## 2011 PreAP Harmonic Motion 5

For the next two questions, be sure to start with the formula. Put in the change, then follow the math.

1. On planet Xorgon the acceleration due to gravity is $1 / 2$ that of the earth's.
A. * By what factor would the period of a pendulum change on Xorgon?
B. * By what factor would the period of a spring-mass system change on Xorgon?
2. A pendulum is moved to planet Pidronium where the acceleration due to gravity is $1 / 8$ the strength of the earth's. (Careful!) What is the change in frequency of the pendulum?
3. An open pipe has a third harmonic of 520 Hz . What is the length of the pipe if the speed of sound on this day is $352 \mathrm{~m} / \mathrm{s}$ (Boy, is it hot!).
4. A closed pipe is 18 cm long. If the second possible harmonic is 1400 Hz , what is the speed of sound that day? (And is it a hot day?)

| 5. Fill in this table. | Pendulum | Spring |
| :---: | :--- | :--- |
| Equilibrium <br> position |  |  |
| Point of Maximum <br> Displacement |  |  |
| Amplitude |  |  |

6. If the speed of sound in air is $340 \mathrm{~m} / \mathrm{s}$, what is the wavelength of a 12 kHz sound?
7. What is the frequency of a sound wave in air that has a wavelength of 12 mm ?
8. A string has a length of 0.8 m .
A. What is the wavelength of the natural frequency of the string?
B. What are the wavelengths of the first 3 harmonics of the string?
C. If the speed of sound in air is $342 \mathrm{~m} / \mathrm{s}$, what is the frequency of the fundamental

I
 for this string?
D. What are the frequencies for the first 3 harmonics of the string?
9. A. How are frequency and pitch related?
B. How are they different (book question)?
10. In which materials is the speed of sound greater:
A. Solids or gases?
B. Dense or non-dense materials?
C. Fast vibrating or slowly vibrating molecules?

From the "Wave Action":
11. Use the four waves shown at the right for the following.
A. Which pair of waves are in-phase: I and II OR III or IV?
B. Which pair of waves will produce destructive interference?
C. Below each pair of waves, sketch the result of the interference that will result.


$$
\mathrm{I}+\mathrm{II}:
$$


$I V \vee \sqrt{~}$ III + IV:
12. Use the graph at the bottom left to answer parts A thru C below.
A. Wavelength =
B. Amplitude =
C. If the wave is vibrating at 380 Hz , what is its speed?
D. Adding the two waves together at each point, draw the combined wave on the third graph below. This is known as "superposition".


Now turn to the "Standing Waves" notes:
13. Why do guitars have a body?
14. A small music box organ plays when the handle is turned, but it is not very loud when held in your hand.
A. How can you make it louder?
B. What is this called?



This is true ANY time that one object (one force) causes another object to vibrate a lot (like a loud sound).
A forced vibration can cause an object to vibrate at any frequency, but it will not be a large vibration: it doesn't "fit".
15. Give the other two names for the first harmonic.

80 dB 200 Hz

16. Use the three instrument pictures at the left to answer the following.
A. Which one has the greatest amplitude?
B. Which one has the highest frequency?
C. Which two have the same timbre?
D. Which one is playing the longest wavelength?
E. Which one is producing the fastest speed of sound?
F. Which one has the smallest period?
G. Which two will sound "in tune"?
H. Why?
17. A sound source has an intensity of $2.1 \times 10^{-7} \mathrm{~W} / \mathrm{m}^{2}$ from 10 m away.
A. How powerful is the sound source?
B. What would be the intensity twice as far away?

18. Slim Jim is driving his truck and honks its horn when he sees Slim Kim on the side of the road.
A. What does Kim hear as the truck passes?
B. What does Bim the dog hear in the back of the truck?
C. What is this called?

