

Physics II

Chapter 12 Practice Items

IMPORTANT: Except for multiple-choice questions, you will receive no credit if you show only an answer, even if the answer is correct. Always show in the space on your answer sheet some sketches, words, or equations which clearly justify your answer. Show the equations you use and the values substituted into them whenever equations are necessary. If you go from a formula directly to an answer without showing the values used, you will lose points. Points will also be deducted for missing or erroneous units.

Each individual answer is weighted roughly evenly throughout the exam.

- I will not lie, cheat, or steal in any of my academic endeavors.
- I will forthrightly oppose each and every instance of academic dishonesty.
- I will not request, receive, or give aid in examinations/tests/quizzes.

Name _____

$$\beta = 10 \text{ dB} \left(\log \frac{I}{I_0} \right) \quad I_0 = 1 \times 10^{-12} \text{ W/m}^2$$

$$\text{speed of sound in air} = 340 \text{ m/s} \quad \sin \theta = \frac{v_{\text{wave}}}{v_{\text{object}}}$$

$$v = \frac{\lambda}{T} \quad v = f\lambda \quad f_{\text{obs}} = f_{\text{emitted}} \left(\frac{v_{\text{sound}} \pm v_{\text{obs}}}{v_{\text{sound}} \mp v_{\text{source}}} \right)$$

1. When a wave experience a ‘hard’ reflection, the reflected wave
 - (a) is unchanged from the original wave.
 - (b) **is inverted from the original wave.**
 - (c) has a higher frequency than the original wave.
 - (d) has a shorter wavelength than the original wave.
2. **T/F** Loud sounds travel faster than soft sounds.
3. **T/F** High frequency sounds travel faster than low frequency sounds.
4. How much will the intensity of a sound be at 6 m away compared to 2 m distant?
 - (a) $\frac{1}{9}$
 - (b) $\frac{1}{3}$
 - (c) $3\times$
 - (d) $9\times$
5. You pluck a violin string, which is fixed at both ends.
 - (a) **All harmonics may be present.**
 - (b) No harmonics can be present.
 - (c) Only odd harmonics may be present.
 - (d) Only even harmonics may be present.
6. An organ pipe is open on one end and closed on the other end. When it is played
 - (a) All harmonics may be present.
 - (b) No harmonics can be present.
 - (c) **Only odd harmonics may be present.**
 - (d) Only even harmonics may be present.
7. Which of the following sound level readings would you expect to hear while you are running a vacuum cleaner? [This kind of thing will not be on our test.]
 - (a) 10 dB
 - (b) 40 dB
 - (c) **70 dB**
 - (d) 120 dB
8. In the tuning of a violin string, a pitch pipe of frequency 427 Hz was blown at the same time as the string was plucked and 5 beats were heard every 2 seconds. Then the violin string was slightly tightened with a fine-adjustment screw. When the pitch pipe and the string were sounded together again no beats were heard. The initial frequency of the note produced by the string before any adjustment was made must have been
 - (a) 422.0 Hz.
 - (b) **424.5 Hz.**
 - (c) 429.5 Hz.
 - (d) 432.0 Hz.
 - (e) 437.0 Hz.
9. If two independent sources, each separately at a noise level of 70 dB, are sounded together, they will produce a noise level of
 - (a) 35 dB.
 - (b) 70 dB.
 - (c) **73 dB.**
 - (d) 90 dB.
 - (e) 140 dB.
10. If $\frac{3}{4}$ of the sound energy produced by a typewriter is absorbed by a sponge rubber pad placed underneath, the sound level produced will fall by
 - (a) 0.25 dB.
 - (b) 0.75 dB.
 - (c) 3.00 dB.
 - (d) **6.00 dB.**
 - (e) 12 dB.
11. A moving train sounds a whistle of frequency 500 Hz. The apparent frequency heard by an observer standing close to the railroad is 462 Hz. If the speed of sound in air is 300 m/s, the train is moving at a speed of
 - (a) 23 m/s away from the observer.
 - (b) 23 m/s towards the observer.
 - (c) **25 m/s away from the observer.**
 - (d) 25 m/s towards the observer.
 - (e) 28 m/s away from the observer.

12. A boat travels in shallow water, in which waves of all wavelengths travel at a speed of 4.0 m/s. What is the speed of the boat if the bow wave generated by the boat has an apex angle of 30° ?
- 2.0 m/s
 - 2.3 m/s
 - 4.0 m/s
 - 6.9 m/s
 - 8.0 m/s
13. A loudspeaker produces a sound intensity level of 80 dB at a point P. If the electrical power to the loudspeaker is cut in half, the intensity level at P will be
- 20 dB
 - 30 dB
 - 40 dB
 - 50 dB
 - 77 dB
14. A radio produces a sound level of 50 dB at a point 2 m away from it. What is the sound level at a point 4 m from the radio? (You may regard the radio as a point source.)
- 40 dB
 - 44 dB
 - 46 dB
 - 47 dB
 - 49.7 dB
15. An ambulance, sounding its siren to produce a note of 800 Hz, approaches a stationary pedestrian P at a steady speed of 40 m/s. Calculate the frequency of the sound heard by P. (Speed of sound in air = 340 m/s)
- 706 Hz
 - 716 Hz
 - 800 Hz
 - 894 Hz
 - 907 Hz
16. A vibrating tuning fork sends sound waves into the air surrounding it. During the time in which the tuning fork makes one complete vibration, the emitted wave travels
- one wavelength.
 - about 340 meters.
 - a distance directly proportional to the frequency of the vibration.
 - a distance inversely proportional to the square root of the pressure.
17. In the Doppler effect for sound wave, factors that affect the frequency that the observer hears include which of the following?
- The speed of the source
 - The speed of the observer
 - The loudness of the source
- i only
 - iii only
 - i and ii only
 - ii and iii only
 - i, ii, and iii
18. Which of the following sound level readings would you expect to hear while you are running a vacuum cleaner? [You don't have to memorize the sound levels of common objects.]
- 10 dB
 - 40 dB
 - 70 dB
 - 120 dB
19. An empty 1 liter water bottle behaves like a tube that is closed on one end. When you blow across the open top of the bottle and produce a tone,
- all harmonics may be present.
 - no harmonics can be present.
 - only odd harmonics may be present.
 - only even harmonics may be present.
20. You pluck a violin string, which is fixed at both ends.
- all harmonics may be present.
 - no harmonics can be present.
 - only odd harmonics may be present.
 - only even harmonics may be present.

21. Two strings are adjusted to vibrate at exactly 200 Hz. The tension in one string is increased slightly. Afterward, three beats per second are heard when the strings vibrate at the same time. What is the new frequency of the string that was tightened?

- (a) 194 Hz
- (b) 197 Hz
- (c) 203 Hz
- (d) 206 Hz
- (e) None of these.

1. (a) A certain machine in a factory produces a 65 dB sound level when operated. Calculate the maximum number of machines which can be operated at the same time in the factory if the noise level is not permitted to exceed 71 dB.

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- (b) The following table shows some typical situations in everyday life. State the approximate noise-levels found in these situations. Note that I haven't asked you to memorize these things for the test.

Situation	Noise level / dB
(i) Quiet places such as libraries and hospital wards	30 or 40 dB
(ii) Normal traffic noise in Scottsdale	≈ 70 dB
(iii) Noise at a level which humans cannot bear	≈ 130 dB

2. An Amtrak train sounds its horn as it approaches you while you stand on the platform at the station. The frequency of sound emitted by this horn is 500 Hz. The train is traveling toward you at 30 m/s.

- (a) You obviously can hear a train's horn. But what is the range of frequencies that a human normally can hear, from lowest to highest?

20 to 20,000 Hz

- (b) What is the period of the 500 Hz note sounded by the train?

0.002 s

- (c) As heard by an observer on the train, what is the wavelength of the 500 Hz note?

Use $v = f\lambda$ to get $\lambda = 0.68$ m

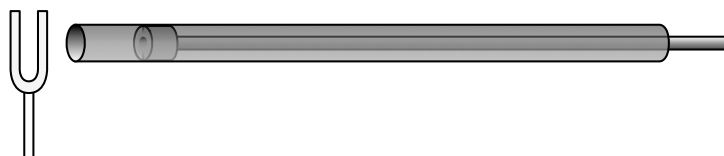
- (d) What is the frequency that you hear?

548 Hz

3. Leaf blowers produce a sound level $\beta \approx 70$ dB at a distance of 50 feet. Suppose that you are enjoying a summer afternoon at the center of a cul-de-sac surrounded by 10 leaf blowers each 50 feet away from you. What will be the sound level you hear resulting from all ten blowers at 50 feet?

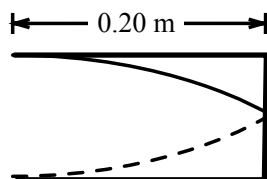
80 dB

4.



A sliding plug is initially positioned at the left end of the tube depicted above. A student sounds a 440 Hz tuning fork and pulls the plug in the tube to the right 0.20 m when a resonance is heard for the first time.

- (a) Sketch a standing wave diagram for the resonating sound wave in the tube when the plug is at this 0.20 m position.



- (b) What is the wavelength of the sound produced by the tuning fork?

0.80 m, because 0.20 m is 1/4 of a wavelength

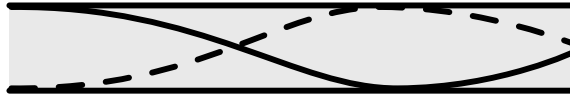
- (c) What is the speed of sound in this tube?

340 m/s

- (d) How far from the left end will the student have to pull the plug in order to hear the next resonance?

3 times farther than 0.20 m, which is 0.60 m or 3/4 of a full wavelength

(e) Sketch the standing wave diagram for this next resonance.



5. If the waves on this lake move at 3 m/s, how fast is the boat moving?

I get the full apex angle to be 15° . So the angle that we are interested in is half that, or 7.5° . Therefore, $\sin 7.5^\circ$ tells us the ratio of wave speed to boat speed. It is 0.13. The inverse of this is the ratio of boat speed to wave speed, and that is 7.7. Therefore the boat speed is about 23 m/s.



6. You see a lightning stroke followed by thunder 10 s later. About how far away was the lightning stroke?

_____ about 2 miles _____