# Phys 1010 Homework 10 (Fall 2012)
# Due Monday Dec 3 midnight, 20+ pts

**1.)** (2pts) **HW 9 Correction.** Each week you should review both your answers and the answer key for the previous week's homework. Often (including this week) you will get to submit one homework correction. Select one problem for which you had the wrong answer. In the text box below, 1) identify the question number you are correcting, 2) state (copy) your original wrong answer, 3) explain where your original reasoning was incorrect, the correct reasoning for the problem, and how it leads to the right answer. If you got all the answers correct!!! bling bling... state which was your favorite / most useful homework problem, and why.

**For the next part of the homework we will be using the Sound Simulation to help us investigate sound waves. It is available online from the Phys 1010 website: http://www.colorado.edu/physics/phys1010**

Begin by visiting the Sound Applet and exploring the various controls you have:

- you can change amplitude and frequency of the sound wave
- you can move the listener toward or away from the speaker
- you can turn the audio on or off, and you can listen to either the sound at the speaker or the sound heard by the listener
- you can switch between the Listen Screen and the Measure Screen
- in the Measure Screen you have a ruler and timer which you can use to make measurements; you also have blue lines which you can move around to help you measure.
- you can stop, run, or clear the sound waves
- you can add another tone, and octave above the primary frequency, and observe the change in the wave form and the sound out of your speaker.

**For questions 2-4: The Listen Screen of the sound simulation lets you adjust the frequency and amplitude sliders and move the listener. The solid gray of the background represents the pressure of the air when no sound wave is present. A darker color represents higher pressure and vice versa. Use the adjustments available to closely examine the relationship between the movement of the speaker cone and the sound waves produced and traveling away from the cone.**

**2)** (0.5pt) When I increase the volume produced by the speaker, how does the movement of the speaker cone change?

a) moves back and forwards more times per second
b) moves back and forward fewer times per second
c) bigger movement - moves further back and further forward
d) smaller movement – moves less far back and less far forward
e) a and c
f) b and d

**3)** (0.5pt) To increase the pitch of the note produced by the speaker, how does the movement of the speaker cone change?

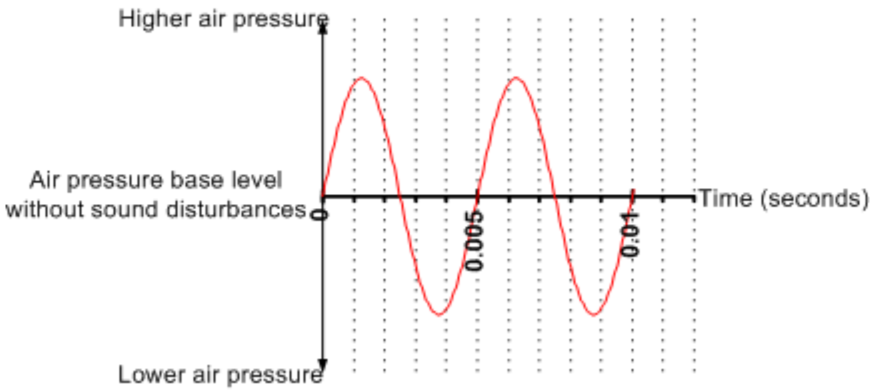
a) moves back and forwards more times per second
b) moves back and forward fewer times per second
c) bigger movement - moves further back and further forward
d) smaller movement – moves less far back and less far forward
e) a and c
f) b and d

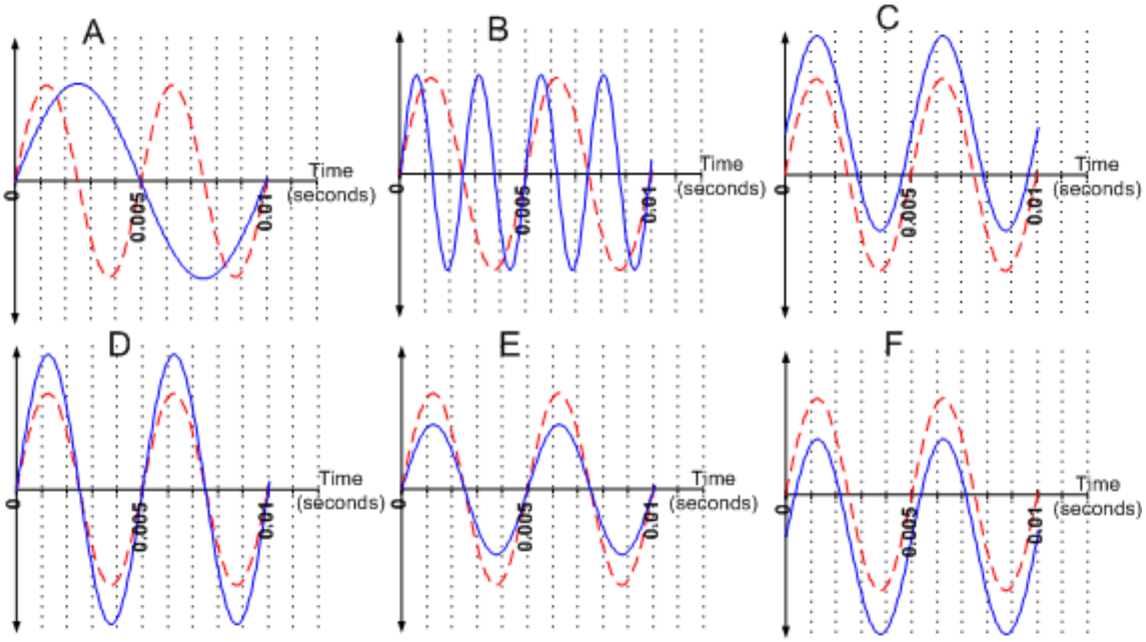
**4)** (0.5pt) To decrease the pitch of the note produced by the speaker, how does the movement of the speaker cone change?

a) moves back and forwards more times per second
b) moves back and forward fewer times per second
c) bigger movement - moves further back and further forward
d) smaller movement – moves less far back and less far forward
e) a and c
f) b and d

**The following graphs relate to Questions 5-9.**

In the top graph we have plotted the pressure measured at the listener's ear as a function of time for a 200 Hz tone generated by the speaker. In the lower graphs of pressure versus time, the dashed red line indicates the original 200 Hz tone. Select the solid blue curve(s) that represents the variation in the pressure at the eardrum versus time in the following situations (you might need to select more than one graph):



**5)** (0.5pt) The speaker is producing a 100Hz tone.

**6)** (0.5pt) The speaker is producing the original 200Hz tone at the original volume and the listener is at the same distance from the speaker.

**7)** (0.5pt) The listener has walked closer to the speaker.

**8)** (0.5pt) The speaker volume is turned down.

**9)** (0.5pt) The speaker produces a tone of a higher pitch.

**10)** (2pts)You hear a Concert A tone from the speaker. Describe the motion of the speaker and how this motion leads to our ears detecting Concert A tone. (include the chain of cause-and-effect logic that results in your hearing Concert A tone from the speaker)

**For Questions 11-13: go to the measure screen on the sound simulation. Initially set the frequency to 500Hz.**

**11)** (0.5pt) If you were listening to this sound, what is the time between adjacent pressure maximums?

a. 500s
b. 1s
c. 0.02s
d. 0.001s
e. 0.002s

**12)** (1.5 pt) Make a measurement of the wavelength using the blue bars and the ruler (Frequency still set at 500Hz). What is the wavelength? Is it more accurate to measure just one wave or the length of several waves?

**13)** (1.5 pt) Use this measurement to calculate the speed of sound in air.

**14)** (2pt) Repeat Questions 12 and 13 at a higher pitch of your choice.

What frequency did you choose?

What is the wavelength?

What is the speed of sound calculated from this second measurement?

Is this answer significantly different (beyond errors in measuring the wavelength) from the speed of sound calculated in Question 13? Is that what you expected?

**In questions 15-18, you are asked to comment on the effect of various changes on the tone of a violin string. Does each change make the tone lower, higher, or leave it unchanged?**

**15)** (0.5 pt) Making the string thicker:

a) Lower
b) Higher
c) Unchanged

**16)** (0.5 pt) Making the string thinner:

a) Lower
b) Higher
c) Unchanged

**17)** (0.5 pt) Making the string looser:

a) Lower
b) Higher
c) Unchanged

**18)** (0.5 pt) Pressing the string down on the fingerboard:

a) Lower
b) Higher
c) Unchanged

**19)** (1 pt) As a violin string vibrates, its motional energy is changing rapidly with time. What 2 types of energy are involved in the motion of an oscillating string such as a violin string (ignore friction and changes in GPE):

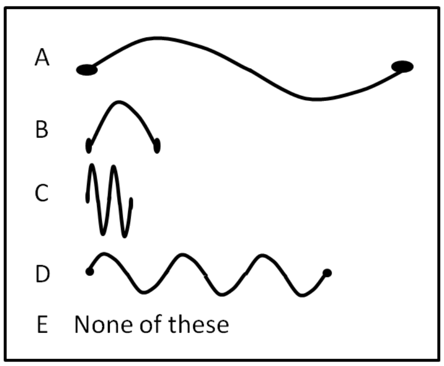
a) KE and work
b) KE and EPE (elastic potential energy)
c) KE and thermal

d) PPE and EPE
e) KE and PPE

**20)** (0.5 pt) Most of the sound from a violin comes directly from the strings. (T/F)

**21)** (0.5 pt) A violin string can only produce a single frequency unless its tuning is changed. (T/F)

**The strings in the drawing below are all fixed at both ends. The picture shows the strings at one instant in time. This drawing is used for Questions 22-23.**

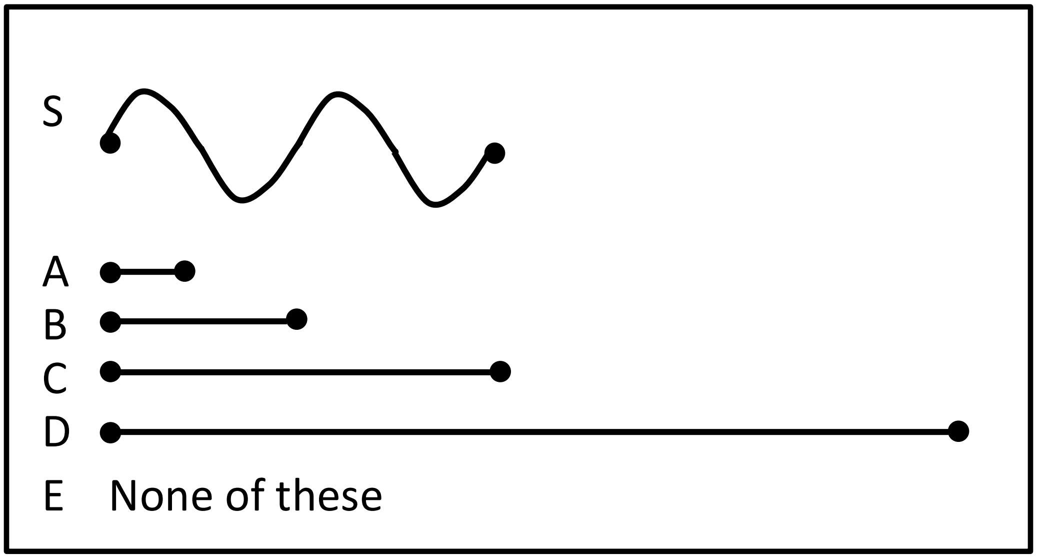



**22)** (0.5pt) Which string is oscillating in its fundamental mode?

**23)** (0.5pt) How many wavelengths are shown on string D?

a) 1
b) ½
c) 2
d) 3
e) 4

**The oscillating elastic string (S) in the picture below is fixed at both ends. The picture shows a snapshot of the string at one instant in time. This picture is used for Questions 24-25.**




**24)** (0.5pt) In what harmonic mode is string S oscillating?

a) Fundamental ($1^{st}$ harmonic)
b) $2^{nd}$ harmonic
c) $4^{th}$ harmonic
d) $8^{th}$ harmonic
e) None of these

**25)** (1 pt) The stationary strings A – E are made of identical material and have identical tension. Which has a fundamental frequency that is the same as the current oscillation frequency of string S?

**26)** (2 pt) **BONUS QUESTION:** Home experiment: Test some of your predictions to questions 15-18. Most of you probably don't have violin strings lying around at home, but you can use other types of string or rubber bands instead. Describe the materials you used, and the way you went about testing your predictions. Did your results match up with what you expected?