Unit 11 Pre-Test Guide

- Use this guide to help you solve each question. This guide is meant to supplement your efforts to review for the test, not to supplant your efforts to study in earnest.

1. (B) All other choices true, sound cannot travel through a vacuum as it needs a medium.

2. (C) Sound travels the fastest the densest materials. Solids are more dense than gases, liquids and certainly more dense than a vacuum (no density)

3. (B) Sound has it audible frequencies between 20 Hz – 20,000 Hz. Above a level would have a prefix of hyper or ultra.

4. (A) Sound intensity is reduced by the inverse square law as it moves away from its source, but the frequency does not change.

5. (D) Read the reading assignment on Attenuation, page 8/25 from Reading I as listed on the web page [http//www.goddardphysics.weebly.com]. This would confirm the inverse square law $1/R^2$.

6. (B) Consistent with the previous question, if you double the distance (R) this results in the intensity to be reduce by ¼.

7. (C) Be careful on this one. Use the equation $dB = 10 \log I/I_o$ twice, once with $I = 1$ and again with $I = ¼$ or 0.25 you will find that with $I = 1$ the $dB = 120$ then with $I = 0.25$ $dB = 112$

8. (C) Amplitude is a measure of sound intensity.

9. (B) Velocity of sound depends on the substance it travels, so choice (D) is out. Frequency does not change otherwise radio signals would change as it travels through our atmosphere into space to satellites and bounces back.

10. (C) Look up pressure wave, it is a sound wave (longitudinal) . Displacement wave is a transverse wave, like a water wave. Sound travels horizontally “pushing” materials back and forth. Water waves (transverse) move up and down as it propagates its energy (90 degrees) in relation to longitudinal waves which move back and forth.

11. (C) The only thing in common is their frequency. The wavelength is different due to sound moving through two different mediums, thus if frequency is the same and wavelength is different, velocity would be different.

12. (B) Check your notes on the drawings of open vs. closed wind instruments for wave generations. Review how they were drawn on the last pre-quiz. Also check the formula sheet for drawings.

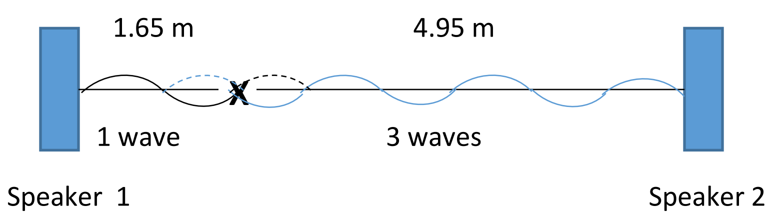
13. (D) If the fundamental frequency is 200 Hz. The harmonics are whole number multiples of this frequency. Therefore harmonics would be 400 Hz, 600 Hz, 800 Hz, 1000 Hz, not 900 Hz.

14. (A) The fundamental frequency n=1. Open tube. The formula $\lambda = 2L/n$ The node is formed in the middle of the tube, with antinodes at the ends. Check the drawing on the formula sheet

15. (C) If the third harmonic is 1200 Hz, divide by 3 to determine fundamental. = 400 Hz. Therefore the 4^{th} harmonic is 4x fundamental = 1600 Hz

16. (B) The fundamental frequency n=1. Closed tube. The formula $\lambda = 4L/n$ The node is formed at the closed end with an antinode at the open end.

17. (B) This one is tricky, follow the best you can. Draw it out.



$V = 330$ m/s $f = 200$ Hz

$\lambda = V / f$

Solve the wavelength λ. $V = f \times \lambda$ $\lambda = 1.65$ m/wave

"In Phase" means that the speakers both generate an up pulse at the same time when the sound leaves the speakers. One wave makes it to point "x" from speaker 1. Three waves makes it to point "x". Notice that once they meet at point "x", they continue beyond. Notice the "dotted" portion of the waves that continue. Compare the "dotted" portion to the portion below and notice they are opposites and will cancel each other. Consequently resulting in <u>destructive interference</u>.

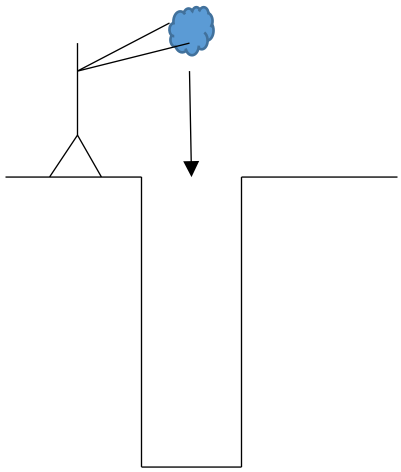
18. (D) Beats are heard when two frequencies are off by 7 or less hertz.

19. (D) Increasing the separation between two tuning forks results in the beat frequency increasing.

20. (B) Safe time in sound is 8 hours at 85 dB. This is cut in half every 3 dB. Therefore the airport worker endured 100 db (140 dB – 40 dB) safely for only 15 min.

21. (A) Keep in mind an echo goes "to and fro" meaning it covers the distance twice. Thus the time of 0.025 seconds must be cut in half to cover the distance the sound covers. $d = v \cdot t$
$d = 340 \text{ m/s} \bullet 0.0125 \text{ s} = 4.25 \text{ m}$

22. (C) Probably the most lengthy question to answer on the test. Practice with help you solve it quickly.



T_{total} = 2.5 s $T_{total} = t_{dn} + t_{up}$
V_{sound} = 340 m/s
D = ?

V = D / t

Keep in mind that the time down does not equal the time up. Because sound is created at the splash and sound travels faster than the falling rock. SO solve distance down and up.

Down

$S = V_o t_{dn} + ½ at^2_{dn}$
Since V_o = 0 m/s
$S_{dn} = ½ at^2_{dn}$

UP

$V = S/t_{up}$ Since velocity is constant (340 m/s)

$S_{up} = V \cdot t_{up}$

- Set these two equations equal to each other since the distance down = distance up.

$$½ at^2_{dn} = V \cdot t_{up}$$

- Since you need time up and/or down to find how deep the well is (distance) you will need to use the previous equation. $T_{total} = t_{dn} + t_{up}$ and rearrange it for either t_{dn} or t_{up} .

  Therefore $t_{up} = T_{total} – t_{dn}$

  Thus: $½ at^2_{dn} = V \cdot (T_{total} – t_{dn})$

  Solve for t_{dn} (may need to use the quadratic equation) and place it back into the equation $S_{dn} = ½ at^2_{dn}$ to determine the depth of the well.

23. (C) Use the decibel equation to solve for the decibel level
    $dB = 10 \log I/I_o$

24. (B) Use the same equation as in #23. But solve for I.

25. (D) Use the equation in problem #27 and solve for I.   Then divide that intensity (I) by 15. Then use this equation and solve for dB.
    .

26. (A) Use the Doppler effect formula to determine the new frequency.

27. (B) Interesting problem. As briefly mentioned in class, sound intensity is the power of the sound per surface area W/m^2. To solve the power (W) we need to cancel the meters squared (m^2). Sound travels spherically, so the formula for surface area of a sphere is $4 \pi r^2$ (page 1 on the formula sheet). Multiply the intensity times surface area.

$$\text{Power} = I \cdot \text{area} \qquad P = 6 \times 10^{-10}\ W/m^2 \cdot 4 \pi (6m)^2$$

28. (C) Use the decibel equation to solve for decibels

29. (C) $1\ mW = 1 \times 10^{-3}\ W$ Determine intensity (I) which is power divided by surface area.

$$\frac{\text{Power}}{\text{Area}} = \frac{1 \times 10^{-3}\ W}{4 \pi r^2} = 3.18 \times 10\text{-}6\ W/m^2 \qquad dB = 10 \log \frac{3.18 \times 10\text{-}6\ W/m^2}{1 \times 10^{-12}\ W/m^2}$$

30. (B) Use the decibel formula to solve the intensity (I) for the one dog barking at 65 dB. Double this answer for two dogs, put it back into the decibel equation and solve for the new decibels.

31. (C) Velocity is not given, therefore use V = 340 m/s. Use the formula for open tubes.

$$f = \frac{V}{2L/n}$$

Solve for "L".

32. (B) Use the equation below to solve for the frequency.

$$f = \frac{V}{4L/n}$$

33. (C) Use the Doppler formula: Solve for f_o. Sound source is moving away from you, therefore V_{sc} is positive.

$f' = 400$ Hz
$f_o = ?$
$V_{sd} = 340$ m/s
$V_o = 0$ m/s
$V_{sc} = 120$ km/h = 2000 m/s

34. (B) Same as #33 except the V_o is negative and V_{sc} is zero.

35. (C) "Mach" is the term for speed of sound. Mach 1.05 is 1.05 times the speed of sound.
Use 331 m/s + 0.6 T = speed of sound. (1.05 x [331 m/s + 0.6T]) =