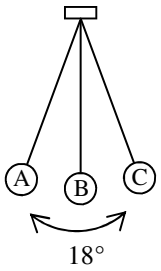
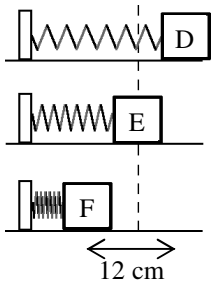
A-Day Due Mon., Apr 10
B-Day: Due Tues., Apr 11

2009-10 PreAP Harmonic Motion 5

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 if a 5 kg mass is on the spring?





2. Fill in this table.	Pendulum	Spring
Equilibrium position		
Point of Maximum Displacement		
Amplitude		

3. What is the speed of sound in air?

4. What is the wavelength of a 12 kHz sound?

5. What is the frequency of a sound wave that has a wavelength of 12mm?

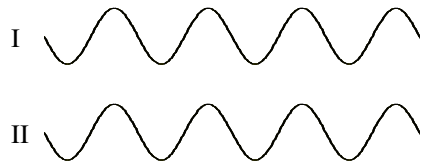
6. A string has a length of 0.8m.
   A. What is the wavelength of the natural frequency of the string?
   B. What are the wavelengths of the first 3 harmonics of the string?
   C. If the speed of sound in air is 342 m/s, what is the frequency of the fundamental for this string?
   D. What are the frequencies for the first 3 harmonics of the string?

7. A. How are frequency and pitch related?
   B. How are they different (book question)?

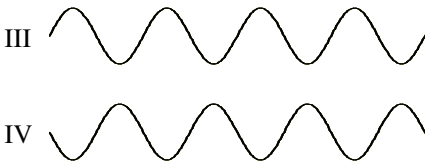
8. In which materials is the speed of sound greater:
   Solids or gases?
   Dense or non-dense materials?
   Fast vibrating or slowly vibrating molecules?

From the "Superposition" notes (or "Wave Action" notes)

9. Use the four waves shown at the right for the following.
   A. Which two 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.

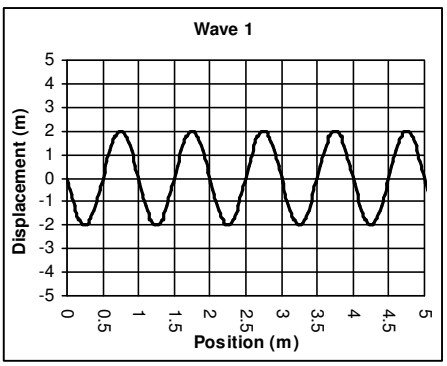


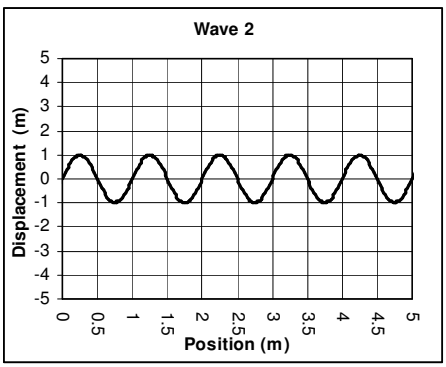
I + II:

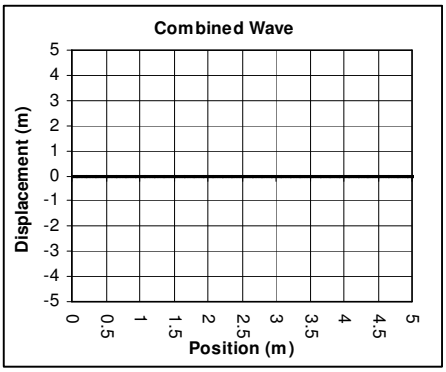


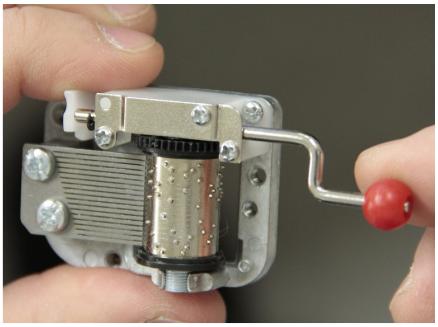
10. Use the graph at the bottom left to answer the A-C.
    A. Wavelength = B. Amplitude =
    C. If the wave is vibrating at 380 Hz, what is its speed?
    D. Using the superposition principle, draw the combined wave below.

III + IV:









Now turn to the "Standing Waves" notes:

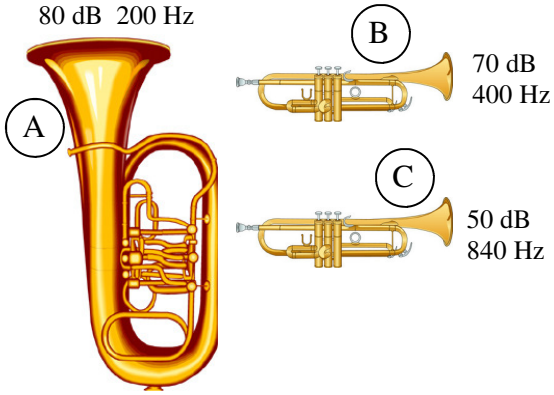
11. Why do guitars have a body?

12. 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".

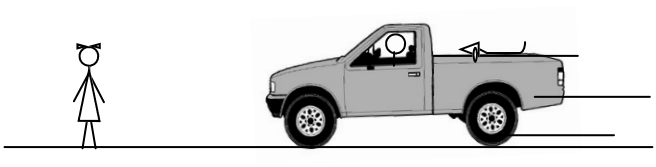
13. Give the other two names for the first harmonic.



14. 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?

15. A sound source has an intensity of 2.1×10^{-7} W/m^2 from 10 m away.
    A. How powerful is the sound source?

    B. What would be the intensity twice as far away?



16. 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?

AND DO THE TAKS PAGE.

Day 23—Energy

Energy can create forces or can cause something to move. An object that is above the ground or moving can cause another object to move.

Kinetic Energy—Energy of motion.

Kinetic Energy (in Joules) → $E_k = (\frac{1}{2})mv^2$ ← mass (in kilograms); ← velocity (in m/s) squared

Potential Energy—Energy due to height.

Potential Energy (in Joules) → $PE = mgh$ ← height above ground (in meters); ← mass (in kilograms); ← acceleration due to gravity (9.8 m/s^2)

Work—How forces add or subtract energy.

Work (in Joules) → $W = Fd$ ← Distance moved (in meters); ← Force (in Newtons)

If the object doesn't move—no work was done because the object's energy doesn't change. More power means a faster energy transfer OR faster work. Running requires more power than walking.

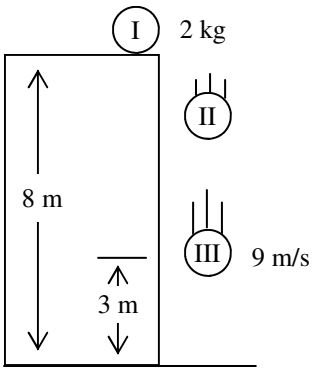
Power—How fast energy is transferred.

Power (*in watts*) → $P = \frac{W}{t}$ ← Work (*in joules*); ← Time (*in seconds*)

Efficiency—what % of the work is not lost to friction.

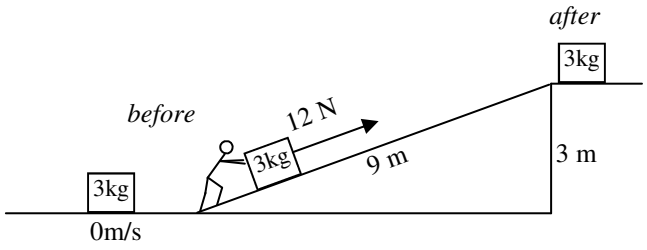
Efficiency (in %) → $Eff = \frac{W_{out}}{W_{in}} \times 100$ ← Energy out (in J); ← Work in (in J)

Law of Conservation of Energy—Energy cannot be gained or lost, only converted into other types of energy. An object can gain energy, but only if work is done (it is moved by a force). If an object loses energy, than work has been done. That "lost" energy is actually converted to heat, like thru friction.



1. What kind of energy is it losing as it falls?
2. What kind of energy is it gaining as it falls?
3. Calculate its energy at the top (use g = 10 m/s^2).
4. Calculate how much potential energy it has at III.
5. How much potential energy did it lose from I to III?
6. How much kinetic energy does it have at III?
7. How much energy was lost from I to III?
8. Where did the energy go?

9. Slim Jim pushes a box up a ramp.
   A. Calculate how much work he does moving the box 9 m up the ramp.
   B. Calculate how much energy it has at the top of the ramp.
   C. Did all of his work become energy?
   D. Calculate the efficiency of his energy transfer.



   E. If it took 20 seconds for him to move the box up the ramp, how much power did he use?

Economic and Environmental impact of energy sources.

10. Solar cells produce electricity from _____.
11. If a house has solar cells for some of its electricity needs, how would their electric bill change?
12. If solar power became more common, would coal fired power plants need to use more or less coal?
13. How would the use of solar cells affect air pollution?
14. Which costs more in the long run: disposable or rechargeable batteries?
15. What affect would switching to rechargeable batteries have on landfills (dumps)?