Student #: _____ Student Name: _____

Physics 11 Homework Unit 6: Vibrations and Waves

____ 1. What is a vibration?

(a) the material that permits the transmission of wave energy
(b) the cyclic motion of an object about an equilibrium point
(c) the transfer of energy through a material
(d) motion that repeats its path

____ 2. The time it takes for a vibrating particle in a wave to complete one cycle is the

(a) period
(b) frequency
(c) wave speed
(d) wavelength

____ 3. Of the following properties of a wave, the one that is *independent* of the others is its:

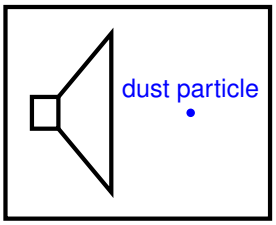
(a) amplitude
(b) speed
(c) wavelength
(d) frequency

____ 4. Waves transmit _____ from one place to another.

(a) mass
(b) amplitude
(c) wavelength
(d) energy

____ 5. A dust particle is suspended in the air (floating due to a small updraft and its own low mass) when a powerful loudspeaker emits a very low frequency of 2 Hz (it can't be heard but you can actually see the speaker move). How will the dust particle move as a result of the speaker being turned on?

(a) The dust particle will move up and down
(b) The dust particle will be pushed across the room
(c) The dust particle will move side to side
(d) The dust particle will move in a circular path



____ 6. In a transverse wave, the individual particles of the medium

(a) move in circles
(b) move perpendicular to the direction of travel
(c) move in ellipses
(d) move parallel to the direction of travel

____ 7. Two waves meet at a time when one has the instantaneous amplitude A and the other has the instantaneous amplitude B. Their combined amplitude at this time is:

(a) A + B
(b) A - B
(c) Between A + B and A - B
(d) Indeterminate

____ 8. Radio amateurs are permitted to communicate on the "10-metre wavelength band." What frequency of radio waves corresponds to this wavelength? (The speed of radio waves is $3.0 \times 10^8\,\mathrm{m/s}$.)

(a) 3.3×10^6 Hz
(b) 3.0×10^7 Hz
(c) 3.3×10^8 Hz
(d) 3.0×10^9 Hz

____ 9. Waves in a lake are $5.0\,\mathrm{m}$ in length and pass an anchored boat $1.25\,\mathrm{s}$ apart. The speed of the waves is:

(a) $0.25\,\mathrm{m/s}$
(b) $4\,\mathrm{m/s}$
(c) $6.25\,\mathrm{m/s}$
(d) $0\,\mathrm{m/s}$

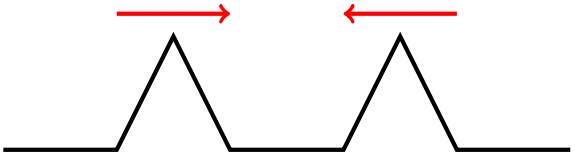
____ 10. As a wave passes across a boundary into a new (different) medium, which characteristic of the wave would *not* change?

(a) Speed
(b) Frequency
(c) Wavelength
(d) All of the above
(e) None of the above

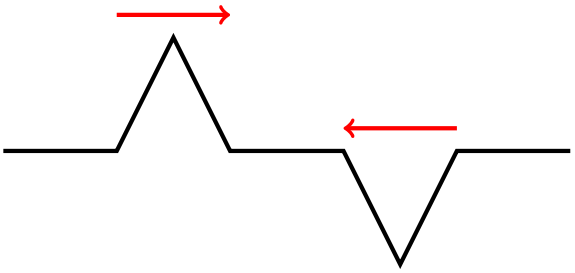
11. Draw diagrams to show a transverse wave along a string. Indicate rest position, amplitude, wavelength, and direction of travel of the wave.

12. The E-string on Tim's (Olympiads' physics teacher!) violin produces a frequency of $660\,\text{Hz}$, and the wavelength of the standing wave on the string is $750\,\text{mm}$,
    (a) Estimate the speed of the travelling wave on Tim's violin
    (b) If that E-string has a tension of $82.3\,\text{N}$, what is the density of the metal that the string is made of? Assume that the string is perfectly circular. (Density $\rho = m/V$)

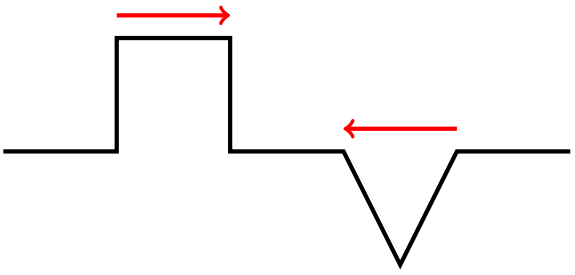
13. Two triangular pulses, each $2\,\text{cm}$ high and $1\,\text{cm}$ wide, are directed towards each other on a spring, as shown. Sketch the appearance of the spring at the instant that they completely overlap. What kind of interference is this?



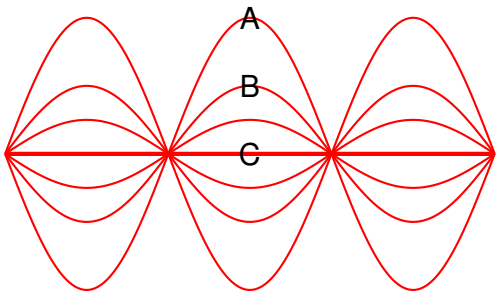
14. Two triangular pulses, each $2\,\text{cm}$ high and $1\,\text{cm}$ wide, are directed towards each other along the same spring. However, the pulse approaching from the right is inverted. Sketch the appearance of the spring at the instant that the two pulses completely overlap. What kind of interference is this?



15. An upright square pulse and an inverted triangular pulse were directed toward each other on a spring, as shown. Sketch the appearance of the spring at the instant the two pulses completely overlapped.



16. The figure shown here represents a standing wave on a string vibrating at its third harmonic frequency.



(a) Label all nodes “N” and anti-nodes “A” on the diagram.
(b) Describe how nodes and anti-nodes are distributed along a standing wave pattern.

17. Using the same diagram as the last quation, the points labelled (A), (B), and (C) represent the location of the central point of the string at various times.

(a) At which location is the central point of the string moving at its maximum speed? _____

(b) At which location is its instantaneous speed zero? _____

(c) At which location is the point on the string moving with an intermediate speed? _____

(d) Explain the reasoning you used to answer the above questions.

18. While relaxing at a wave pool, you notice the wave machine making 12 waves in $40\,\text{s}$ and the wave crests are $3.6\,\text{m}$ apart.

(a) Determine the velocity that the waves must be travelling.
(b) Your friend tells you that he can make the waves travel faster by increasing the frequency to 2 waves/second. Would you agree? Explain. What would change in the wave if the frequency increases?

19. A large earthquake hits the Pacific Ocean near Japan. The time of the earthquake is 9:00 AM local time in Los Angeles. The authorities estimate that the wavelength of the resulting tsunami is $37\,\text{m}$, and the frequency of the wave is $6\,\text{Hz}$. The site of the earthquake is $8000\,\text{km}$ from LA. There is a sand castle building contest scheduled for 2:00-4:00 PM local time on the same day at a beach near LA. Should they cancel the contest because of the coming tsunami or will they finish before the wave arrives?