

Chapter 8 (Sound Transmission)

1. The intensity of a sound in a free, unbounded medium is 95 dB SPL at a distance of 200 meters from the source.
 - a. In accordance with the inverse square law, by how many dB will the SPL be **decreased** at a distance of 2,000 meters from the source? Show your work.

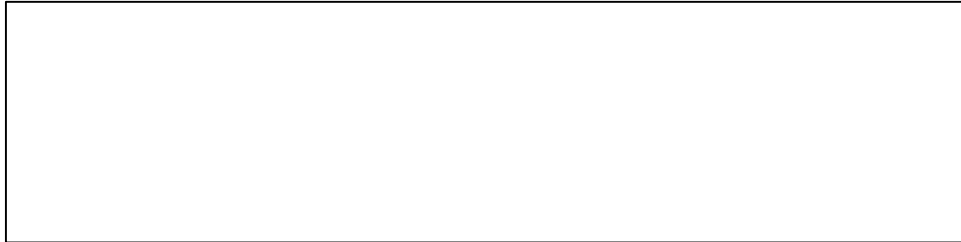
 - b. What is the **level, in dB SPL**, of the sound at a distance of 2,000 meters from the source? Show your work.

2. Describe the ways in which reflecting surfaces and absorbent materials in a medium should cause the inverse square law not to hold strictly.

3. In the discussion of standing waves and resonant frequency for a tube that is *open at one end and closed at the other end*, we stated that a **displacement node** (a point of no vibration) is always located at the closed end of the tube because the air is not free to move, and a **displacement antinode** (a point of maximum vibration) is always located at the open end where the air can move freely. We can also talk about a **pressure node** (a point of zero pressure) and a **pressure antinode** (a point of maximum pressure), because not only are the air particles moving (being displaced), but also sound pressure increases and decreases in the tube. Describe the relation between displacement and pressure nodes and antinodes.

4. The tube shown in (a) below is closed at both ends.

a. Draw the **displacement pattern** for the second resonance, F_2 .



b. If the speed of sound is 340 m/s and the length of the tube is 0.4 m, calculate F_2 (show your work):

5. Two identical loud-speakers produce sine waves at a frequency of 170 Hz. If the speakers are separated by 6 meters, draw a diagram showing the positions of the **nodes** of the standing wave produced by two speakers.

6. You are standing 3 meters from a sound source and measure a sound pressure level of 40 dB SPL. How far do you have to walk away for the sound pressure to reach a level of 33 dB SPL? (Assume spherical waves with no reflections).

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7. Calculate the fundamental frequency of a tube with length of 2 meters for the following conditions:

a. Tube is open on both ends, F_0 : _____

b. Tube is closed on one end, F_0 : _____

8. You have two loudspeakers, one producing a pure tone at position A, the second producing white noise at position D. At position B, the level of the tone and noise are both equal at 55 dB SPL. What is the signal to noise ratio at position C? B is 2 meters from A, C is 2 meters further, and D is 2 meters further still.

