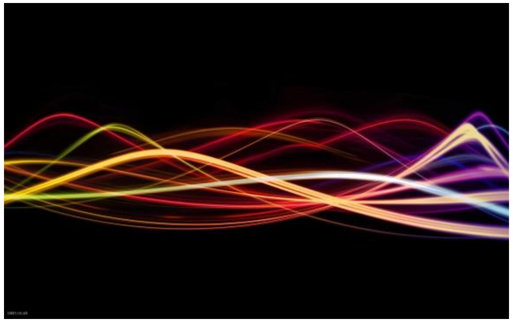
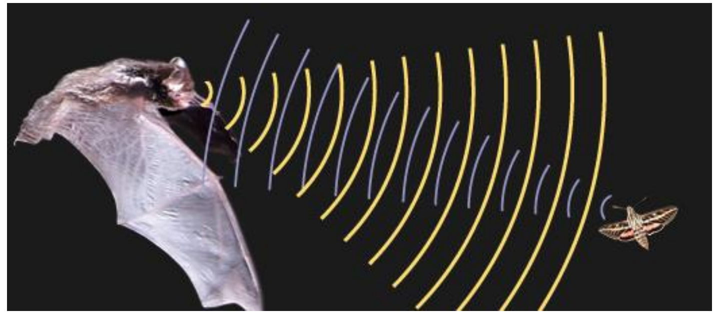
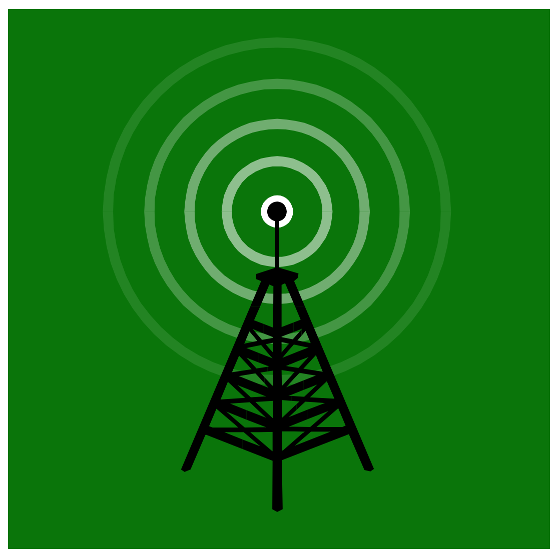
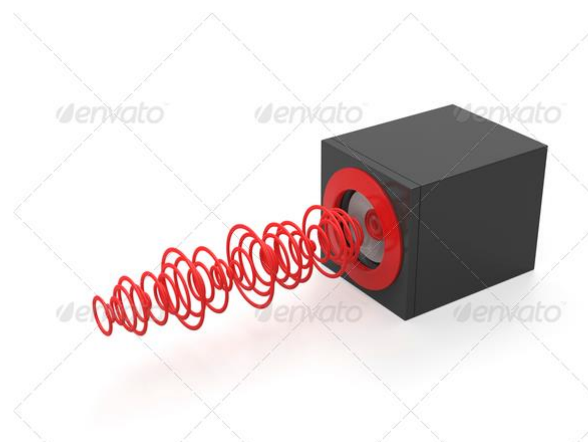
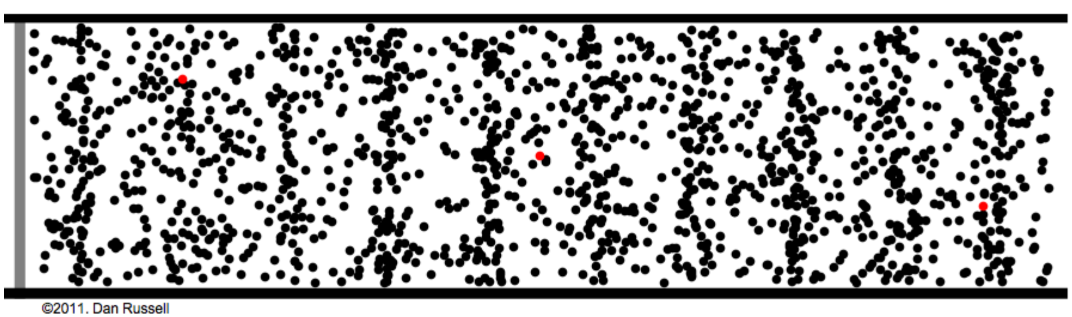



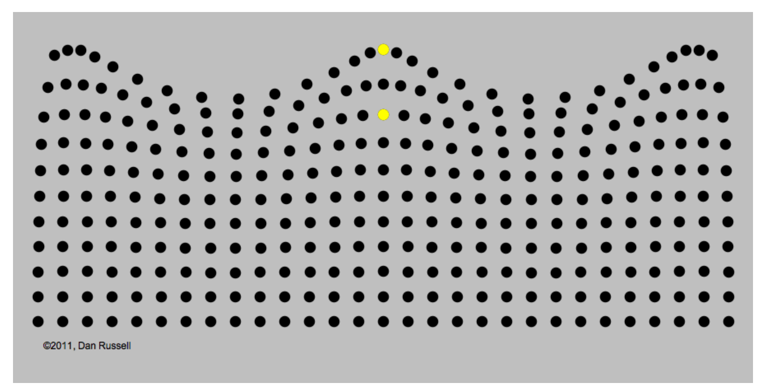

# Chapter 23: Waves

# Waves

- <u>Waves- A</u> disturbance that travels through a **medium** (*substance*) like air, water, a rope, etc. by oscillating and transfers energy from place to place.
- the particles in the medium <u>stay in one spot</u>

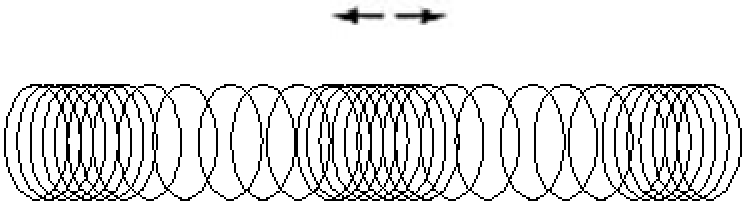


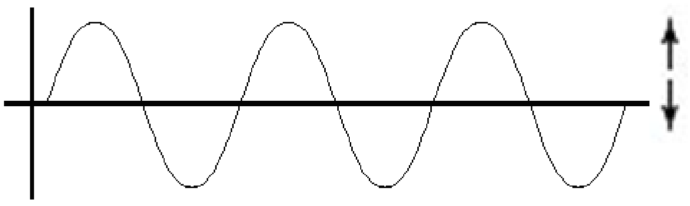



# Introduction to Waves

http://www.youtube.com/watch?v=w2s2fZr8sqQ

# Longitudinal vs. Transverse Waves





Oscillations are in the direction (parallel) of motion

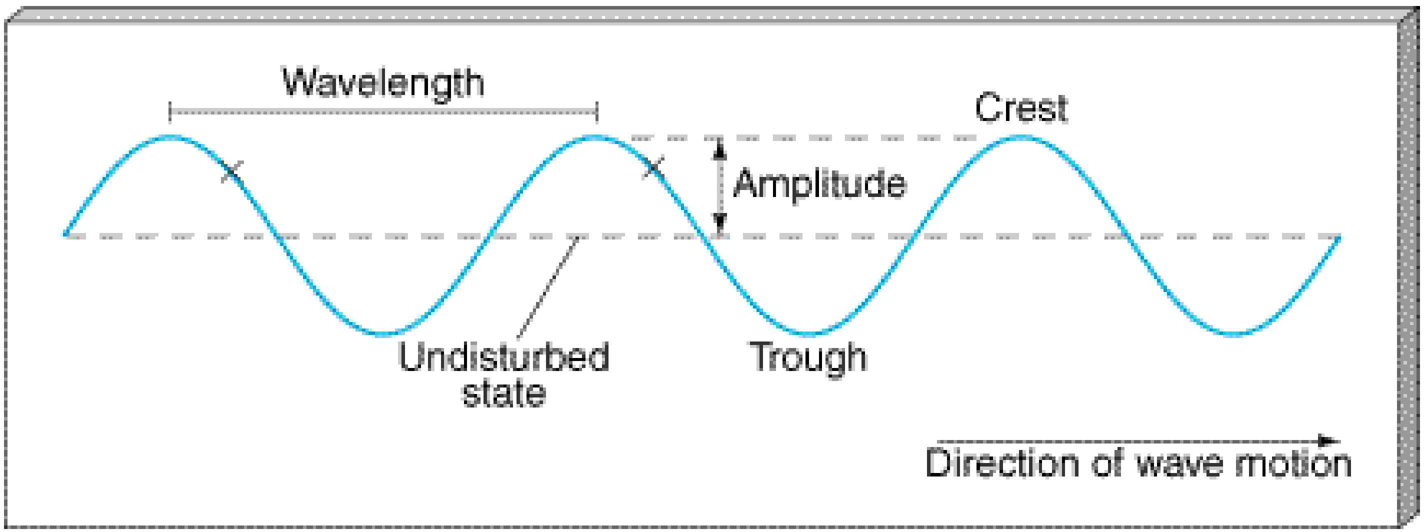
Ex. Sound

Oscillations are perpendicular to the direction of motion

Ex. Water, light,

- http://www.acs.psu.edu/drussell/demos/waves/wavemotion.html

# Characteristics of a Wave




Wavelength ($\lambda$) length or size of one oscillation

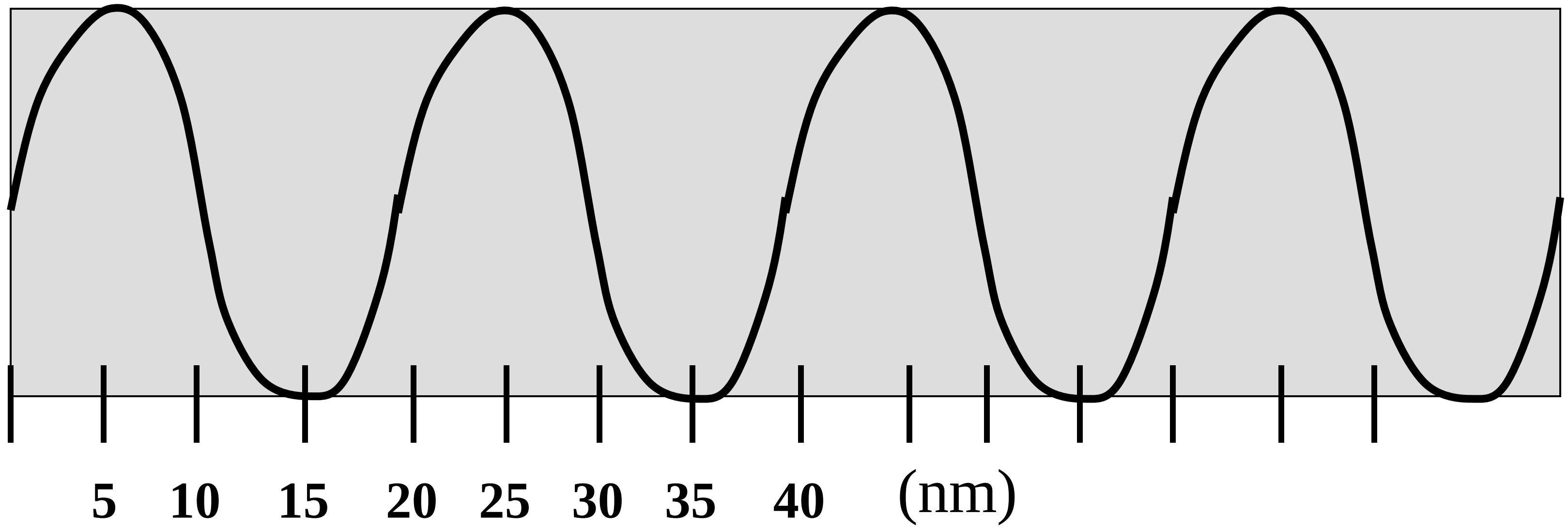
Amplitude (A) strength of disturbance (intensity)

# Frequency & Amplitude

http://www.classzone.com/books/ml_science_share/vis_sim/wslm05_pg18_graph/wslm05_pg18_graph.html

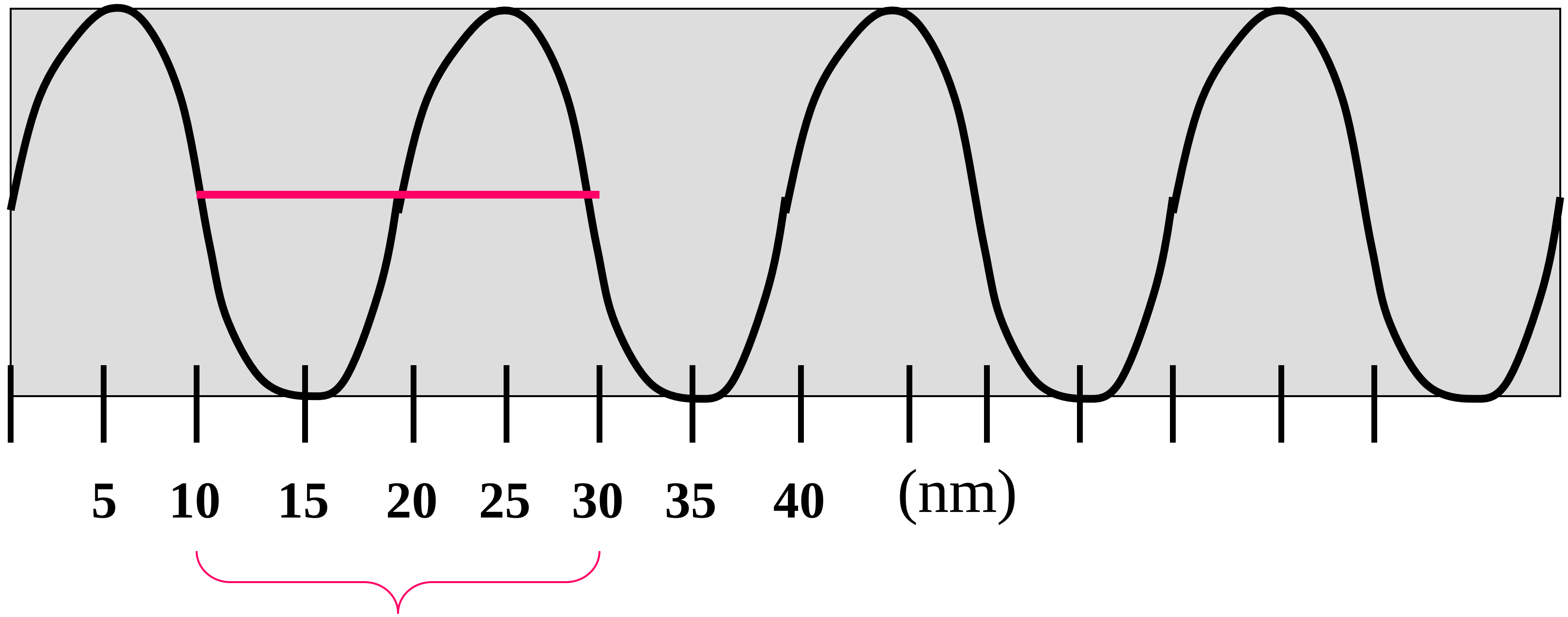
# What is the Wave length?

- Measure from any identical two successive points



# What is the Wave length?

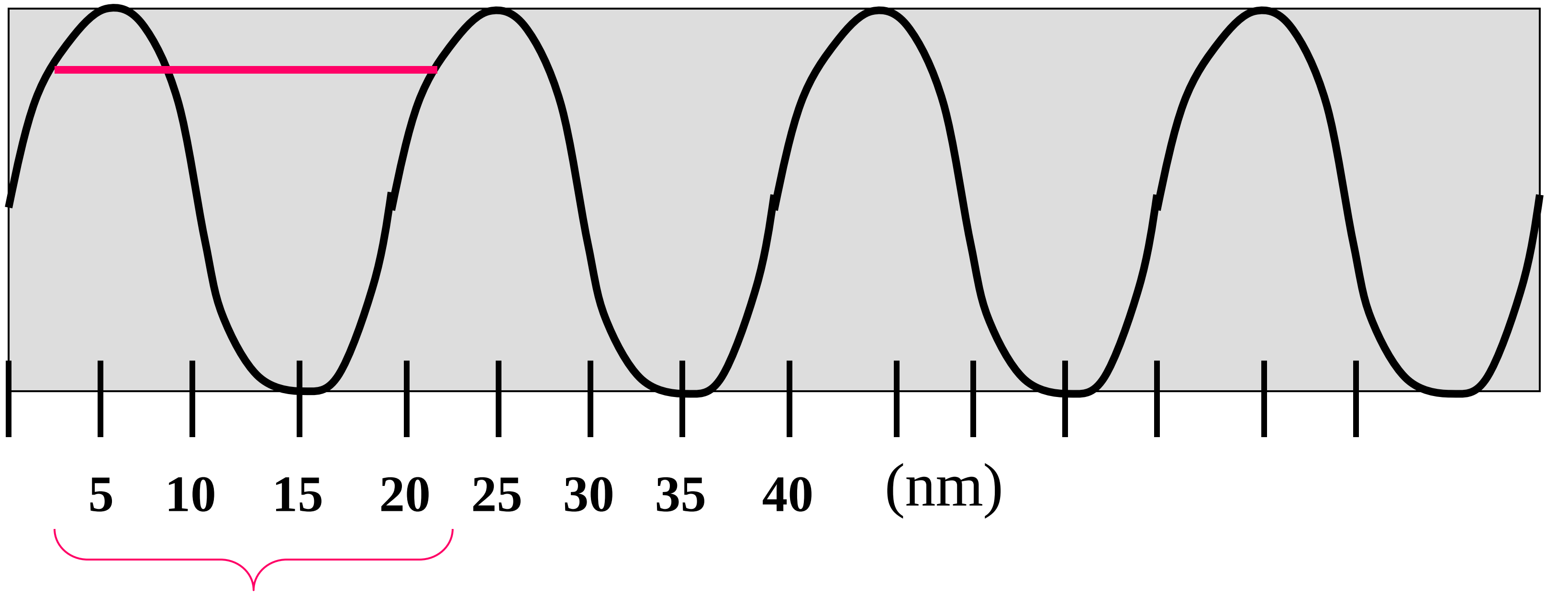
- Measure from any identical two successive points




30nm – 10nm = 20nm

# What is the Wave length?

- Measure from any identical two successive points




22.5nm - 2.5nm = 20nm

- There are 4 complete oscillations depicted here
- ONE WAVE = 1 COMPLETE OSCILLATION

# Frequency & Period

- Period (T) = seconds it takes to complete one cycle
- Frequency (f) = 1/T = # of cycles/second

- If it takes 10 seconds to go 2 cycles, what is the frequency and period?

10 seconds/2 cycles → 5 seconds/1 cycle
Period = 5
Frequency = 1/5 Hz

# Wavespeed (v)

- Wave speed (v) – How fast the wave is moving

- Speed depends on the medium.

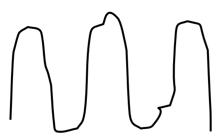
- $v = \gamma f$

# Wave Properties

The energy of a wave is proportional to its frequency.

Fast oscillation = high frequency = high energy 

Slow oscillation = low frequency = low energy 

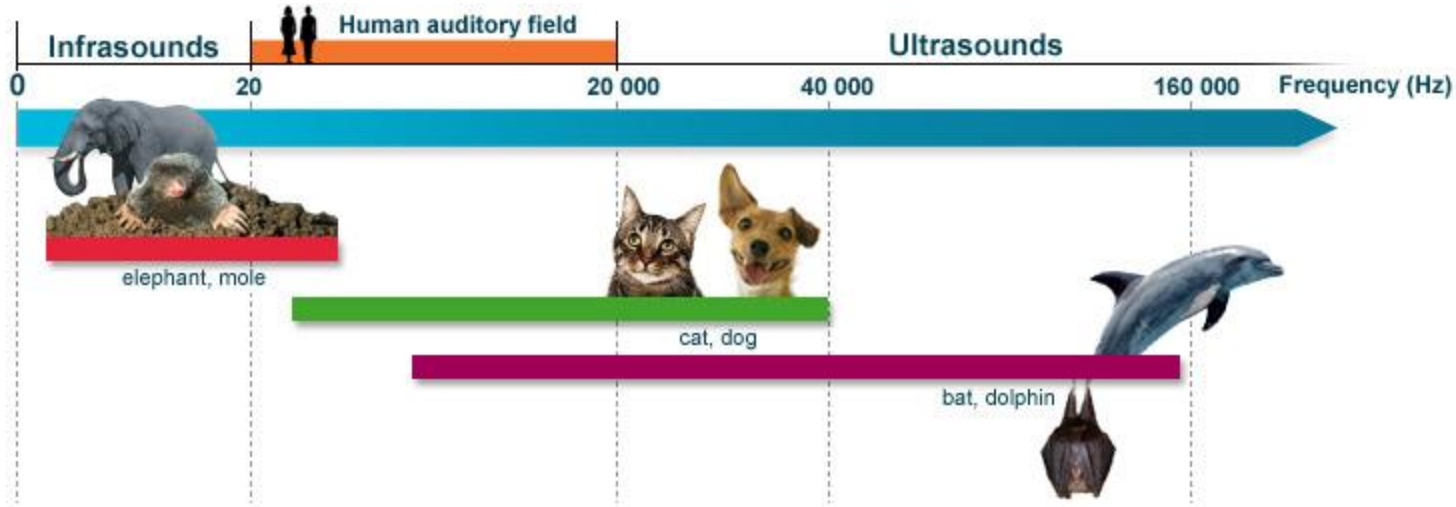
 vs. 

The amplitude is a measure of the wave intensity.

SOUND: high amplitude = loudness

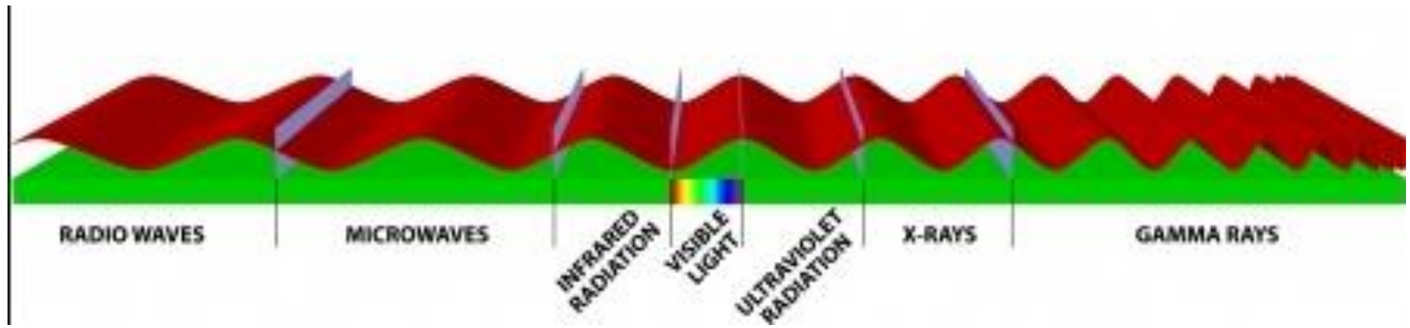
LIGHT: high amplitude = brightness

# Sound



Infrasounds
Human auditory field
Ultrasounds
0
20
20 000
40 000
160 000
Frequency (Hz)
elephant, mole
cat, dog
bat, dolphin

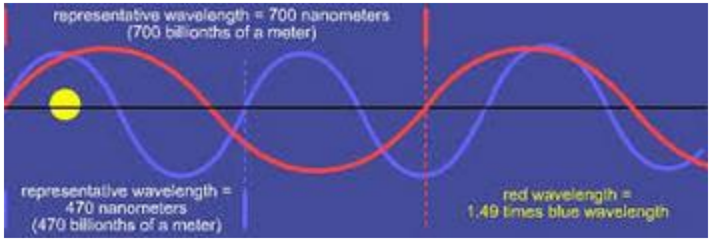

# Light



RADIO WAVES
MICROWAVES
INFRARED RADIATION
VISIBLE LIGHT
ULTRAVIOLET RADIATION
X-RAYS
GAMMA RAYS

# Concept Check

- So which color has more energy? Red or Blue?

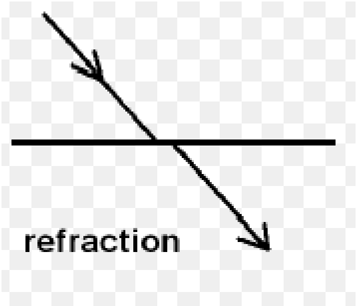


# Guitar Strings

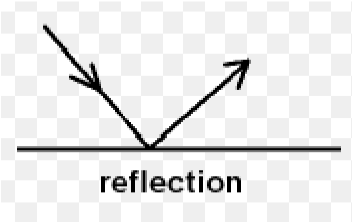
- Each string has a different frequency because of it’s tightness, length, and thickness producing different sounds.

# Interactions of Waves

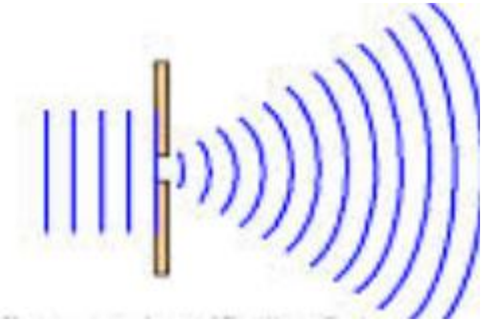
Refraction




Reflection

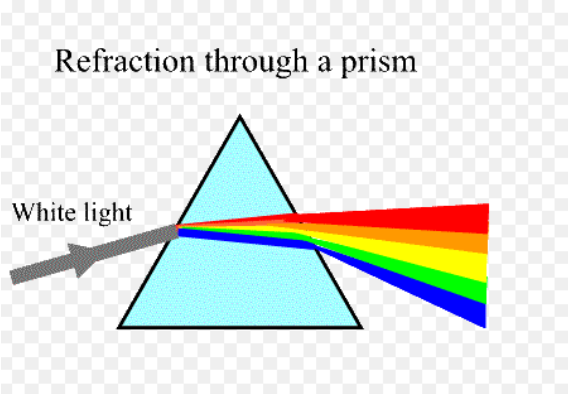


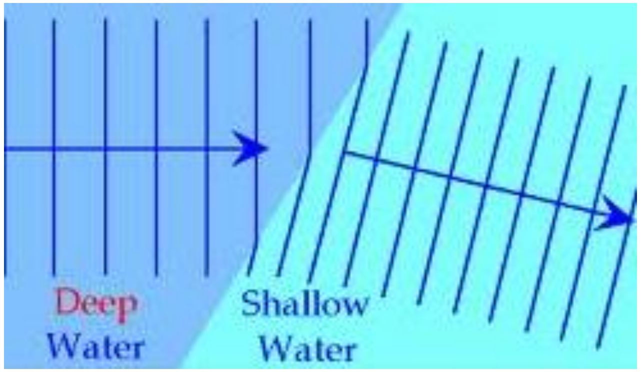

Diffraction

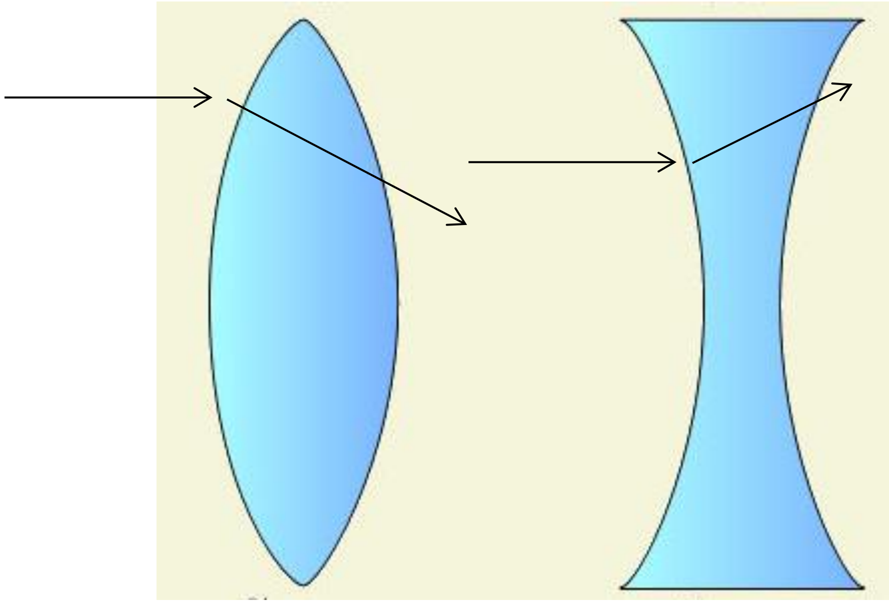


# Refraction

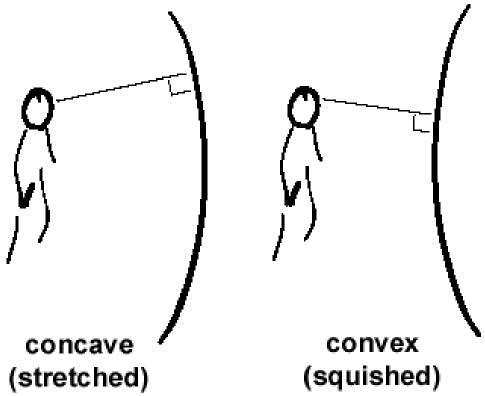
The bending of waves due to passing through different mediums

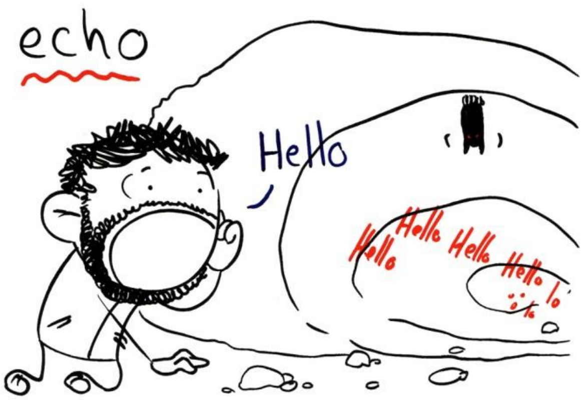


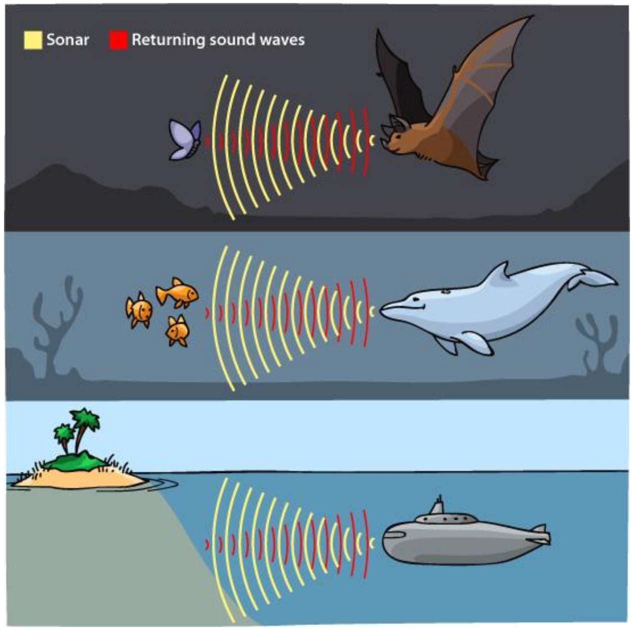



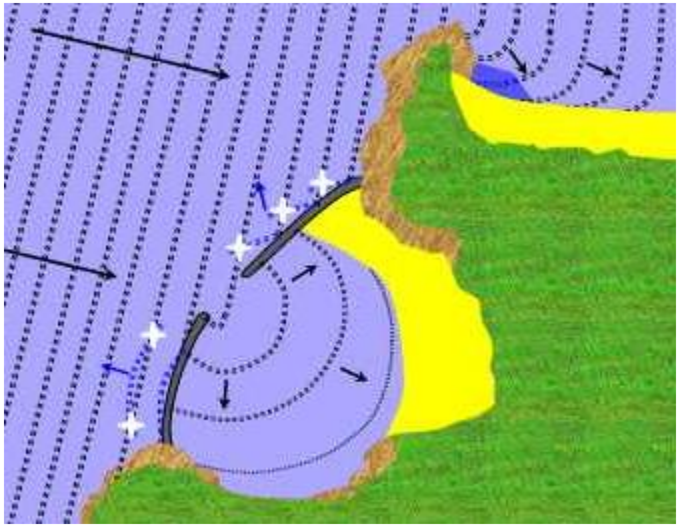
# **Reflection** – waves bouncing off a non-penetrating surface

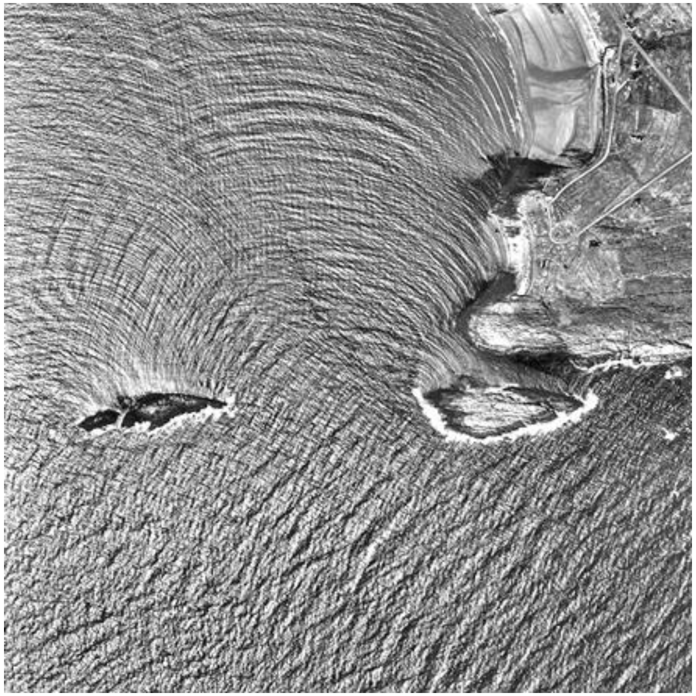



**Diffraction -** interference of waves due to bending around objects





# Homework (10 points)

- Due next Monday the $18^{th}$ (A day) or Tuesday the $19^{th}$ (B day)
- On a piece of paper
  - Write your name and your class period
  - Go to grade portal:
    - write your number and letter grade
    - write which assignments you are missing
  - Go to my website (www.GrapesBiology.weebly.com):
    - Go to the physical science tab, click on the "Number homework" link, and write the number down that this PDF contains

# Extra Credit

(3 points on 9 weeks final grade)

- Due by next Friday (22nd)
- Go to my website and open up which test version you had.
- For each question you got wrong on your test, write on a piece of paper the full question and full answer with a one sentence explanation on why it is right.

# Lab 23B: Frequency on a String

- Due at the end of class.
- Change the frequency to get different numbers of antinodes, or “bubbles”