

# Physics 101: The Science of Sound

## MiniTest 5a, 12/18/06

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: \_\_\_\_\_%

1) [18 pts] Identify the correct final pitch for each initial pitch and musical interval:

- (a) One octave below 100Hz is (A) 12.5Hz (B) 50Hz (C) 98Hz (D) 200Hz (E) 800Hz  
 (b) One fourth above 200Hz is (A) 150Hz (B) 200.25Hz (C) 250Hz (D) 266.7Hz (E) 800Hz  
 (c) One fifth below 300Hz is (A) 60Hz (B) 200Hz (C) 240Hz (D) 450Hz (E) 1500Hz  
 (d) Four semitones below 400Hz is  
 (A) 310.2Hz (B) 317.5Hz (C) 395.8Hz (D) 398Hz (E) 504Hz  
 (e) One octave and a fifth above 500Hz is  
 (A) 200Hz (B) 666.7Hz (C) 1005Hz (D) 1100Hz (E) 1500Hz  
 (f) One fifth and one whole tone below 600Hz is  
 (A) 119Hz (B) 356.4Hz (C) 399Hz (D) 901Hz (E) 1010.2Hz

2) [16 pts] In the table below, fill in columns left of the double line. Right of the double line, place FIVE examples in the appropriate categories, with at least one in each category. For each example, give what method(s) it uses to play a variety of frequencies (a word or two is enough).

Category	Sub-category	Vibration Source	Example Instrument	Methods for Frequencies
Brass				
Woodwinds				

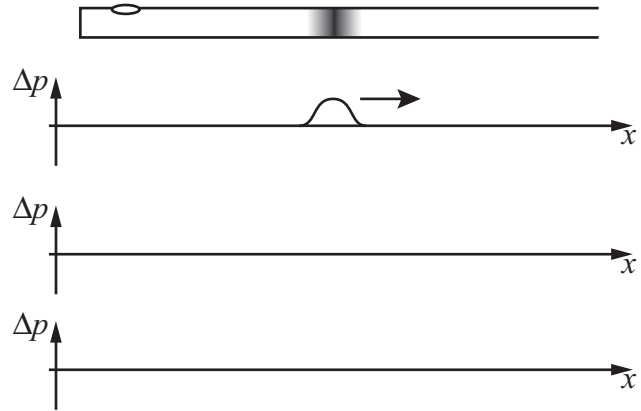
3) [10 pts] The line to the right represents a taut string in its equilibrium position.

- (a) Draw (between the same end points) a representation of a standing wave with length equal to two wave lengths.  
 (b) How many nodes does your picture have?



(c) What is the harmonic number of your standing wave?

4) The picture represents a flute; the small oval is the embouchure hole, and all finger holes are closed. The first graph shows an air compression traveling in the tube just after having been blown in the embouchure hole.



(a) [8 pts] Label the two ends of the flute “fixed” or “free,” as appropriate for the graphs.

(b) [8 pts] On the next two axes, show how the pulse looks the next two times that it passes the middle of the instrument (moving in either direction). Include arrows showing the direction that the pulse is traveling.

5) [15 pts] A large pipe shown here from a pipe organ is open at the top, and you can see the wind hole near the bottom. If it sounds a note with frequency 76Hz, what do you expect is the distance between the end and the air hole?



6) [10 pts] Another pipe on that organ is identical to the 76Hz one, except that the top end is closed off. What frequency does that pipe make?

7) [15 pts] A clarinet (length 61cm) with all finger holes closed sounds the same frequency as a particular string on a piano. That string is 1.30m long, and is stretched with a tension of 95N. What is the linear mass density of the string?