

Physics 101: The Science of Sound

MiniTest 3a, 10/19/05

Name _____

For questions with numerical answers, draw a box around your final answer.

Except as noted, correct answers get full credit. Incorrect answers get partial credit based on the work shown.

If any problem relies on a previous answer, scoring on that problem will be based on YOUR previous answer, whether or not it is correct.

Potentially useful equations

acceleration due to gravity = 9.8 m/s^2

$$\Delta x = A \cos(\phi)$$

$$\Delta x = A \cos\left(\frac{360^\circ}{T} t + \phi_0\right)$$

$$f = \frac{1}{2\pi} \sqrt{\frac{k}{m}}$$

$$PE = \frac{1}{2} k(\Delta x)^2$$

$$KE = \frac{1}{2} m v^2$$

$$L_I = (10 \text{ dB}) \log\left(\frac{I}{I_0}\right)$$

$$I = I_0 10^{(L_I/10 \text{ dB})}$$

$$\Delta L_I = L_{I1} - L_{I2} = (10 \text{ dB}) \log\left(\frac{I_1}{I_2}\right)$$

$$\frac{I_1}{I_2} = 10^{(\Delta L_I/10 \text{ dB})}$$

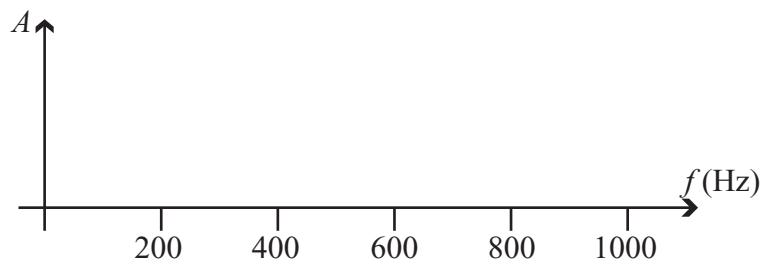
$$A = \pi r^2$$

Scoring:

Raw Total: _____/100 pts

Adjusted Score: _____%

- 1) [15 pts] You are listening to two musical instruments, playing frequencies of 230Hz and 330Hz. Assuming that the spectrum of each instrument has all harmonic partials, sketch the combined spectrum on the axes given. What is the frequency of the 5th partial of the combined sound?



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- 2) [10 pts] Low C and C# have respective frequencies of 131Hz and 138Hz. If played together, with what frequency will beats occur?

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- 3a) [10 pts] A speaker cone (that's the circular part that vibrates to make noise) has a mass of 180g, a radius of 9cm, and is held in place by mountings with a stiffness constant of 230N/m. While playing a certain passage of music, the cone vibrates in and out by 2mm between the extremes of position. How much energy does the speaker cone have?

- 3b) [10 pts] That speaker is radiating 24mW of sound power. What is the Sound Intensity right in front of the cone?

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- 4) [10 pts] What number is half way between 10^{-2} and 10^{-4} on a linear scale?

5) [15 pts] In lab, you measure the sound intensity level of a cell phone ringing to be 74dB. What intensity is that sound?

6) [15 pts] At a cocktail party, your partner in conversation speaks so that you hear their voice at 70dB. Other party-goers are talking, each one creating a background noise (for you) of 60dB. How many people would raise the background to 75dB, threatening to drown out your conversation?)

7) [15 pts] Two sounds are measured to have intensities of $2.0 \times 10^{-3} \text{ W/m}^2$ and $2.4 \times 10^{-3} \text{ W/m}^2$. What is the sound intensity level difference between them?

Extra Credit) [4 pts] If these sounds were played to you, would you most likely be able to tell that they had different loudnesses (Yes or No)?