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Physics 2C, Winter 2020

PRACTICE QUIZ 1-1

All students must work independently. You are allowed one page of handwritten notes only; no communication devices (cell phones, etc) permitted. Show all work; no credit will be given for answers with no derivation. Any problem asking for a vector (e.g., force) requires a vector as an answer!

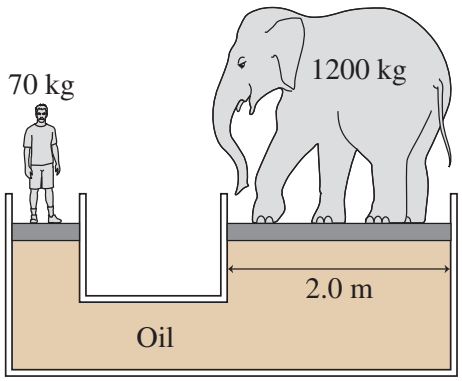
Directions: Work each problem on the exam sheet provided. Put your NAME and PID on EACH sheet (one for each problem) in the space provided. If you don't have enough room on a single side of the page, finish the problem on the back of the page. $15 + 15 + 15 + 4(3) = 57$ points total for this exam.

Please keep in mind the following before you turn in your exam to avoid a 10% penalty:

- Make sure your name and PID are on each sheet in the space provided.
- Turn in all 6 pages. Do not turn in this cover page. If you absolutely could not fit a problem on the front/back of a single sheet, clearly communicate this to the proctor/TA/instructor when you turn in your exam.
- Make sure your pages are in numerical order (page 1, page 2, page 3, etc.)

Name:
PID:

1. (15 points, 5 points each): A 70 kg student shown in the figure below balances a 1200 kg elephant on a hydraulic lift.



(a) What is the *diameter* of the piston the student is standing on?

(b) When a second student joins the first, the piston sinks 35 cm. What is the second student's mass?

(c) The first student steps off the piston. How much does the piston rise?

Name:
PID:

2. (15 points, 3 points each): At a distance D away from a fire alarm, you hear the alarm sounding at an intensity level of 92.0 dB. Assume sound is emitted from the source isotropically in three dimensions.

   (a) At what distance R should you stand from the alarm in order for the sound intensity level to drop to 83.0 dB?

   (b) Suppose there are now two identical fire alarms. You're standing exactly in between them, such that the distance between you and each fire alarm is R. What sound intensity level do you observe now in dB?

   (c) You begin walking away from one fire alarm and toward the other alarm at a speed of 1.0 m/s. Due to the Doppler effect, you notice a beat frequency of 2.0 Hz. Assuming both alarms are emitting sound at the same frequency, what is the frequency of each alarm (the frequency emitted by the sources)?

Name:
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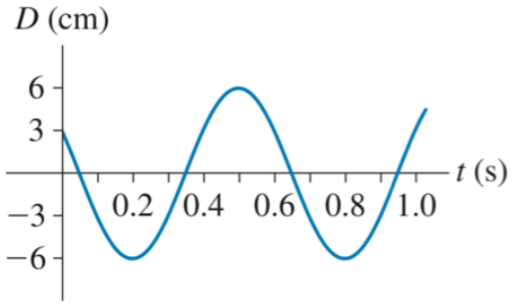
3. (15 points, 5 points each): A transverse wave travels to the left in the $-\hat{\mathrm{x}}$ direction with speed 2.0 m/s. Consider the following history graph of the wave at $x = 0$ m:



(a) What is the frequency (in Hz) and the wavelength (in m) of this wave?

(b) Give an equation for this wave of the form $D(x,t) = A\cos[\ldots]$.

(c) Draw a snapshot graph for this wave at $t = 0.20$ s.

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(12 points, 3 points each): 4 Multiple-choice questions / fill-in-the-blanks on various topics.

Directions for multiple-choice questions: COMPLETELY FILL IN THE SQUARE for the answer. Directions for fill-in-the-blank questions: Your answer should be entirely in the boxed region. Include the number of significant figures ("sig. figs.") requested in the problem.

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4. Two guitar strings (A and E) are under the same tension and produce standing waves of the same wavelength. The frequency of the A string is 110.00 Hz, and the frequency of the E string is 82.41 Hz. Which of the following best describes how the linear mass densities of the two strings sompare with one another?

   ☐ The A string has a linear mass density that is 16% higher than that of the E string.
   ☐ The A string has a linear mass density that is 33% higher than that of the E string.
   ☐ The A string has a linear mass density that is 16% lower than that of the E string.
   ☐ The A string has a linear mass density that is 33% lower than that of the E string.
   ☐ The A string has a linear mass density that is 44% lower than that of the E string.

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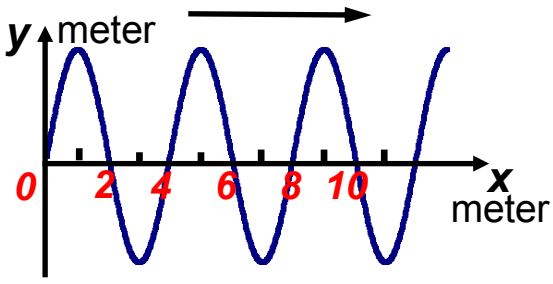
5. A transverse wave is traveling to the right with velocity 2 m/s and wavelength 4 m (shown below at $t = 0$ s). Of the following ($A > 0$), which equation describes the wave at $t = 1.5$ s?

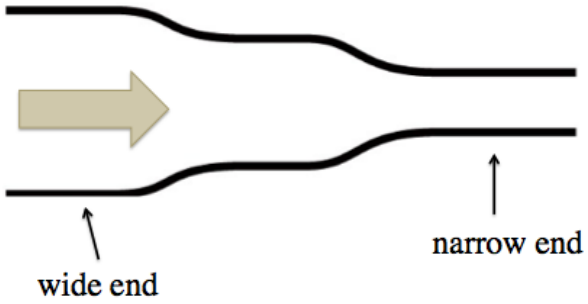


   ☐ $+A\sin(kx)$
   ☐ $-A\sin(kx)$
   ☐ $+A\cos(kx)$
   ☐ $-A\cos(kx)$
   ☐ None of the above

Name:
PID:

6. Water flows through a horizontal tapered pipe. At the wide end its speed is 4.0 m/s. The difference in pressure between the two ends is 4.5×10^3 Pa. The speed of the water at the narrow end is:

- ☐ 2.6 cm/s
- ☐ 3.4 cm/s
- ☐ 4.0 cm/s
- ☐ 4.5 cm/s
- ☐ 5.0 cm/s



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7. A light wave has a 670 nm wavelength in air. Its wavelength in a transparent solid is 420 nm. What is the speed of light to 2 sig. figs. in this solid?
