General Physics I **Exam 4 - Chs. 10,11,12 - Fluids, Waves, Sound** **Nov. 19, 2008**

Name: Rec. Instr.: Rec. Time:

For full credit, make your work clear to the grader. Show the formulas you use, essential steps, and results with correct units and significant figures. Partial credit is available if your work is clear. Points shown in parenthesis. Use g = 9.80 m/s^2, 1 atm = 101.3 kPa, ρ_{water}=1000 kg/m^3. For TF and MC questions, choose the best answer.

1. (12) While scuba diving in the Bahamas, where the sea water has a density of 1025 kg/m^3, Leslie notices that her pressure meter shows a *gauge pressure* of 4.50 atm.

a) (2) If she dives a little deeper, the meter reading should a. decrease. b. not change. c. increase.

b) (2) Before jumping into the water, the reading on her meter should have been closest to a. 0.0 atm. b. 1.0 atm c. -1.0 atm. d. 2.0 atm.

c) (4) At what depth is Leslie diving when the meter reads 4.50 atm?

d) (4) At that depth, what force does the water pressure produce on any flat surface of area 1.00 cm^2?

2. (12) 2.000 kg sugar (sucrose, specific gravity 1.587) are dissolved in 1.000 kg of water (take its SG = 1.000). Assume that the volume of the solution formed is the sum of the sugar volume and water volume.

a) (6) What is the final volume of the solution?

b) (6) What is the specific gravity of the solution?

3. (2) **T** **F** The bouyant force on a submerged empty 2.0-liter bottle is greater than the bouyant force on a floating empty 2.0-liter bottle.

4. (2) **T** **F** A boat floating on a river experiences no bouyant force.

5. (2) **T** **F** When an ice cube floating in a glass filled with water melts, some water will overflow.

6. (2) In the "Cartesian diver" demo, (tall water-filled tube with attached pressure bottle to control a mini-submarine), squeezing on the bottle causes the submarine to

a. expand and float higher. b. contract and float higher.
c. expand and float lower. d. contract and float lower.

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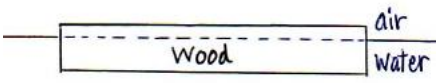
7. (16) A 60.0 cm × 30.0 cm × 4.0 cm block of wood floats on water with 80.0% of its volume below the surface of the water.



a) (4) How large is the bouyant force acting on the block of wood?

a) (6) What is the density of the wood, in kg/m^3?

b) (6) While floating on the water, how much mass can be placed on top of the block before it starts to sink?

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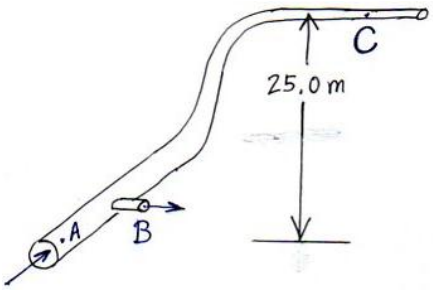
8. (8) A large water main pipe maintains a *gauge pressure* of 3.60 atm (at point A) with water moving through it there at $v_A = 0.250$ m/s. The water main carries water uphill to a point C 25.0 m higher, into a narrower pipe where the water is moving at 4.00 m/s. How large is the gauge pressure at that higher point C?



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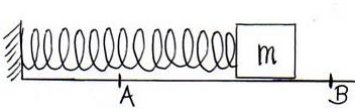
9. (14) A mass oscillates back and forth between two points A and B separated by 56.0 cm, while attached to a spring with spring constant $k = 245$ N/m. It requires 0.250 s to travel from A to B (and 0.250 s to travel from B to A).



a) (6) What are the period T, frequency f, and amplitude A of the motion?

b) (4) What total mechanical energy E is in the oscillations?

c) (4) How large is the mass?

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10. (10) A pendulum is made by suspending a 7.00-kg bowling ball on a cord 5.00 m long connected to the ceiling. The ball is pulled to the side 1.00 m along the arc and released.

a) (4) How long does it take for the bowling ball to first return to the starting point?

b) (6) How large is the maximum speed of the bowling ball?

11. (6) A 512-Hz sound wave traveling in steel ($v_s = 5200$ m/s) emerges into the air ($v = 343$ m/s). What is the ratio of its wavelength in the steel compared to its wavelength in air?

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12. (12) A loudspeaker is radiating sound isotropically with an average emitted power of 4.4 W. You are listening with your right ear 2.5 m from the loudspeaker.

a) (6) What sound intensity reaches your right ear?

b) (6) What is the sound level (in dB) at your right ear?

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13. (12) Blowing across the top of a partially filled beer-bottle, sound at the fundamental resonance frequency, 690 Hz, is produced. Assume the speed of sound inside the bottle is 331 m/s (air at 0°C).

a) (4) How deep is the airspace inside the bottle, from the top of the bottle to the surface of the beer?

b) (4) What will be the next harmonic frequency of the beer bottle (first overtone)?

c) (4) If the 690-Hz sound from the bottle causes a 66-cm long guitar string to vibrate in resonance, what is the speed of the waves on the guitar string?