Waves - Questions for Review

Introduction to Waves

1. What is a wave?
2. What is a transverse/longitudinal wave?
3. What type of wave travels on water?
4. What is the pattern of water particles if you cut parallel to their direction of travel?
5. How would you produce a wave pulse in a slinky?
6. How is a wave pulse different from a traveling wave?

Wave Terminology

7. Describe the period, frequency, amplitude and wavelength of a wave.
8. What is the relationship between period and frequency?
9. Can you draw a wave to show amplitude, crest and troughs on a transverse wave diagram.
10. Can you draw a wave to show amplitude, compression and rarefactions on a longitudinal wave diagram.
11. How is the amplitude of a wave related to the amount of energy transferred?
12. If the same amount of energy was applied to create a wave in a dense material, how would its amplitude compare to that of a less dense medium?
13. What is the equation for velocity?
14. What affects the velocity of a wave?

Waves at Boundaries, Free End and Fixed End Reflection

15. Describe an incident wave, a transmitted wave and a reflected wave.
16. When a wave hits a "fixed end", what will the transmitted and reflected wave look like?
17. When a wave hits a "free end", what will the transmitted and reflected wave look like?
18. When a wave hits a "less dense medium", what will the transmitted and reflected wave look like?
19. When a wave hits a "more dense medium", what will the transmitted and reflected wave look like?
20. How does velocity change when the density of a medium changes at a boundary?

Superposition Principle

21. What does the superposition principle state?
22. When two waves meet on the same medium, do they reflect off of each other or do they pass through each other? How do you know?
23. Describe a situation with constructive interference.
24. Describe a situation with destructive interference.
25. How can you identify constructive versus destructive interference?
26. What is total destructive interference (TDI)?

Waves – Questions for Review

Standing Waves

27. How many nodes does a first, 2nd and 3rd harmonic wave have?
28. How many loops does a first, 2nd and 3rd harmonic wave have?
29. What is a harmonic frequency?
30. How is a standing wave formed?

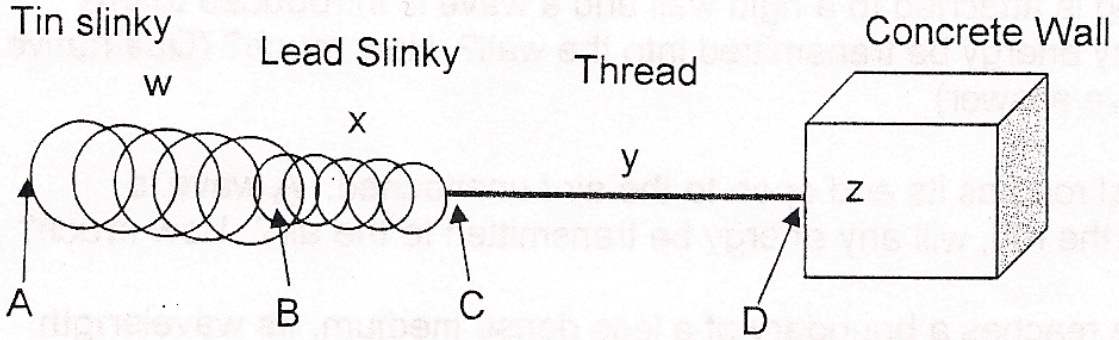
Diffraction and Refraction

31. What is diffraction of a wave?
32. How does wavelength affect the amount of diffraction?
33. How does the size of the opening in a barrier affect the amount of diffraction?
34. What happens to waves behind a barrier with two or more openings?
35. What is refraction of a wave and give an example? (water, light)
36. Describe all corresponding changes in frequency, velocity and wavelength of a wave that is refracting.

Law of Reflection

37. What is The Law of Reflection?
38. How do you distinguish between the incident wave and the reflected wave?
39. Explain how to draw a normal line on a diagram of a wave undergoing reflection off of a solid barrier.

Waves at Boundaries Review



A wave pulse travels right in a tin slinky as a crest;

a. As it moves right, will it be a crest or trough in:
   i. x
   ii. y
   iii. z

b. Will most of the Energy be reflected or transmitted at the following boundaries:
   i. B
   ii. C
   iii. D

c. Will the **reflected** wave be a crest or a trough in the following:
   iv. w
   v. x
   vi. y

d. Will the **velocity** change at the following boundaries:
   vii. B
   viii. C
   ix. D

Waves at Boundaries Review

1. If a light spring is attached to a rigid wall and a wave is introduced to the spring, will any energy be transmitted into the wall? How much? (Qualitative not quantitative answer)

2. A dense metal rod has its end open to the air / unattached. A wave is introduced to the rod, will any energy be transmitted to the air? How much?

3. When a wave reaches a boundary of a less dense medium, its wavelength and velocity change but its frequency does not. Explain why.

4. When a wave with a frequency of 200 Hz transfers from a dense medium to a less dense medium:
   i. Will the transmitted wave be slower or faster?
   ii. What will the frequency of the wave in the less dense medium be?
   iii. Will the transmitted wave have an increased wavelength? Why or why not?

5. A wave moves from water (density = 1.0 g/mL) to ketchup (density = 1.2 g/mL).
   i. How does the wavelength change?
   ii. Will the wave be erect or inverted in the water? What about the transmitted wave into the ketchup?
   iii. Will more energy be transmitted or reflected?

Physics 20 – Standing Waves Practice Name:_____

1. A student shakes the end of a 2.40 m long spring (the other end being attached to a wall.) The student shakes the spring at the frequency necessary to create a fourth harmonic standing wave.
   a) How many nodes does the fourth harmonic standing wave have?
   b) How many loops does the fourth harmonic standing wave have?
   c) What is the wavelength of this standing wave?

2. The student from question 1 changes their standing wave to the fifth harmonic, did the wavelength increase or decrease? Did the frequency they are shaking the spring at increase or decrease?

3. The student from question 1 varies the frequency again and a new standing wave with a wavelength of 1.60 m appears on the spring. Which harmonic does this new standing wave represent?

4. The student in question 1 decides to make a standing wave with a wavelength of 1.25 m on the spring. Is this possible? Explain.

5. A standing wave has 6 loops. Which harmonic does this represent?

6. A standing wave has 3 nodes. Which harmonic does this represent?

7. A first harmonic standing wave is created when a 80.0 cm long metal rod is vibrated at 900 Hz. What is the speed of the wave through the rod?

8. What frequency of vibration, when applied to the metal rod from question 7, would create a second harmonic standing wave? How does this frequency compare to the frequency that created a first harmonic standing wave?

Bonus - Without using any equations, find the frequency of vibration that would create a fifth harmonic standing wave on the metal rod from questions 7 & 8. (The information and answers from questions 7 & 8 provide a clue.)

Numerical Answers:

Try the question first. Use the answers to check if you are correct. If you peek before you try, you will learn a lot less.

1. a) 5
   b) 4
   c) 1.20 m
3. Third
5. Sixth
6. Second
7. 1440 m/s
8. 1800 Hz