Practice Exam 4

1. If the tension in a string is increased by a factor of 4, the speed at which waves travel along the string will
a) increase by a factor of 2 c) increase by a factor of 4 e) none of these
b) decrease by a factor of 2 d) decrease by a factor of 4

2. A sound wave is an example of a transverse wave.
a) True b) False

3. A standing wave may be correctly described as the sum of two identical waves traveling in opposite directions.
a) True b) False.

4. A pebble is dropped into a pond and creates a wave given by $y_1(x,t)$. After these waves dissipate, another pebble is dropped into the pond and creates a wave given by $y_2(x,t)$. If the pebbles were to be dropped into the pond at the same time, the resulting wave would be given by
a) $y_1(x,t)+y_2(x,t)$ c) $y_1(x,t)y_2(x,t)$ e) none of these
b) $y_1(x,t)-y_2(x,t)$ d) $y_1(x,t)/y_2(x,t)$

5. A standing wave has an amplitude A. What is the displacement of the nodes of the wave?
a) $A/2$ c) 0 e) $A/4$
b) A d) $-A$

6. Is it theoretically possible to produce a sound wave that cancels out a pre-existing sound wave thereby creating silence?
a) Yes b) No

7. Is an electromagnetic wave a mechanical wave?
a) Yes b) No

8. If the length of organ pipe is doubled, how will its fundamental frequency change?
a) It will increase by a factor of 2 c) It will increase by a factor of 4 e) it will not change
b) It will decrease by a factor of 2 d) It will decrease by a factor of 4 f) none of these

9. A sinusoidal wave is traveling along a rope. The oscillator that generates the wave completes 40.0 vibrations in 30.0 seconds. Also, a given maximum (wave peak) travels 425 cm along the rope in 10.0 seconds. What is the wavelength?
a) 319 m c) 3.13 m e) none of these
b) 0.319 m d) 17.7 m

10. Two speakers are driven in phase by a common oscillator at 800 Hz and face each other at a distance of 1.25 m. Let speaker on left be at $x = 0$, and that on the right be at $x = 1.25$. Which of the following positions along the line between the speakers is *not* a node? (speed of sound = 343 m/s).
a) $x = 0.625$ m c) $x = 0.303$ m e) none of these
b) $x = 0.518$ m d) $x = 0.0891$ m

11. An automobile tire has a gauge pressure of 0 psi. What is the absolute pressure within the tire?
a) 0 psi. c) negative
b) atmospheric pressure d) none of these

12. According to Bernoulli's law, as the velocity of fluid in a horizontal pipe increases, the pressure
a) increases c) remains unchanged
b) decreases d) none of these

13. What is the absolute pressure at an ocean depth of 1000 m? [Assume that the density of sea water is 1024 kg/m^3 and that the air above exerts a pressure of 101.3 x 10^3 Pa.]
a) 1.01 x 10^{12} Pa c) 1.01 x 10^7 Pa e) none of these
b) 6.8 x 10^{11} Pa d) 4.99 x 10^{23} Pa

14. Lead has a greater density than iron, and both are denser than water. If F_L is the buoyant force on a fully submerged lead object of volume *V*, and F_I is the buoyant force on a fully submerged iron object of volume *V*, then a) $F_L < F_I$ b) $F_L > F_I$ c) $F_L = F_I$

15. A Ping-Pong ball has a diameter of 3.80 cm and average density of 0.084 g/cm^3. What force is required to hold it completely submerged under water?
a) 17.6 N c) 8.89 x 10^{-3} N e) none of these
b) 1.93 N d) 0.258 N

16. A horizontal pipe 10.0 cm in diameter gradually narrows to become a pipe with a 5.0 cm diameter. If the pressure of the water in the wider section of the pipe is 8.0 x 10^4 Pa, and the pressure in the narrower section of the pipe is 6.0 x 10^4 Pa, at what rate does water flow through the pipe?
a) 0.188 kg/s b) 1.94 kg/s c) 194 kg/s d) 12.8 kg/s e) none of these

17. Water flows through a fire hose of diameter 6.35 cm at a rate of 0.012 m^3/s. The fire hose ends in a nozzle of diameter 2.20 cm. What is the speed with which the water exits the nozzle?
a) 13.2 m/s b) 3.16 m/s c) 31.6 m/s d) 132 m/s e) none of these

18. A patient's systolic pressure measure at the level of her heart is 124 mm Hg. The patient's systolic pressure at a point 30 cm above the level of her heart is about
a) 100 mm Hg b) 148 mm Hg c) 117 mm Hg d) none of these

19. A water hose 2.00 cm in diameter is used to fill a 20-liter bucket. If it takes 1.0 minute to fill the bucket, what is the speed at which water moves through the hose?
a) 106 cm/s b) 498 cm/s c) 3 x 10^{10} cm/s d) 8 cm/s e) none of these

20. Assume that an atmospheric pressure of 1.0 x 10^5 Pa acts on the entire surface of your eyeball. Suppose that your eyeball can be modeled as a sphere with a diameter of 2.5 cm. What is the total inward force of the atmosphere on your eyeball?

_______________ Newtons.

21. How much pressure must be applied to the ends of a cylindrical bone with a Young's modulus of 2 x 10^{10} N/m^2 in order to compress the bone by 0.1%?

22. Assume that the bulk modulus of the human brain 2 x 10^9 N/m^2. If the intracranial pressure increases by 2 x 10^{-6} N/m^2, by how much does the brain compress as fraction of its volume?

23. Suppose that when the center of an ear drum is displaced from its equilibrium position by an amount *x*, it is acted on by a restoring force *F* given by *F* = -*kx*. Does the ear drum undergo simple harmonic motion?

24. A champagne glass vibrates at a natural frequency of 500 Hz. What is the frequency at which a singer's voice must vibrate to have the best chance of shattering the glass?

a) 500 Hz b) 250 Hz c) 1000 Hz d) 440 Hz

25. When a mass m hangs at the end of a spring with constant k, it vibrates at an angular frequency ω. If the mass is increased by a factor of 16, what is the new angular frequency of oscillation?

26. When a mass m hangs from a light string of length L in a gravitational field with acceleration of gravity g, this pendulum oscillates with angular frequency ω. If this pendulum is moved to planet with an acceleration of gravity of $16g$, what will be the new frequency of oscillation.

27. A rope is connected to a pole by a ring that is allowed to slide freely up and down the pole. If the rope is jerked so that a pulse travels toward the pole, will the reflected pulse be inverted?
a) yes b) no

28. For an harmonic oscillator to return to static equilibrium in shortest possible time it must be
a) under damped b) critically damped c) over damped

29. A listener stationary relative to an ambulance measures the frequency f_S of its siren to be 300 Hz. When the ambulance travels at speed v_S = 30 m/s toward the stationary ($v_L = 0$) listener, what frequency f_L will she measure? Assume that the speed of sound v is 343 m/s.

[Hint: $f_L = \left(\dfrac{v + v_L}{v - v_S}\right) f_S$]

a) 329 Hz b) 280 Hz c) 275 Hz d) 561 Hz

30. Jane whistles a steady tone at 440 Hz. Tom simultaneously whistles a steady tone at 438 Hz. What is the frequency of the beats that result?
a) 440 Hz b) 438 Hz c) 2 Hz d) 880 Hz