Physics of Sound and Music 2006
Midterm I

Thursday Apr 20th 2006, 9:30 am.
Professor Meadows

Name .....

1. An object in motion may have an acceleration in the opposite direction to its velocity
a) True; b) False.

2. If you move 3 (m) North, then 4 (m) East in an elapsed time of 21 seconds, then your average speed is
a) 5/18 (m/s); b) 4/18 (m/s); c) 1/2 (m/s). d) 1/3 (m/s).

3. A ball is thrown upward at a speed of 9.8 (m/s). It rises to a maximum height of 4.9 (m). At this point (*i.e.* at the very top point in its motion) its instantaneous speed is
a) -9.8 (m/s); b) +4.9 (m/s); c) 0 (m/s^s); d) 0 (m/s).
("+" means upward and a "-" is downward.)

4. When the air pressure in the room increases by 0.1 (N/m^2) then the force pressing inward from all directions on your body increases by
a) 1 (N); b) 1 (N/m^2); c) 0.1 (N); d) 0.1 (N/m^2); e) It decreases.

5. Pressure in a fluid (like air) is a measure of the force per unit area pressing inward from all directions on any object immersed in that fluid.
a) True; b) False.

6. A spring has a force constant k=5 (N/m). If you stretch it by 1 (cm) then you will need to use a force of
a) 0.2 (N); b) 5 (N); c) 5×10^{-2} (N). d) 500 (N).

7. In simple harmonic motion, the maximum displacement from the equilibrium point is called the
a) wavelength; b) frequency; c) period; d) amplitude; e) force constant.

8. The maximum speed of a mass m on a spring with constant k, moving

in simple harmonic motion, occurs at the
a) highest point; b) lowest point; c) equilibrium point; d) somewhere else.

9. The maximum acceleration of a mass m on a spring with constant k, moving in simple harmonic motion, occurs at the
a) highest point; b) lowest point; c) equilibrium point; d) somewhere else.

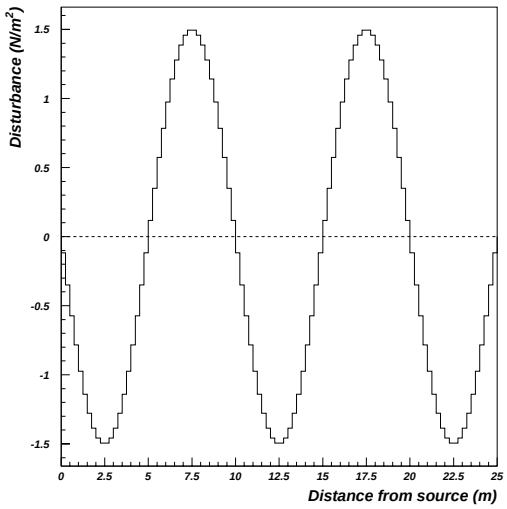
10. The period T of a mass m on a spring with constant k, moving in simple harmonic motion, is
a) $T = 2\pi\sqrt{k/m}$; b) $T = 2\pi\sqrt{m/k}$;

11. In simple harmonic motion, an object experiences a force that is always directed toward the equilibrium point, and is also proportional to the distance from it. a) True; b) False.

12. In an instance of simple harmonic motion, the frequency f is 100(Hz). The time for a single cycle (one period) is equal to
a) 10^{-3} (s); b) 10^{-2} (s); c) 10^{-1} (s); d) 100 (s).

13. The speed v of waves in a metal is found to depend on its "density" d (kg/m^3) and its "elasticity" E (N/m^2). Considering the units for these quantities, v could be given by which of the following formulae:
a) $v = E/d$; b) $v = \sqrt{E/d}$; c) $v = E \times d$; d) $v = d/E$.
[Hint: Recall that 1(N) is the same as 1 (kg·m/s^2).]

14. Answer the following questions relating to the wave in the figure that is propagating in a medium at a speed of 15 (m/s).



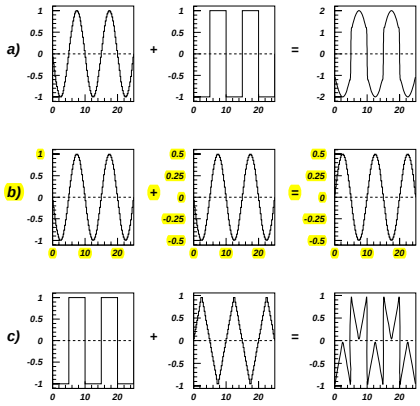
A: What is the wavelength?
a) 25 (m); b) 12.5 (m); c) 10.0 (m); d) 1.5 (m); e) less than all the above.

B: What is the amplitude?
a) 25 (N/m^2); b) 12.5 (N/m^2); c) 10.0 (N/m^2); d) 1.5 (N/m^2); e) less than all the above.

C: What is the frequency of the wave?
a) 25 (Hz); b) 12.5 (Hz); c) 10.0 (Hz); d) 1.5 (Hz); e) less than all the above.

D: What is the period of the wave?
a) 25 (~~Hz~~); b) 12.5 (~~Hz~~); c) 10.0 (~~Hz~~); d) 1.5 (~~Hz~~); e) less than all the above.

18. Each of the rows below represent wave profiles in a medium at a moment in time. The two waves on the left interfere as indicated to make the superposition shown on the right. One of these rows does *NOT* correctly represent the principal of superposition. That one is:



19. An observer moves *towards* a violin that is emitting a sound at 440 Hz. Which of the following frequencies could that observer have heard
a) 441 (Hz); b) 431 (Hz); c) 220 (Hz).

20. A sound wave with wavelength λ is emitted by a stationary source. The sound is heard by a girl who is running away from it at speed v. As a result of the Doppler effect, the wavelength of sound entering her ear is λ' where: a) λ' gets smaller as v increases;
b) $\lambda' = \lambda$, no matter what v is;
c) $\lambda' > \lambda$ as long as she is running away from the sound; OR
~~c~~) $\lambda' < \lambda$ as long as she is running away from the sound.
(Choose the most correct statement.)