Physics 1401 - Exam 3
Chapter 9 Review

2. At standard temperature and pressure, carbon dioxide has a density of 1.98 kg/m^3. What volume does 0.85 kg of carbon dioxide occupy at standard temperature and pressure?

(a) 0.43 m^3 (c) 1.7 m^3 (e) 4.8 m^3
(b) 0.86 m^3 (d) 2.3 m^3

3. What mass of water (at 4.0 °C) can be contained in a rectangular box whose dimensions are 10.0 cm by 5.00 cm by 1.00 cm? The density of water at 4.0 °C is 1.000 × 103 kg/m^3.

(a) 5.0 g (c) 25.0 g (e) 0.25 kg
(b) 10.0 g **(d) 50.0 g**

4. The density of iron is 7860 kg/m^3. What is the mass of an iron sphere whose diameter is 0.50 m?

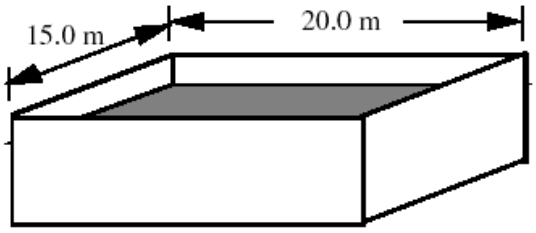
(a) 123 kg **(c) 514 kg** (e) 4110 kg
(b) 164 kg (d) 983 kg

7. A solid cylinder has a radius of 0.051 m and a height of 0.0030 m. The cylinder is composed of two different materials with mass densities of 1950 kg/m3 and 1470 kg/m3. If each of the two materials occupies an *equal volume*, what is the mass of the cylinder?

(a) 8.4×10^{-2} kg (c) 6.5×10^{-2} kg **(e) 4.2×10^{-2} kg**
(b) 7.1×10^{-2} kg (d) 5.3×10^{-2} kg

Questions 15 and 16 pertain to the situation described below:

A swimming pool has the dimensions shown in the drawing. It is filled with water to a uniform depth of 8.00 m. The density of water = 1.00×10^3 kg/m^3.



15. What is the total pressure exerted on the bottom of the swimming pool?

(a) 0.79×10^5 Pa **(c) 1.80×10^5 Pa** (e) 2.49×10^5 Pa
(b) 1.48×10^5 Pa (d) 1.97×10^5 Pa

16. What is the total force exerted on the bottom of the swimming pool?
(a) 2.40×10^7 N (c) 5.90×10^7 N (e) 8.40×10^7 N
(b) 5.40×10^7 N (d) 7.50×10^7 N

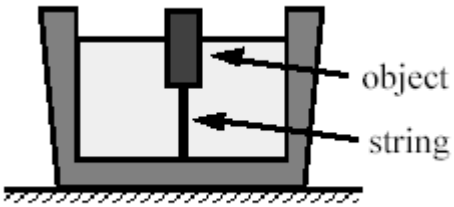
26. Which one of the following statements concerning a completely enclosed fluid is true?
(a) Any change in the applied pressure of the fluid produces a change in pressure that depends on direction.
(b) The pressure at all points within the fluid is independent of any pressure applied to it.
(c) Any change in applied pressure produces an equal change in pressure at all points within the fluid.
(d) An increase in pressure in one part of the fluid results in an equal decrease in pressure in another part.
(e) The pressure in the fluid is the same at all points within the fluid.

27. A force of 250 N is applied to a hydraulic jack piston that is 0.01 m in diameter. If the piston which supports the load has a diameter of 0.10 m, approximately how much mass can be lifted by the Ignore any difference in height between the pistons.
(a) 255 kg (c) 800 kg (e) 6300 kg
(b) 500 kg **(d) 2550 kg**

28. In a car lift, compressed air with a gauge pressure of 4.0×10^5 Pa is used to raise a piston with a circular cross-sectional area. If the radius of the piston is 0.17 m, what is the maximum mass that can be raised using this piston?

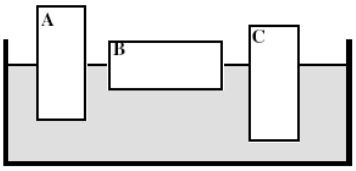
(a) 530 kg (c) 9800 kg (e) 41 000 kg
(b) 3700 kg (d) 22 000 kg

30. 30. A 2-kg block displaces 10 kg of water when it is held fully immersed. The object is then tied down as shown in the figure; and it displaces 5 kg of water. What is the tension in the string?



(a) 10 N (d) 70 N
(b) 20 N (e) 100 N
(c) 30 N

32. Three blocks labeled A, B, and C are floating in water as shown in the drawing. Blocks A and B have the same mass and volume. Block C has the same volume, but is submerged to a greater depth than the other two blocks. Which one of the following statements concerning this situation is false?



(a) The density of block A is less than that of block C.
(b) The buoyant force acting on block A is equal to that acting on block B.
(c) The volume of water displaced by block C is greater than that displaced by block B.
(d) The buoyant force acting on block C is greater than that acting on block B.
(e) The volume of water displaced by block A is greater than that displaced by block B.

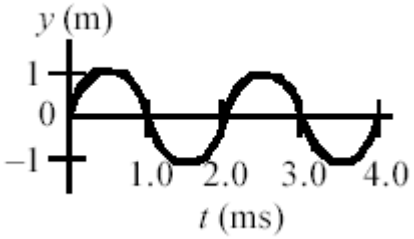
31. A balloon inflated with helium gas (density = 0.2 kg/m^3) has a volume of $6 \cdot 10^{-3}$ m3. If the density of air is 1.3 kg/m^3, what is the buoyant force exerted on the balloon?

(a) 0.01 N (c) 0.8 N (e) 7.8 N

(b) 0.08 N (d) 1.3 N

Physics 1401
Chapter 10 & 11 Review

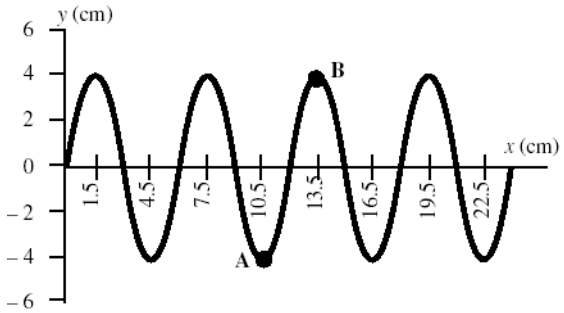
4. The speed of sound in a certain metal block is 3.00×10^3 m/s. The graph shows the amplitude (in meters) of a wave traveling through the block versus time (in milliseconds). What is the wavelength of this wave?



(a) 0.5 m (d) 4.0 m
(b) 1.5 m **(e) 6.0 m**
(c) 3.0 m

7. What is the wavelength of a wave with a speed of 12 m/s and a period of 0.25 s?
(a) 0.25 m **(c) 3.0 m** (e) 48 m
(b) 1.5 m (d) 24 m

7. ***Questions 9 through 12 pertain to the situation described below:***
The displacement of a vibrating string versus position along the string is shown in the figure.
The periodic waves have a speed of 10.0 cm/s. **A** and **B** are two points on the string.



9. What is the amplitude of the wave?
(a) 2 cm
(b) 4 cm
(c) 8 cm
(d) 12 cm
(e) 16 cm

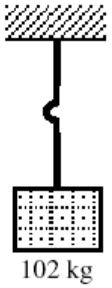
10. What is the wavelength of the wave?
(a) 3.0 cm (c) 9.0 cm (e) 15 cm
(b) 6.0 cm (d) 12 cm

11. What is the frequency of the wave?
(a) 0.60 Hz (c) 1.1 Hz **(e) 1.7 Hz**
(b) 0.90 Hz (d) 1.3 Hz

12. What is the difference in phase between the points A and B?
(a) (π/4) radians **(c) πradians** (e) 2πradians
(b) (π/2) radians (d) (3π/4) radians

14. A steel wire of mass 0.400 kg and length 0.640 m supports a 102-kg block. The wire is struck exactly at its midpoint causing a small displacement. How long does it take the peak of this displacement to reach the top of the wire?

(a) 2.00 x10^{-3} s
(d) 8.00 x10^{-3} s
(b) 4.00 x10^{-3} s
(e) 1.60 x10^{-2} s
(c) 6.00 x10^{-3} s



15. A certain string on a piano is tuned to produce middle C (f = 261.63 Hz) by carefully adjusting the tension in the string. For a fixed wavelength, what is the frequency when this tension is doubled?

(a) 130.08 Hz
(c) 370.00 Hz
(e) 523.26 Hz
(b) 185.00 Hz
(d) 446.63 Hz

17. A wave is traveling at 5.5 m/s on a string with a linear density of 0.082 kg/m. What is the tension in the string?

(a) 0.20 N
(c) 2.5 N
(e) 6.3 N
(b) 0.45 N
(d) 4.4 N

18. A transverse periodic wave described by the expression $y = \sin\left[2\pi\left(\frac{x}{2} + \frac{t}{10}\right)\right]$ (where y and x are in meters and t is in seconds) is established on a string. Which one of the following statements concerning this wave is false?
(a) The wave is traveling in the negative x direction.
(b) The amplitude is 1.0 m.
(c) The frequency of the wave is 0.10 Hz.
(d) The wavelength of this wave is 2.0 m.
(e) The wave travels with speed 5.0 m/s.

20. A wave has an amplitude of 0.35 m, a frequency of 1.05×10^6 Hz, and travels in the positive X-direction at the speed of light, 3.00×10^8 m/s. Which one of the following equations correctly represents this wave?
(a) $y = 0.35 \sin (6.60 \times 10^6 t - 0.022X)$
(b) $y = 0.35 \sin (6.60 \times 10^6 t + 0.022X)$
(c) $y = 0.35 \sin (286t - 1.05 \times 10^6 X)$
(d) $y = 0.35 \sin (286t + 1.05 \times 10^6 X)$
(e) $y = 0.35 \sin (1.05 \times 10^6 t + 3.00 \times 108X)$

35. A bell produces sound energy at a rate of 4.00×10^{-3} W and radiates it uniformly in all directions. What is the intensity of the wave 100.0 m from the bell?
(a) 3.18×10^{-8} W/m^2
(b) 3.14×10^{-7} W/m^2
(c) 5.02×10^{-2} W/m^2
(d) 5.02×10^{2} W/m^2
(e) 6.28×10^{7} W/m^2

37. During a typical workday (eight hours), the average sound intensity arriving at Larry's ear is 1.8×10^{-5} W/m^2. If the area of Larry's ear through which the sound passes is 2.1×10^{-3} m^2, what is
the total energy entering each of Larry's ears during the workday?
(a) 1.8×10^{-5} J (c) 7.4×10^{-4} J (e) 4.1×10^{-3} J
(b) 2.2×10^{-4} J **(d) 1.1×10^{-3} J**

38. Two boys are whispering in the library. The radiated sound power from one boy's mouth is 1.2×10^{-9} W and it spreads out uniformly in all directions. What is the minimum distance the boys must be away from the librarian so that she will not be able to hear them? The threshold of hearing for the librarian is 1.00×10^{-12} W/m^2.
(a) 100 m (c) 23 m **(e) 9.8 m**
(b) 35 m (d) 16 m

40. The decibel level of a jackhammer is 130 dB relative to the threshold of hearing. Determine the decibel level if two jackhammers operate side by side.
(a) 65 dB **(c) 133 dB** (e) 260 dB
(b) 130 dB (d) 144 dB

42. At a distance of 5.0 m from a point sound source, the sound intensity level is 110 dB. At what distance is the intensity level 95 dB?
(a) 5.0 m (c) 14 m (e) 42 m
(b) 7.1 m **(d) 28 m**

43. According to US government regulations, the maximum sound intensity level in the workplace is 90.0 dB. Within one factory, 32 identical machines produce a sound intensity level of 92.0 dB. How many machines must be removed to bring the factory into compliance with the regulation?
(a) 2 **(c) 12** (e) 24
(b) 8 (d) 16

Physics 1401
Chapter 12 Review

6. Sound waves are emitted from two speakers. Which one of the following statements about sound wave interference is false?
(a) In a region where both destructive and constructive interference occur, energy is not conserved.
(b) Destructive interference occurs when two waves are exactly out of phase when they meet.
(c) Interference redistributes the energy carried by the individual waves.
(d) Constructive interference occurs when two waves are exactly in phase when they meet.
(e) Sound waves undergo diffraction as they exit each speaker.

7. A pebble is dropped in a lake; and it produces ripples with a frequency of 0.25 Hz. When should a second pebble be dropped at the same place to produce destructive interference?
(a) 0.50 s after the first
(b) 0.75 s after the first
(c) 1.0 s after the first
(d) 1.5 s after the first
(e) 2.0 s after the first

8. Two loudspeakers, **A** and **B**, are separated by a distance of 2.0 m. The speakers emit sound waves at a frequency of 680 Hz that are exactly out of phase. The speed of sound is 343 m/s. How far from speaker **A** along the +*x* axis will a point of constructive interference occur?

(a) 0.25 m (c) 0.46 m (e) 0.98 m
(b) 0.30 m **(d) 0.88 m**

Questions 10 and 11 pertain to the situation described below:
Two loudspeakers are located 3 m apart on the stage of an auditorium. A listener at point **P** is seated 29.0 m from one speaker and 25.0 m from the other. A signal generator drives the speakers in phase with the same amplitude and frequency. The wave amplitude at **P** due to each speaker alone is *A*. The frequency is then varied between 20 Hz and 300 Hz. The speed of sound is 343 m/s.

10. At what frequency or frequencies will the listener at **P** hear a maximum intensity?
(a) 170 Hz only
(b) 113 Hz and 226 Hz
(c) 86 Hz, 170 Hz, 257 Hz
(d) 57 Hz, 113 Hz, 170 Hz, 227 Hz, and 284 Hz
(e) 43 Hz, 85 Hz, 128 Hz, 170 Hz, 213 Hz, 257 Hz, and 298 Hz.

11. Determine the value of the maximum amplitude in terms of A.
(a) 2.0A (c) 3.0A (e) 5.0A
(b) 2.5A (d) 4.0A

16. A guitar string produces 4 beats/s when sounded with a 250 Hz tuning fork and 9 beats per second when sounded with a 255 Hz tuning fork. What is the vibrational frequency of the string?
(a) 240 Hz (c) 254 Hz (e) 263 Hz
(b) 246 Hz (d) 259 Hz

19. Two identical tuning forks vibrate at 587 Hz. After a small piece of clay is placed on one of them, eight beats per second are heard. What is the period of the tuning fork that holds the clay?
(a) 1.68×10^{-3} s **(c) 1.73×10^{-3} s** (e) 1.80×10^{-3} s
(b) 1.70×10^{-3} s (d) 1.76×10^{-3} s

20. A guitar string has a linear density of 8.30 × 10–4 kg/m. The length of the string is 0.660 m. The tension in the string is 52.0 N. When the fundamental frequency of the string is sounded with a tuning fork of frequency 196.0 Hz, what beat frequency is heard?

(a) 6 Hz (c) 12 Hz (e) 2 Hz
(b) 4 Hz (d) 8 Hz

27. A 4.00-m long string, clamped at both ends, vibrates at 2.00 × 102 Hz. If the string resonates in six segments, what is the speed of transverse waves on the string?

(a) 100 m/s **(c) 267 m/s** (e) 400 m/s
(b) 133 m/s (d) 328 m/s

28. A certain string, clamped at both ends, vibrates in seven segments at a frequency of 2.40 × 102 Hz. What frequency will cause it to vibrate in four segments?

(a) 89 Hz (c) 274 Hz (e) 420 Hz
(b) 137 Hz (d) 411 Hz

29. Four standing wave segments, or loops, are observed on a string fixed at both ends as it vibrates at a frequency of 140 Hz. What is the fundamental frequency of the string?
(a) 23 Hz **(c) 35 Hz** (e) 70 Hz
(b) 28 Hz (d) 47 Hz

Questions 32 and 33 pertain to the situation described below:
Vibrations with frequency 6.00 × 102 Hz are established on a 1.33-m length of string that is clamped at both ends. The speed of waves on the string is 4.00×10^2 m/s.

32. How many antinodes are contained in the resulting standing wave pattern?
(a) 2 **(c) 4** (e) 6
(b) 3 (d) 5

33. How far from either end of the string does the first node occur?
(a) 0.17 m (c) 0.49 m (e) 0.75 m
(b) 0.33 m (d) 0.66 m

41. Pipe **A** is 0.50 m long and open at both ends. Pipe **B** is open at one end and closed at the other end. Determine the length of **B** so that it has the same fundamental frequency as **A**.

(a) 0.25 m (c) 0.75 m (e) 2.0 m
(b) 0.50 m (d) 1.0 m

42. Determine the shortest length of pipe, open at both ends, which will resonate at 256 Hz. The speed of sound is 343 m/s.

(a) 0.330 m (c) 0.990 m (e) 1.67 m
(b) 0.670 m (d) 1.32 m

43. A cylindrical tube sustains standing waves at the following frequencies: 600 Hz, 800 Hz, and 1000 Hz. The tube does not sustain standing waves at 500 Hz, at 900 Hz, at any frequencies between 600 and 800 Hz, or at any frequencies between 800 and 1000 Hz. Determine the fundamental frequency of the tube and whether the tube is open at both ends or has only one end open.

(a) 50 Hz, both ends (c) 100 Hz, both ends **(e) 200 Hz, both ends**
(b) 100 Hz, one end (d) 200 Hz, one end

44. When a tuba is played, the player blows into one end of a tube that has an effective length of 3.50 m. The other end of the tube is open. If the speed of sound in air is 343 m/s, what is the lowest frequency the tuba can produce?

(a) 8.00 Hz (c) 16.0 Hz **(e) 49.0 Hz**
(b) 12.0 Hz (d) 24.0 Hz

45. Some of the lowest pitches attainable on a musical instrument are achieved on the world's largest pipe organs. What is the length of an organ pipe that is open on both ends and has a fundamental frequency of 8.75 Hz when the speed of sound in air is 341 m/s?

(a) 9.83 m (c) 21.2 m (e) 32.4 m
(b) 19.5 m (d) 29.3 m