Physics 101: The Science of Sound
MiniTest 4a, 11/2/04

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

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

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

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

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

$$KE = \frac{1}{2}mv^2$$

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

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

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

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

$$A = \pi r^2$$

$$A = 4\pi r^2$$

acceleration due to gravity = 9.81 m/s^2

semitone ratio = 1.05946

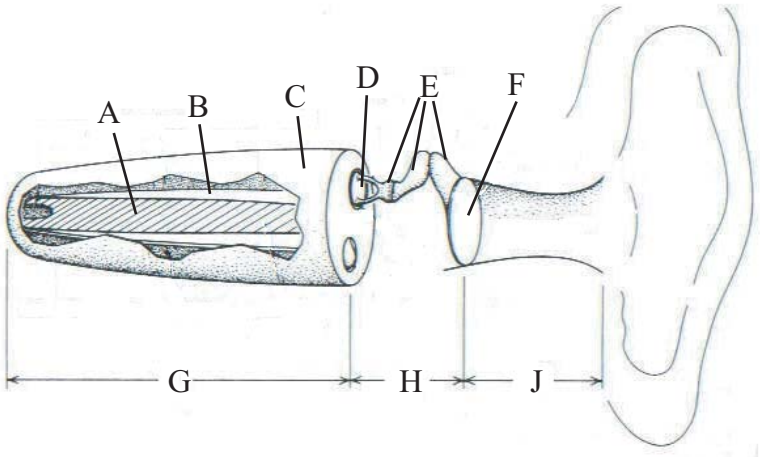
Scoring:

Raw Total: _____/100 pts

Adjusted Score: _____%

Part I: Multiple Choice, etc.; No Partial Credit

1) [10 pts] The above schematic drawing showing the parts of the ear has many parts labeled. Write the appropriate letter label next to the name of each part.
(One listed item is not labeled; leave that one blank.)



____ basilar membrane	____ ear drum	____ middle ear	____ oval window
____ bony shelf	____ inner ear	____ ossicles	
____ cochlea	____ helicotrema	____ outer ear	

---

2) [10 pts] When played simultaneously, the two frequencies 1000Hz and 1050Hz can be heard as separate pitches. The frequencies 1000Hz and 1048Hz sound like one pitch (with a "rough" sound). In this example, 50Hz is a …

(A) just noticeable difference	(B) fusion frequency difference	(C) critical band width
(D) beat frequency	(E) interval	(F) virtual pitch

---

3) [13 pts] The frequency one octave and 2 semitones above 200.0 Hz is …

(A) 402.12 Hz	(B) 204.12 Hz	(C) 224.30Hz
(D) 112.15Hz	(E) 448.98 Hz	(F) 423.70Hz

---

4) [13 pts] A vibration of a speaker with amplitude 0.800mm produces a power output of 3.0×10^{-2} W. What amplitude will reduce the power output to 1.5×10^{-2} W?

(A) 0.566 mm	(B) 0.400mm	(C) 0.200mm
(D) 1.131mm	(E) 0.640mm	(F) 0.894mm

---

5) [13 pts] If the speaker is in the middle of an empty floor, when the power output is 3.0×10^{-2} W, then the sound intensity at a distance of 2 meters will be …

(A) 2.39×10^{-3} W/m^2	(B) 7.50×10^{-3} W/m^2	(C) 1.19×10^{-3} W/m^2
(D) 5.97×10^{-4} W/m^2	(E) 1.20×10^{-1} W/m^2	(F) 1.5×10^{-2} W/m^2

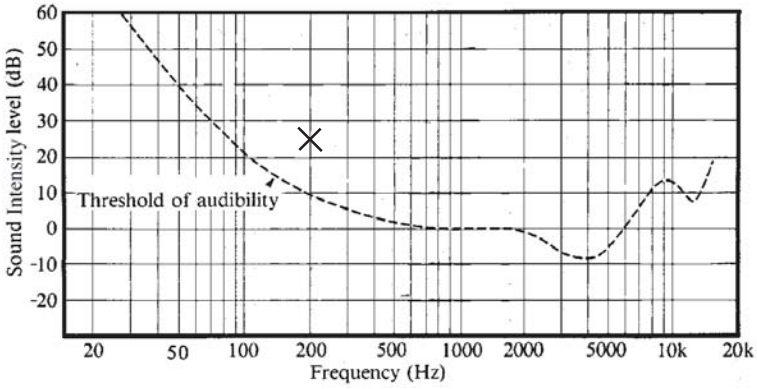
6) [10 pts] The fact that we can hear low pitches from harmonic sounds through the telephone, even though the telephone does not transmit low frequencies, is best explained by …

(A) place theory (B) absolute pitch (C) Fechner's law
(D) Ohm's law (E) delusion (F) periodicity theory

---

7) [10 pts] The X on the graph to the right represents an HL (hearing loss level) at 200Hz of …

(A) -25dB (B) -15dB
(C) -5dB (D) +5dB
(E) +15dB (F) +25dB



Part II: Problems, Partial Credit Available

8) [21 pts] Below is given the intensity spectrum of a sound. Draw the corresponding SIL spectrum (with linear axes). Draw your peak heights accurately; for maximum clarity, label each peak with its SIL.