Wave Motion

Pre-Test

1. When a wave is propagating (moving) through a given medium how can we say the particles in the medium are moving? (Hint: think about a "stadium" wave)
   a. The particles are moving at the same speed as the wave is traveling.
   b. The particles are moving along with the wave in the same direction.
   c. The particles are oscillating back and forth passing its equilibrium (initial) position each time.
   d. The particles are not moving at all.
   e. More than one answer is correct.

2. True or False: Does it seem reasonable that any type of wave propagating through a given medium involve a continual transfer of energy. I.e. Potential Energy ≠ Kinetic Energy. Explain your response.

3. **Challenge Question**: Knowing what we know about a transverse wave, what can we say about how fast (velocity) the wave travels through the medium? (Ignoring any energy loss due to friction) (Hint: think/draw a free-body diagram of all forces acting on ONE oscillating particle in the medium)
   - **a.** The velocity of the wave should remain constant.
   - **b.** The velocity of the wave should be continually increasing as the wave is propagating medium.
   - **c.** The velocity of the wave should be continually decreasing as the wave is propagating through the medium.
   - **d.** Not enough information to answer the question.

4. (1) What type of wave is a sound wave? Explain in terms of the motion of particles how you know this to be so. (2) Based on your answer to (1), which type of wave motion requires motion through a medium?

5. What is the significance of the term *wavelength*?
   - **a.** Wavelength represents the total distance the wave has traveled in one complete oscillation (cycle).
   - **b.** Wavelength represents the total vertical distance the wave has traveled in one complete oscillation (cycle).
   - **c.** Wavelength represents the total time the wave has traveled in one complete oscillation (cycle).
   - **d.** Wavelength represents the total distance traveled from crest to trough of a wave.

6. A wave is traveling down a string predict and explain what you will happen to the *reflected* wave in both of the situations: (1) the wave meets a fixed, stationary end, (2) the wave meets a free end.

7. Two waves, with equal amplitudes (upward displacements) are traveling towards each other. (1) The first situation is one in which both waves have an upward displacement in the same direction, (2) one in which both waves have an upward displacement in the opposite direction. Describe the when moment both waves meet and interfere with each other.
   a. The resulting wave will be half as large in both cases.
   b. The resulting wave will be two times as large; the resulting wave will be equal to zero.
   c. The resulting wave will be equal to zero; the resulting wave will be two times as large.
   d. The resulting wave will be two times as large in both cases.
   e. The resulting wave will be zero in both cases.

8. Following this how will the motion of the two waves be affected after they meet? In other words, how will the waves look *after* they collide?
   a. There will be no difference. The waves will continue moving in the same direction they were traveling, with the same amplitude, and with the same upward displacement direction.
   b. There will be a difference after the waves collide, some energy will be lost, resulting in a decreased amplitude for both waves.
   c. There will be a difference after the waves collide, the waves will continue propagating in the same direction, however, they will have an opposite upward displacement direction.
   d. None of the above answers are correct.

Note

When two waves interfere, the resulting displacement of the medium at any location is the algebraic sum of the displacements of the individual waves at that same location.

9. (1) Frequency and (2) amplitude correspond to which of the two conventional terms to describe sound:
   a. Loudness; Intensity
   b. Loudness; Pitch
   c. Pitch; Loudness
   d. Both frequency and amplitude represent the same physical quantities.
   e. None of the above is correct

10. We know that the speed of sound involves oscillations of sound particles about their equilibrium position. We also know that the velocity with which a sound wave propagates depends on both the type of medium the sound wave is propagating as well as the elasticity ("springiness") of the medium. We also know that wave propagation is a vector quantity. Why is it that we (1) hear a car approach us beeping its horn, the pitch of the horn seems to increase (as well as the loudness), (2) the pitch of the horn seems to decrease (as well as the loudness) when the car is receding (leaving) us? What is this phenomenon known as?

Web Site URL's to learn the concepts:

1. **http://www.glenbrook.k12.il.us/gbssci/phys/Class/waves/u10l1a.html**
2. **Tones**
   http://www.explorescience.com/activities/Activity_page.cfm?ActivityID=44
3. **Transverse Waves**
   http://members.xoom.com/Surendranath/Twave/Twave02.html

   Longitudinal Waves
   http://members.xoom.com/Surendranath/Lwave/Lwave01.html
   http://members.xoom.com/Surendranath/Lwave/Lwave02.html
4. **Superposition of Waves**
5. **http://www.physics.gatech.edu/academics/tutorial/phys2121/Java%20Applets/ntnujava/waveSuperposition/waveSuperposition.html**
6. **Doppler Shift**
7. **http://www.physics.gatech.edu/academics/tutorial/phys2121/Java%20Applets/ntnujava/Doppler/Doppler.html**
8. **Mouse Wave** (Excellent example of the phenomena "Sonic Boom"-by airplanes traveling at or greater than the speed of sound)
   http://www.phy.nau.edu/~layton/JavaApps/mousewave/FMouseWave.html

(Access the first URL and complete Lesson's 1-4. Following this, access each successive URL. All of which are applets (interactive animations) designed to solidify your knowledge of wave motion.)

Chapter 1 Post-Test

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b) The velocity of the wave should be continually increasing as the wave is propagating medium.
c) The velocity of the wave should be continually decreasing as the wave is propagating through the medium.
d) Not enough information to answer the question.

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