Announcements – 1 Dec 2009

1. Reading assignment modification: Since we didn't talk about "bulk modulus" or "Young's modulus" back in chapter 9, you can skip section 14-5 (8th edition) in Thursday's reading assignment which refers to those two properties.

2. Exam 4 results:
   a. 75th percentile =
   b. 50th percentile (median) =
   c. 25th percentile =

3. Final exam info
   a. Take in Testing Center any time during Finals week
   b. No time limit, no notes, no calculators (can check one out)
   c. I plan 40-43 questions
      i. 10-11 on new stuff (Chap 13 & 14)
      ii. 30-32 on Chapters 1-12 (midterms 1-4)
   d. I will shoot for 75-79% average

4. **Clicker quiz:** Vote for option A or option B
   a. Option A: Final as planned; I will put a safety net at 76% (curving it up if average/median is less than 76%)
   b. Option B: Final will **also** replace one of your midterm exam scores if that helps you (computer will choose which one helps most)
      i. …but safety net will be set a little lower, at 72%

   For reference: 2007 final: 71% 2008 final: 64%.

5. Instructor/course evaluations due before Dec 13
   http://studentratings.byu.edu
   → Please take both the ratings and the comments seriously. I read every single comment, as does the Physics Department promotion/tenure committee.
   → Sorry, no extra credit, I consider it your "civic duty"

6. Soon I will be sending around my own survey, of possible ways to improve the class for next time around. Things like,
   - "Should I give one more free late HW?"
   - "Should I give only 3 midterms instead of 4?"
   - "Should I take out the section on engines even though it's on the MCAT?"
   - "What are some ways you would improve the course if you were the teacher?"
   - Etc.

   I **will** make changes based on your feedback!

   Clicker quiz: Vote for option A or option B
   a. Option A: Do the "Colton survey" kind of like a warmup
      i. You put in your CID, so it's not completely anonymous
      ii. Since I will know who completed the survey, I can give you extra credit (probably 2 points)
   b. Option B: Fully anonymous
      i. no CID
      ii. no extra credit either

"Simple harmonic motion"

→ **Sinusoidal *vibrations***

Demo: weight on spring

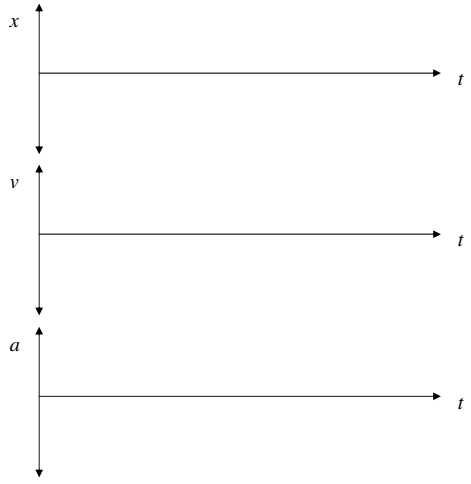
Occurs when an object has a **spring-like** restoring force:

F ~ displacement

Result: $x=A\cos(\omega t)$

→ or $x=A\sin(\omega t)$ or $x=A\cos(\omega t+\phi)$ ...what's the difference?

A = "amplitude", how far from origin it travels



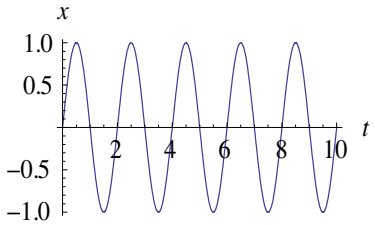
Quick proof, using simple calculus (sorry):

x =

v =

a =

Reading info from graph:



Amplitude A= _____

Period T = _____ sec

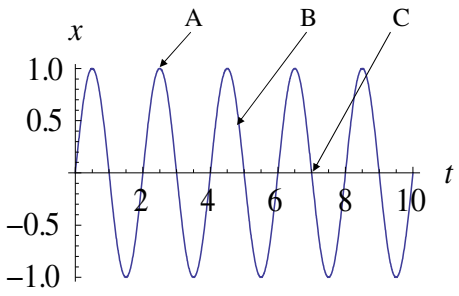
Frequency f = _____ cycles/sec (Hz)

Angular frequency ω =_____ rad/sec

$$f = \frac{\omega}{2\pi}$$

Angular frequency?? Where's the angle?

Demo: SHM/Circular motion analogy



Clicker quiz 1: Where does it have the most kinetic energy?

a. position A
b. position B
c. position C

Clicker quiz 2: Where does it have the most potential energy?

a. position A
b. position B
c. position C

Clicker quiz 3 (from warmup): Where does it have the largest acceleration?

a. position A
b. position B
c. position C

Springs

Demo: spring with mass

Frequency, period:

Pendulums

Demo: pendulum

Frequency, period:

(plotting θ vs t)

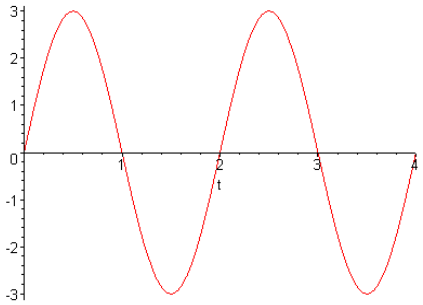
Clicker quiz: Does period depend on amplitude?

a. yes
b. no
c. it depends

From warmup: Consider a mass m hanging on a spring. We pull the weight downward and then release it so that it oscillates up and down. If we repeat this on the *moon* with the same weight and the same spring, the frequency of the oscillation will be:

a. larger
b. smaller
c. the same

Clicker quiz: Given the oscillation picture below,



what's the correct equation to describe the position vs. time?

a. x(t) = 6 cos(t)
b. x(t) = 3 sin(2t)
c. x(t) = 6 sin(2t)
d. x(t) = 3 sin(πt)
e. x(t) = 3 cos(πt)

Worked Problem: A 70 kg trapeze artist swings on a long trapeze and takes 5 seconds to return to his starting spot.

How long will it take a woman of mass 50kg to make the same swing? _____ sec

How long will it take for the 70 kg man to swing from his starting place to when he first reaches the bottom?
_____ sec

How long is the rope? _____ m

From warmup: Ralph is confused about pendulums. He read in the textbook that the period T of a pendulum depends on its length L and on the acceleration of gravity g,but does not depend on its mass. Ralph thinks that heavier pendulums should swing with a longer period. After all, if he puts a heavier weight on the end of the spring, it oscillates more slowly. Can you help Ralph understand this?

Answer from the class:

Waves

→ Oscillating motion that transfers ***energy*** but not mass

Direction: where the energy is going

Medium: what is doing the "waving"

Oscillation: how the medium is moving

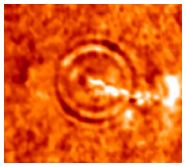
Transverse—Oscillation is ⊥ to the direction of the wave

Longitudinal—Oscillation is // to the direction of the wave

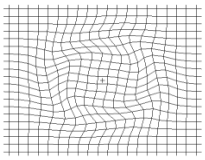
Demo: Suspended slinky

Web Demo: http://www.gmi.edu/~drussell/Demos/waves/wavemotion.html

Examples:
Slinky (demo)
Rope (demo)
Shive wave machine (demo)
Sound
Earthquake (P & S)
Water
Light



surface of the Sun



Wikipedia: "S-wave" (spherical)

Speed, frequency, wavelength

m/s wave/s m/wave

$$v = f\lambda$$

Worked Problem: AM 1320 broadcasts the Utah Jazz games ☺ at a frequency of 1320 kHz. Radio waves travel at the speed of light, 3×10^8 m/s. (a) What is the wavelength of the AM1320 radio waves? (b) What is the period?

What will changing the **tension** do?

(Web demo, continued)

$$v = \sqrt{\frac{T}{\mu}}$$ For waves on a rope/string/etc

(book uses symbol F for tension in this section)
(I don't know why)

From warmup: Two students play with an extra-long Slinky. The student on the left end sends waves to the other student by shaking her end back and forth. After the waves die down, both students take a step backwards and try it again. How will the speed of the waves now compare to the previous waves?

a. They will be faster
b. They will be slower
c. They will go the same speed

Demo: rubber tubing

Question: What happens when you increase the wave speed while keeping the wavelength constant?

Demo: violin

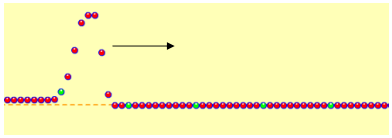
Clicker quiz: Two guitar strings of the same length have the same tension, but one has four times the mass of the other. The speed of a wave on the heavier guitar string is _____ that of the lighter string.

a. ¼
b. ½
c. the same as
d. 2×
e. 4×

Clicker quiz: A boy shakes a rope, moving his hand up and down. He sends a wave crest out every 0.5 seconds. He sees the wave crests move away with a distance between them of 25 cm. How fast is the wave moving?

a. 0-10 cm/s
b. 10-20 cm/s
c. 20-30 cm/s
d. 30-40 cm/s
e. more than 40 cm/s

Reflections



Clicker quiz: What happens when an upward pulse hits the end and turns around?

a. the wave reflects back, upward
b. the wave reflects back, downward
c. it depends

Web Demo:
http://www.colorado.edu/physics/phet/simulations/stringwave/stringWave.swf

Boundaries

Rope: Light rope meets heavy rope
Light: Air meets glass

In both cases: _____

Sound: Thin air meets dense air
→ Also can cause reflections