Physics 5B Practice Problems

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1 Multiple Choice Section

1. The figure below shows two identical speakers that are connected to the same amplifier, but Speaker B is wired backwards such that it oscillates 180 out of phase with respect to Speaker A. If the speakers emit the same sound intensity, and if the wavelength of the sound waves is 2 m, then the point P is

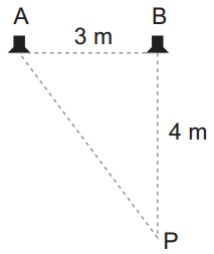

Figure 1: This figure is courtesy of Professor Robert Johnson.

   A. a point of maximum sound intensity.
   B. a point of negative sound intensity.
   C. a point of zero sound intensity.
   D. a point of minimum sound intensity.

2. The wavelength of visible light is closest to
   A. 1 centimeter $10^{-2}m$
   B. 1 Angstrom $10^{-10}m$
   C. 1 micron $10^{-6}m$
   D. 1 nanometer $10^{-9}m$
   E. 1 femtometer $10^{-15}m$

3. The lowest tone to resonate in an organ pipe open at both ends is 200 Hz. What is the frequency of the first overtone that resonates in the same pipe?
   A. 200 Hz
   B. 300 Hz
   C. 400 Hz
   D. 600 Hz
   E. 100 Hz

4. A speaker is radiating sound uniformly in all directions, with no obstructions present anywhere around it. At a distance of 5 m the sound intensity level is 90 dB. Which of the following is the sound intensity level at a distance of 500 m?

   A. 70 dB

   B. 60 dB

   C. 50 dB

   D. 40 dB

5. The figure represents the instantaneous shape of a transverse wave traveling from left to right. At this instant in time, the segment of string at point P has

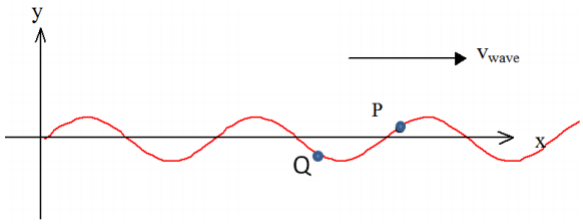

Figure 2: This figure is courtesy of Professor Robert Johnson.

   A. $v_y < 0$ and $a_y < 0$

   B. $v_y > 0$ and $a_y < 0$

   C. $v_y < 0$ and $a_y > 0$

   D. $v_y > 0$ and $a_y > 0$

2 Free Response

6. A cylindrical telescoping pipe is closed at one end and located in a room filled with an unknown gas. An audio speaker located outside the pipe near the open end emits a tone of 2000 Hz. The length of the pipe is slowly reduced until a loud resonance is heard. The pipe is then slowly reduced in length again, by 0.25 m, whereupon a second loud resonance is heard. What is the speed of sound in the pipe?

   What is (approximately) the shortest length that this pipe can have for it to resonate at 2000 Hz?

7. A diverging lens with focal length $f_1 = -6$ cm is placed 10 cm behind a converging lens of focal length $f_1 = 4.0$ cm. A 2 cm tall object is placed 4.0 cm in front of the converging lens. Draw the principal rays to locate final image and verify mathematically. Is the final image virtual or real? Is it upright or inverted?