

Thursday, April 9, 2009: Conceptual Review for Exam 2

1. What is the fundamental difference between a longitudinal wave and a transverse wave?
2. What is a phasor and why is it useful?
3. Two oscillations are superimposed. Explain the use of phasors to describe this phenomena.
4. What is a beat frequency?
5. Give an example of a coupled oscillation system and write down the equations of motion.
6. What is a normal mode?
7. For N coupled, transverse oscillators, the n th normal mode of the p th cart is mathematically given by what equation?
8. Standing waves can be shown to be a combination of two travelling waves. Is this statement true or false? Please justify your answer.
9. Write down a mathematical equation which enables you to determine the propagation speed.
10. Write down the one-dimensional wave equation.
11. Building on conceptual question 9, above, write down two alternate mathematical equations which enable you to determine the wave propagation speed.
12. What is the wave number, k , equal to?
13. How is the tension in the string related to the wave propagation speed?
14. Write down an expression for the power delivered by the string force.
15. What is the difference between the *maximum* power delivered by the string force and the *average* power delivered by the string force?
16. Normal modes of a string are standing waves having an integral multiple of half waves. Write down the mathematical expression which relates the length of the string to the wave number k .
17. What is the mathematical form of the n th mode wave function?
18. What is the difference between superimposed and coupled oscillations?
19. What is linear mass density? Write down a mathematical relationship for linear mass density.
20. What is the fundamental difference between a traveling wave and a standing wave?
21. Draw a picture of a wave which denotes the fundamental mode. For a string fixed at both ends, what is the fundamental frequency?
22. Draw a picture of a wave which denotes the first overtone, or 2nd harmonic. What will be the corresponding frequency for such a wave?
23. Write down a mathematical expression for an incident wave traveling to the left. What will be the mathematical expression for a reflected wave traveling to the right?
24. How is the standing wave amplitude related to either of the original traveling wave amplitudes?
25. What is the fundamental difference between a node and an antinode?
26. Write down an expression for the transverse velocity of a particle. What is the maximum particle speed?
27. Write down an expression for the transverse acceleration of any particle. What is the maximum particle acceleration?
28. Sketch the equation $y(x,t) = (1.0 \text{ m}) \cos(2x - 4t)$ for $t=0$ s, from $x = 0$ to $x = \pi$. On this graph, label the amplitude and determine the wave number and wave propagation speed. On this same sketch, superimpose $y(x,t) = (1.0 \text{ m}) \cos(2x - 4t)$ for $t = 1$ s. At $x=3$ m is the wave moving to the right or to the left? How do you know?