 m. What is the sound's frequency?
7. A sound has a velocity of 450 m/s and a frequency of 350 Hz. What is the sound's wavelength?
8. A G note above middle C has a frequency of 784 Hz. If the temperature of the air is  $25^{\circ}\text{C}$ :
  - a. Calculate the speed of the sound wave.
  - b. Find the length of the wave.
9. You hear a clap of thunder 14.5 seconds after seeing a bolt of lightning. The speed of sound in the air is 340 m/s.
  - a. How far did the sound travel in 14.5 seconds?
  - b. What is the temperature of the air?
10. A train passes a station at a constant speed of 34.0 m/s. The train horn is sounded at its typical 340 Hz frequency. The temperature of the air is  $22^{\circ}\text{C}$ .
  - a. If you are standing on the platform and the train is coming toward you, does the train horn sound higher or lower than normal?
  - b. Calculate the frequency of the sound you hear.



11. Honors: The figures below show a stretched string vibrating in several of its modes. If the length of the string is 3.0 m, what is the wavelength of the wave on the string in each picture?



12. Honors: What are the first three harmonics of a note produced on a 38.0 cm long cello string if waves on the string have a speed of 243 m/s?

13. Honors: A pipe that is open at both ends has a fundamental frequency of 380 Hz when the speed of sound in air is 340 m/s.
- What is the length of this pipe?
  - What are the next two harmonics?
  - One end of the pipe is closed off. Calculate the fundamental frequency?

14. How did Thomas Young determine that light travels in a transverse wave?
15. Waves have to create oscillations in a medium. What medium does light oscillate?
16. List the types of waves on the electromagnetic spectrum from longest to shortest wavelength.
17. List the colors of light of the visible spectrum from longest to shortest wavelength.
18. What is a nanometer?
19. How fast is the speed of light?
20. Blue light has a wavelength of 410 nanometers.
  - a. What is the wavelength in meters?
  - b. What is the frequency of the wave?
  - c. How much energy does the wave have?
21. KGNB, the AM radio station in New Braunfels, broadcasts their signal at 1,420,000 Hz. What is the wavelength of their waves?
22. What is the particle-wave duality of light?
23. What is the photoelectric effect?
24. Who figured out that light acts like a particle?
25. What is a "particle" of light called?
26. The work function of silver is 4.85 eV. What is the lowest frequency of light that will cause electrons to be emitted from the metal?
27. Honors: Potassium has a work function of 2.3 eV. Violet light ( $\lambda = 450 \text{ nm}$ ) is shined on potassium.
  - a. Calculate the energy of the light.
  - b. What is the maximum kinetic energy (in electron volts) of the electrons that are emitted from the metal?
  - c. Convert the maximum kinetic energy to joules.
  - d. The mass of an electron is  $9.1 \times 10^{-31} \text{ kg}$ . Calculate the maximum speed of an electron as it is emitted.

