B-Day: Due Fri., Apr 9
A-Day: Due Mon., Apr. 12

2009-10 Harmonic Motion 9 Test Review

(1) $T = 2\pi\sqrt{\frac{l}{g}}$ (4) $f = \frac{1}{T}$

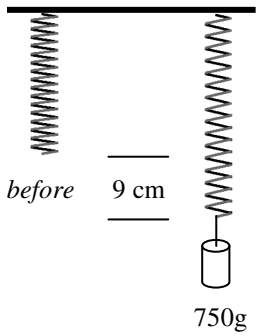
(2) $T = 2\pi\sqrt{\frac{m}{k}}$ (5) $F = -kx$

(3) $v = f\lambda$ (6) $S = \frac{D}{T}$

From "*Harmonic Motion Basics*" Table:

1. Which equation do you use? (*May be used more than once.)*

A. _____ Find the period of a spring given the mass and spring constant.
B. _____ Find how far a wave travels in a 8 seconds.
C. _____ Calculate the period of a spring that has a frequency of 10 Hz.
D. _____ Calculate the length of a pendulum that has a period of 0.5 seconds.
E. _____ Calculate the wavelength of a 20 Hz wave.
F. _____ Find the spring constant of a spring given the force and how far it stretches.
G. _____ Find the frequency of a sound wave, given the period.



2. A 750 g mass is attached to a spring. The spring stretches 9 cm.
   A. On the diagram, change the numbers to standard units.
   B. How much ***force*** is pulling down on the spring?

   C. By Newton's 3rd Law, with how much force is the spring pulling up?
   D. How far is the spring stretched?

   F. Calculate the spring constant of the spring.

3. What is the period of a pendulum that is 55 cm long?

From "*Standing Waves*"

4. A. Which harmonic is 2.5 wavelengths long?
   B. Which harmonic has the fastest wave speed?
   C. Which harmonic has 5 nodes?
   D. What is the natural frequency for this string?

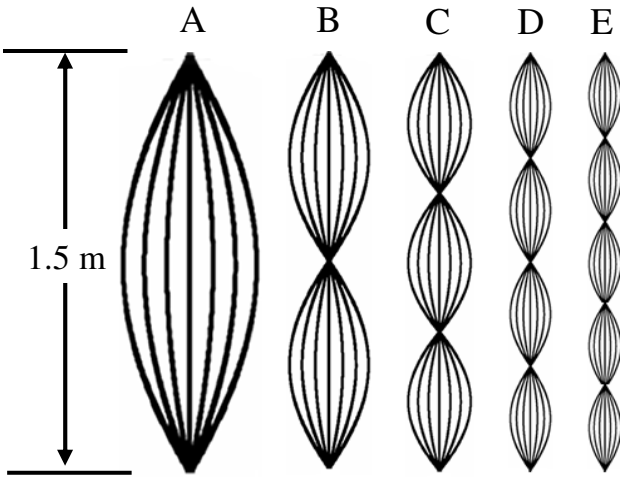
   E. What is the wavelength of the fundamental frequency?

   F. What is the wavelength of the 3rd harmonic?

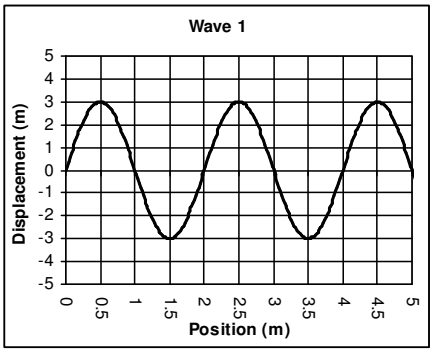
   G. What is the frequency of H_3?

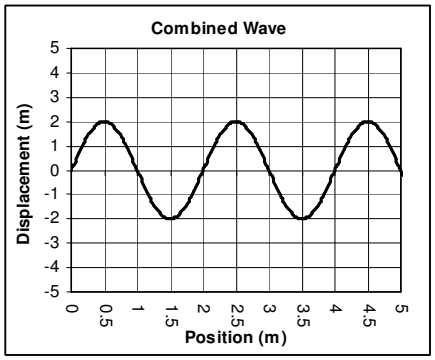
   H. What is speed of the third harmonic?

   I. What is the speed of the 4th harmonic?



48 Hz





From "*Wave Interactions*":

5. The superposition principle is how we add the energy of waves together. Wave 2 is not shown.
   A. What must Wave 2's amplitude be?

   B. Is Wave 2 in phase or out of phase with Wave 1?

   C. Wave 1's wavelength =

From "*Sound*"

6. Which has a lower frequency (smaller number): a high note or a low note?
7. Which has a longer wavelength: a high note or a low note?
8. A louder note has more or less amplitude than a quiet note?
9. We hear 10 more decibels as:

10. Is sound faster in gases or solids? In elastic substance (springy) or inelastic?

11. What is faster: sound or light?

From "*Ancillary Sound Topics*"

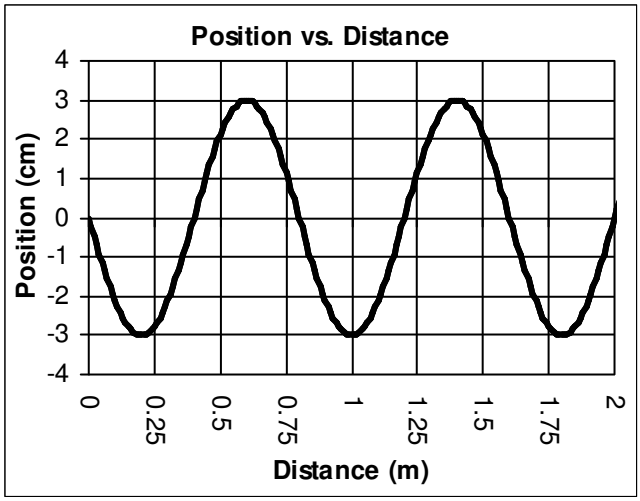
12. A gun is fired in a cave. The echo returns in 1.8 seconds. How deep is the cave?

13. A 560 Hz sound and a 555 Hz sound are played together.
    A. How many beats are heard each second?
    B. If the frequencies get closer are there more beats or less beats per second?
    C. What causes the beats?

14. A clarinet and a trumpet can be playing the same notes, but they sound different because the have different t_____. This is because the actual sounds are made up of different amounts of different h_____.

Just as velocity is in m/s (meters divided by seconds) and frequency is in cycles/sec (cycles divided by sec), wavelength is in meters for each wave OR # meters/ # of waves (cycles).

15. A. How long is the graph?
    B. How many wavelengths are shown?
    C. Calculate the wavelength of the wave.



And do the TAKS homework.

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.

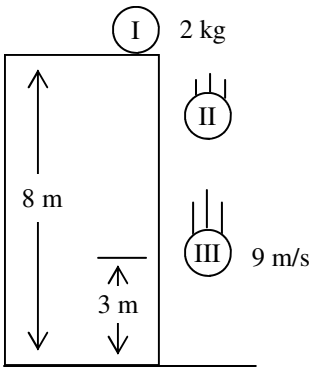
Power—How fast energy is transferred.

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

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

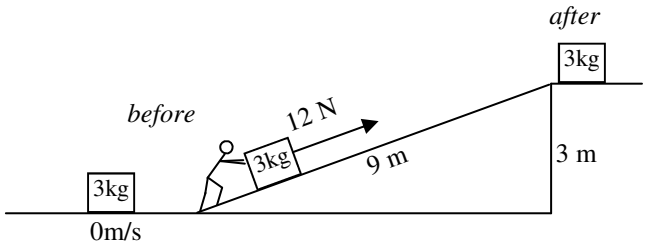
Efficiency (in %) → $Eff = \frac{W_{out}}{W_{in}} \times 100$ ← Energy out (in J); ← Work in (in J)

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)?