Physics 101: The Science of Sound
MiniTest 2a, 10/20/06

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.

Scoring:

Raw Total: _____/100 pts

Adjusted Score: _____%

Potentially useful equations

$$g = 9.81 \text{ m/s}^2$$

$$\pi = 3.1415$$

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

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

$$v_{\text{avg,pp}} = 4 \frac{A}{T}$$

$$v_{\max} = \frac{\pi}{2} v_{\text{avg,pp}}$$

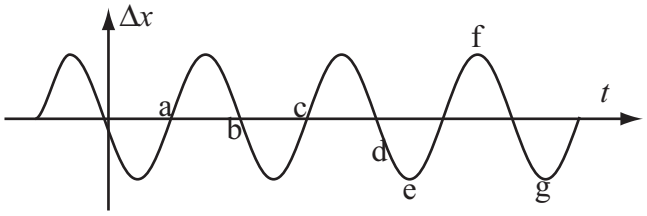
$$f = \frac{1}{2\pi} \sqrt{\frac{k}{m}}$$

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

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

$$E = \frac{1}{2} k A^2$$

1a) [10 pts] The graph to the right shows the SHM of the center of a gong after it is struck. At which of the labeled times does this SHM have the most kinetic energy? (Choose one)



(A) a & c (B) b only (C) e & g

(D) e, f, & g (E) d only (F) a, b, & c

(G) f only (H) It's the same at all points.

1b) [10 pts] For the graph as shown, the initial phase of this motion is closest to … (Choose one)

(A) 0° (B) 45° (C) 90° (D) 135° (E) 180° (F) 225° (G) 270° (H) 315°

(I) It depends on which letter you are refering to (**a** or **b** or whatever)

Add "using cosine"

2a) [10 pts] While tuning a piano, two strings get to be almost (but not quite) the same pitch: one is at 315Hz and the other at 317Hz. If they are played at the same time, you would hear … (Choose ***all that apply***)

(A) a single pitch.
(B) two simultaneous pitches, if listening analytically.
(C) a sound that warbles, switching back and forth between the pitches.
(D) a steady volume of sound.
(E) a sound that gets louder and softer repeatedly.
(F) an unexpectedly soft sound, as the two will tend to cancel each other out.

2b) [10 pts] In this situation, the beat frequency is … (Choose one)

(A) -4 Hz (B) -2 Hz (C) -1 Hz (D) 1 Hz (E) 2 Hz (F) 4 Hz (G) 158 Hz (H) 316 Hz.

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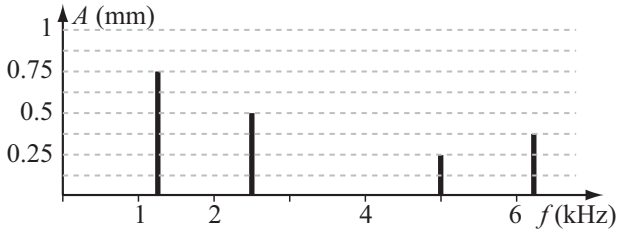
3) [10 pts] An amplitude spectrum for the motion of a vibrating surface is shown. If the resulting sound has a fundamental with an intensity of 1.00×10^{-7}W/m^2, then what is the intensity of the 4th harmonic? (Choose one, all options are in W/m^2)

(A) 3.33×10^{-8} (B) 1.11×10^{-8} (C) 2.50×10^{-8}

(D) 3.00×10^{-7} (E) 9.00×10^{-7} (F) 2.00×10^{-7}

(G) 5.00×10^{-8} (H) 5.77×10^{-8}



4) [10 pts] Given the spectrum from the previous problem, the period of that complex sound is … (Choose one)

(A) 0.8ms (B) 1.25kHz (C) 0.8ms and 0.4ms (D) 0.2s (E) 0.16ms

(F) 6.25kHz (G) 0.8s (H) [This complex sound doesn't have a well defined period.]

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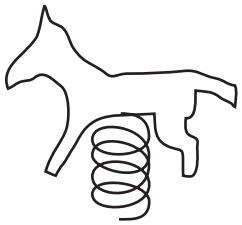
5) [20 pts] A toy in the park playground is made of an animal statue (mass 12kg) mounted on top of a very stiff spring. If a 16kg child sits on the animal, it moves 2cm downward. At what frequency will the child then be able to bounce?f



Not for credit: what animal is that, anyway? _____

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6) [20 pts] Below are graphs of an microphone diaphragm's position when it detects two pure tones separately. Draw, on the same graph, what the position vs. time would be while detecting both sounds simultaneously (assuming they are aligned as shown).