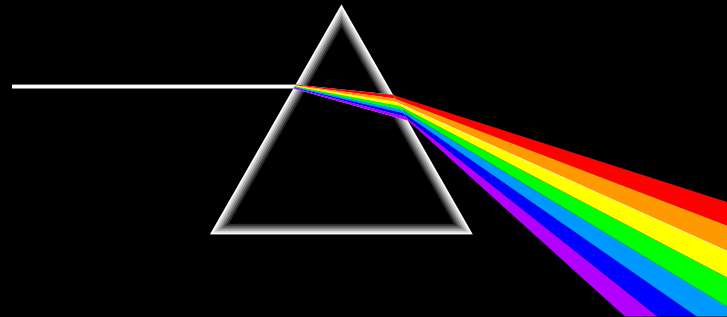
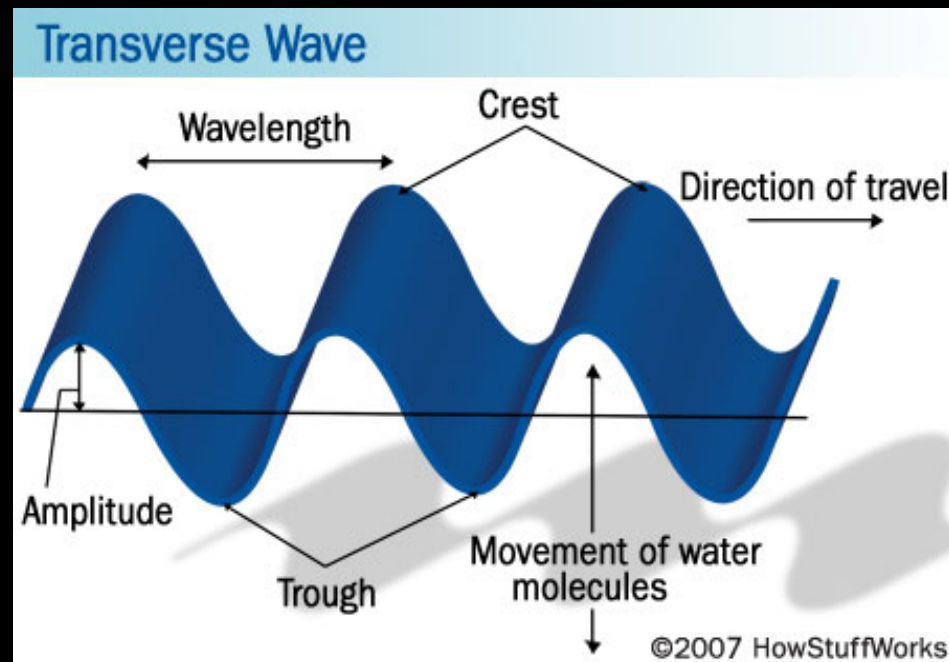


# Electromagnetic Waves & the Electromagnetic Spectrum

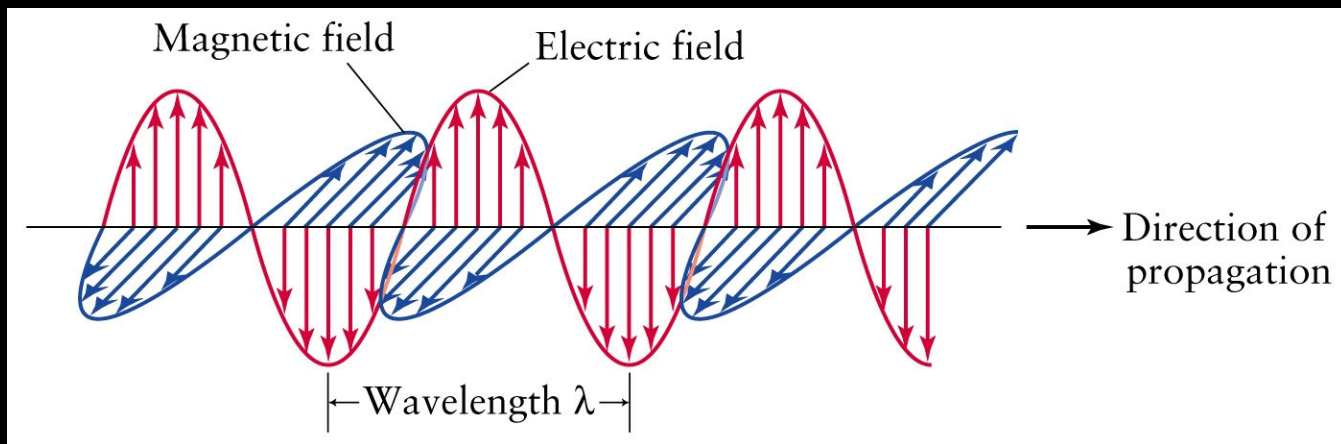


# Electromagnetic Waves

- Transverse waves without a medium!
- (They can travel through empty space)

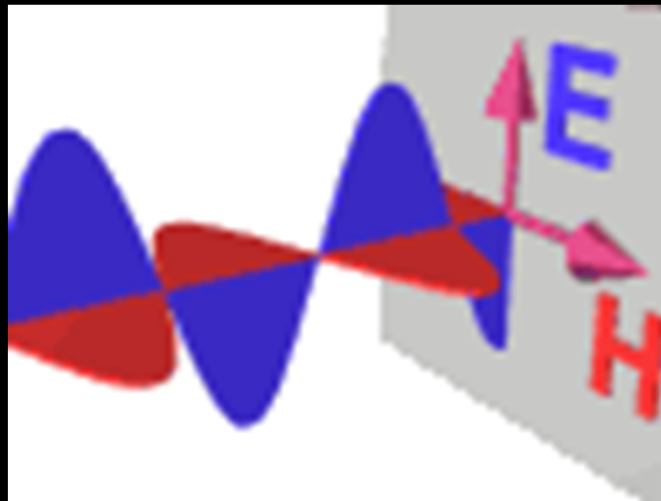


- They travel as vibrations in electrical and magnetic fields.
  - Have some magnetic and some electrical properties to them.



The changing magnetic field causes the electric field to change. When one field vibrates—so does the other.

RESULT-An electromagnetic wave.

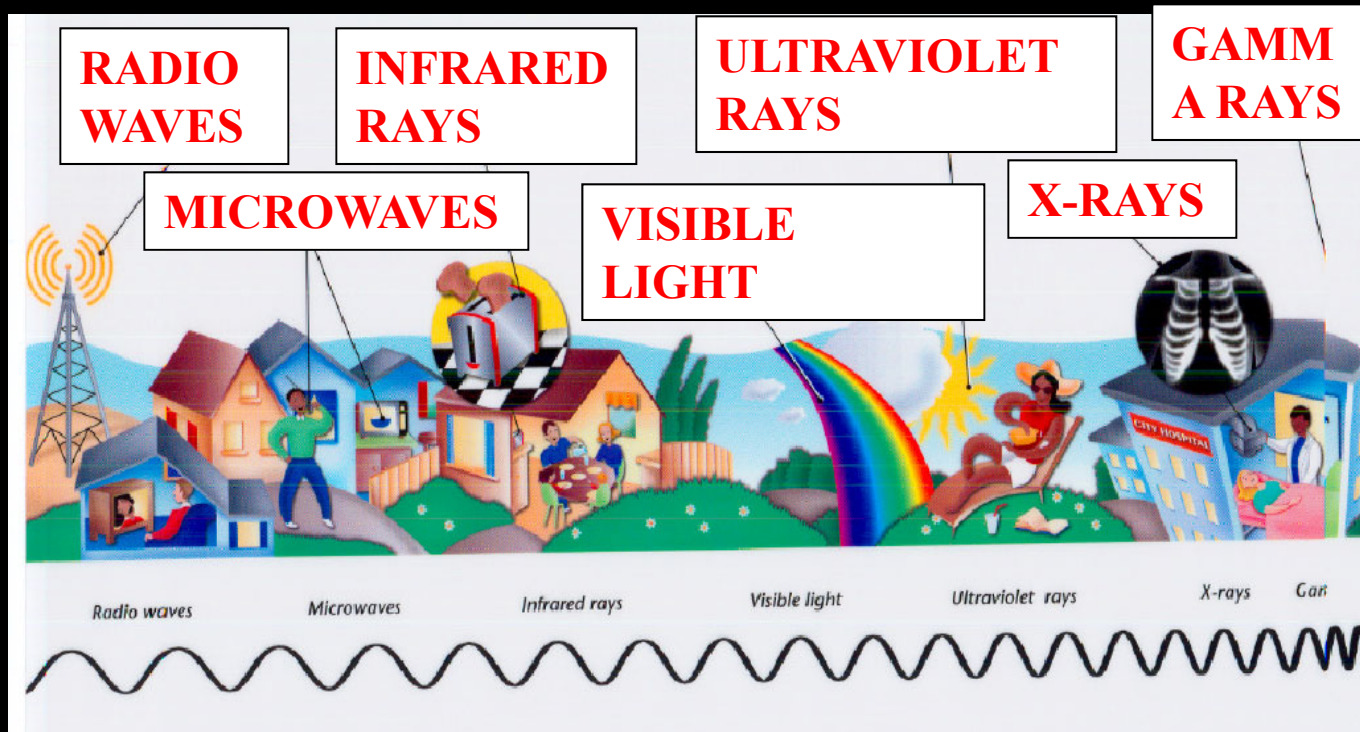


Electromagnetic waves travel  
VERY FAST - around 300,000  
kilometres per second (the speed  
of light).

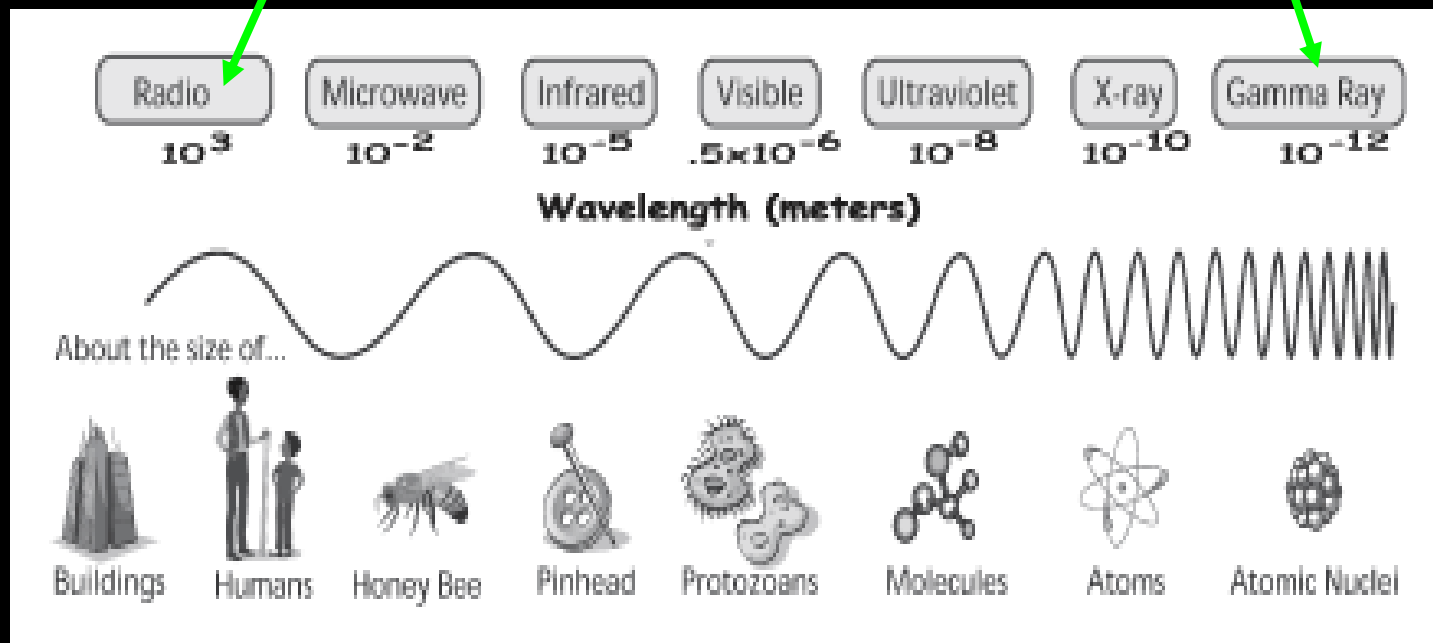
*At this speed they  
can go around the  
world 8 times in one  
second.*



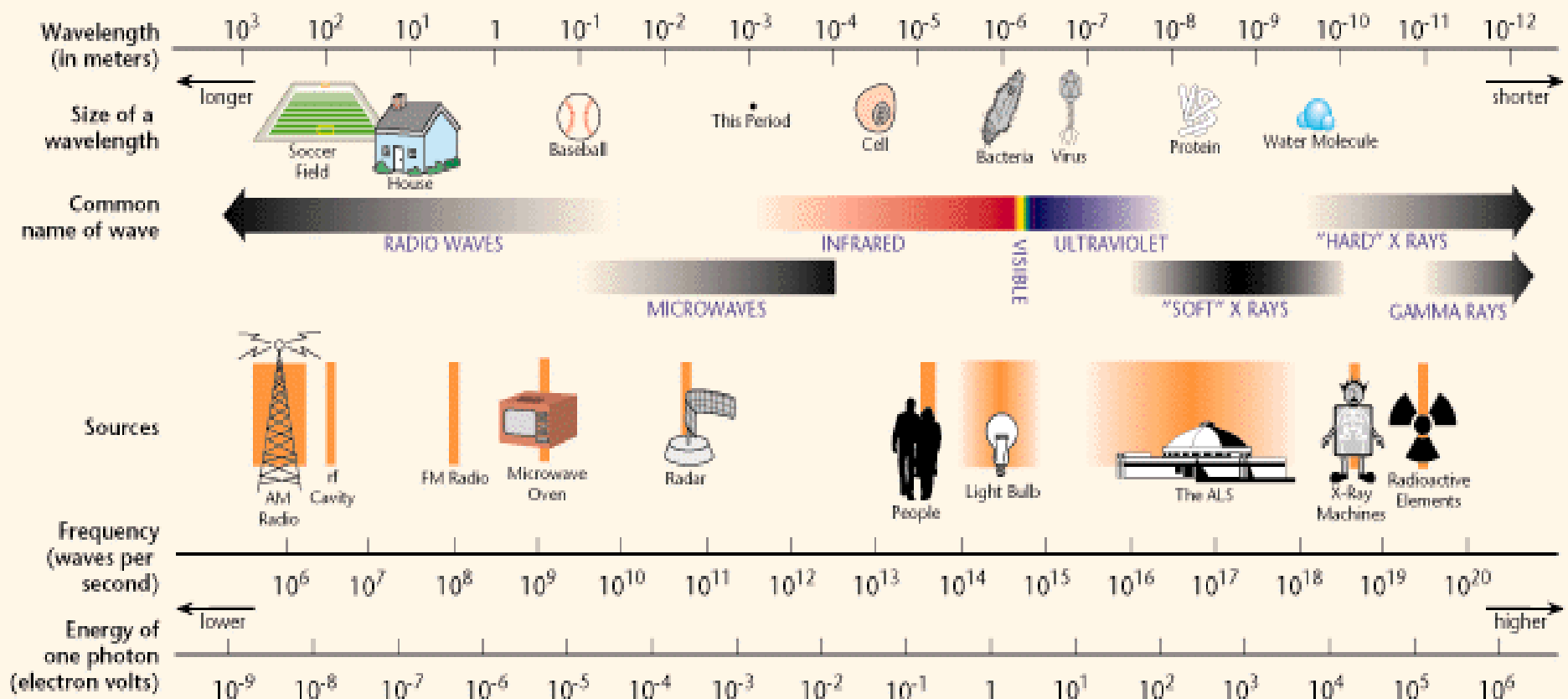
Electromagnetic Spectrum—name for the range of electromagnetic waves when placed in order of increasing frequency



Notice the wavelength is long (Radio waves) and gets shorter (Gamma Rays)



# THE ELECTROMAGNETIC SPECTRUM







Thursday, January 10, 2019

Pick up: none

Today you will:

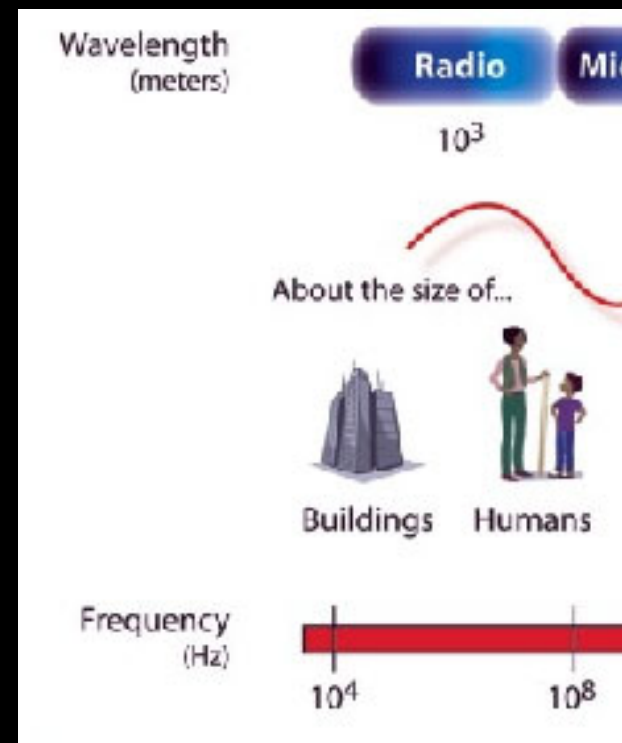
- [EM Spectrum Video clip](#)
- Notes on ISN pg 99

HOMEWORK:

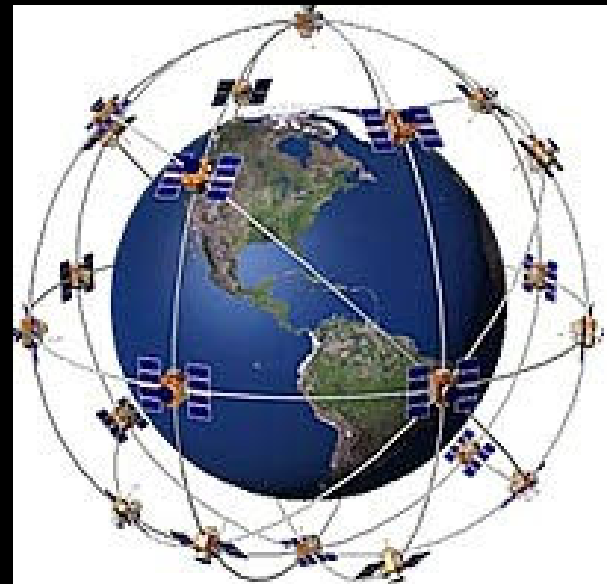
- Anything not done
- Get new ISN if necessary

# RADIO WAVES

Have the longest wavelengths and lowest frequencies of all the electromagnetic waves.

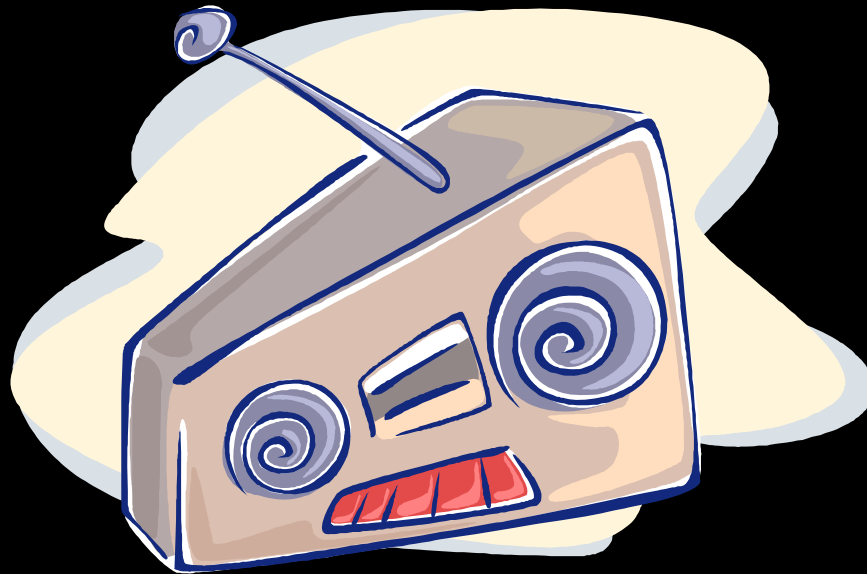


Global Positioning Systems (GPS) measure the time it takes a radio wave to travel from several satellites to the receiver, determining the distance to each satellite.

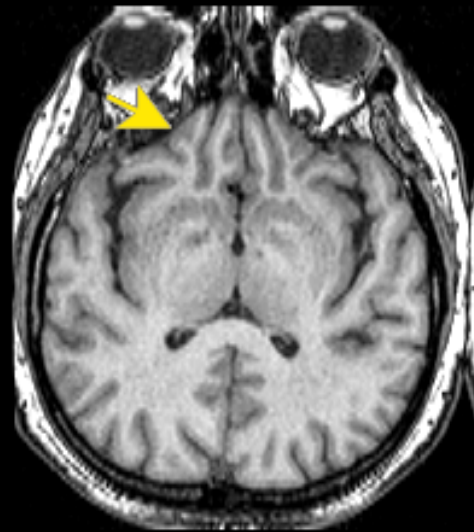


A radio picks up radio waves through an antenna and converts it to sound waves.

- Each radio station in an area broadcasts at a different frequency.
  - # on radio dial tells frequency.

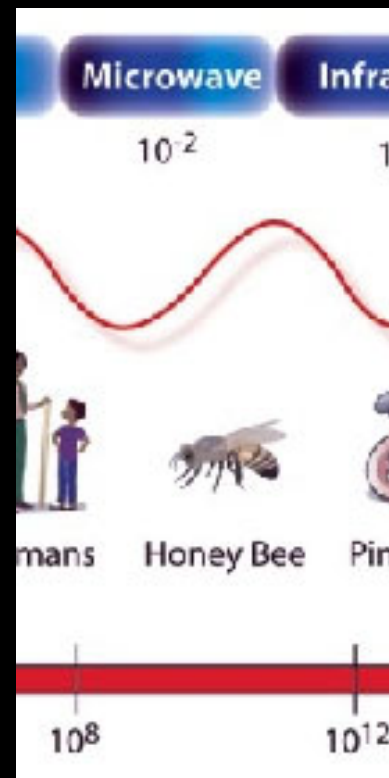


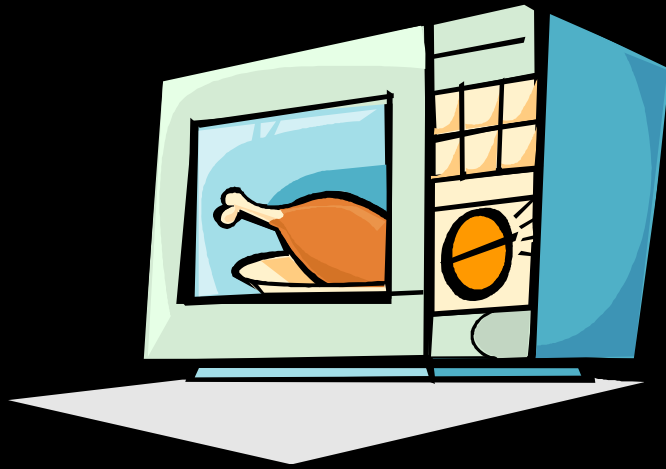
**MRI**  
**(MAGNETIC RESONANCE IMAGING)**  
Uses Short wave radio waves with a  
magnet to create an image.



# MICROWAVES

Have the  
shortest  
wavelengths and  
the highest  
frequency of  
the radio  
waves.





Used in microwave ovens.

- Waves transfer energy to the water in the food causing them to vibrate which in turn transfers energy in the form of heat to the food.

**RADAR** (Radio  
Detection and  
Ranging)

- Used to find the speed of an object by sending out radio waves and measuring the time it takes them to return.





# INFRARED RAYS

Infrared = below  
red  
Shorter  
wavelength and  
higher  
frequency than  
microwaves.



You can feel the  
longest ones as  
warmth on your  
skin

Warm objects  
give off more  
heat energy than  
cool objects.

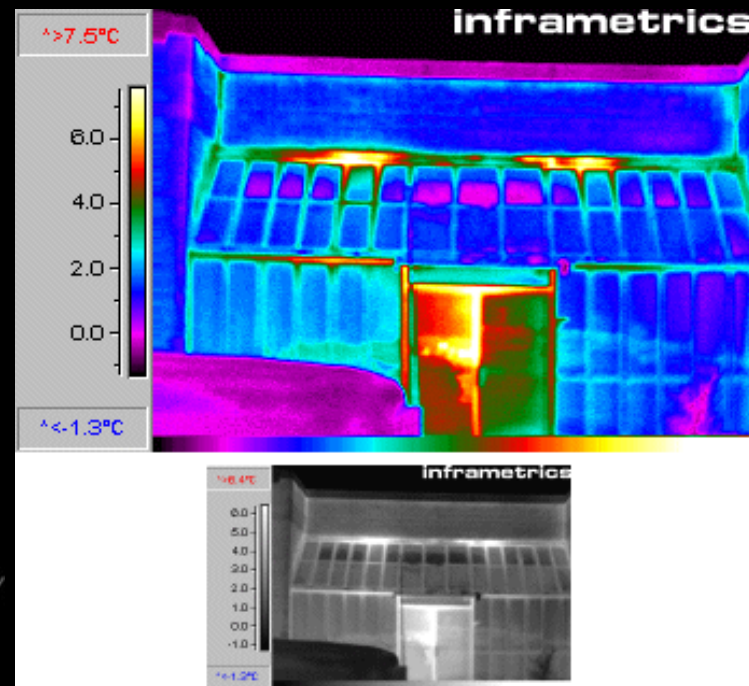


**Thermogram**—a picture that shows regions of different temperatures in the body. Temperatures are calculated by the amount of infrared radiation given off.

Therefore people give off infrared rays.



Heat lamps give off infrared waves.



# VISIBLE LIGHT

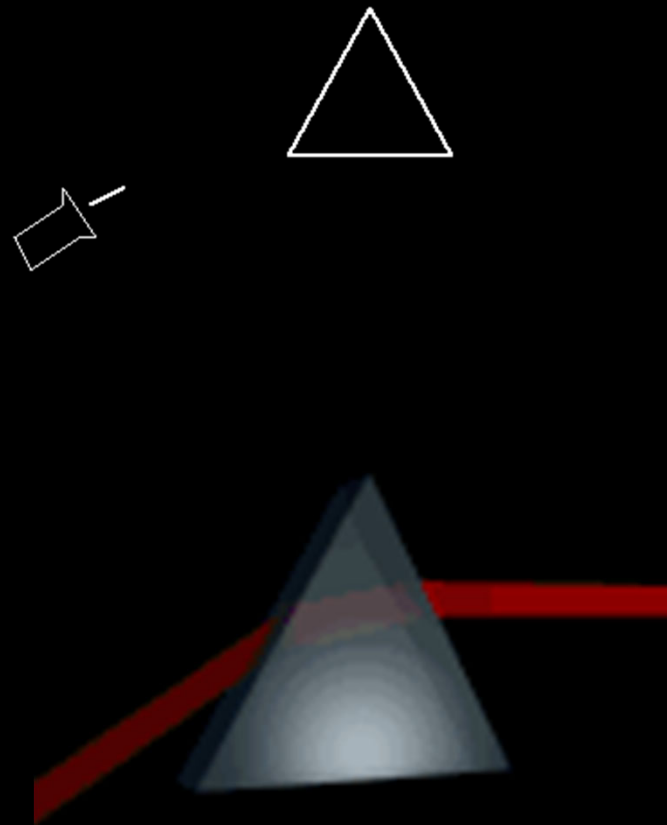
Shorter wavelength and higher frequency than infrared rays.

Electromagnetic waves we can see.

Longest wavelength= red light

Shortest wavelength= violet (purple) light



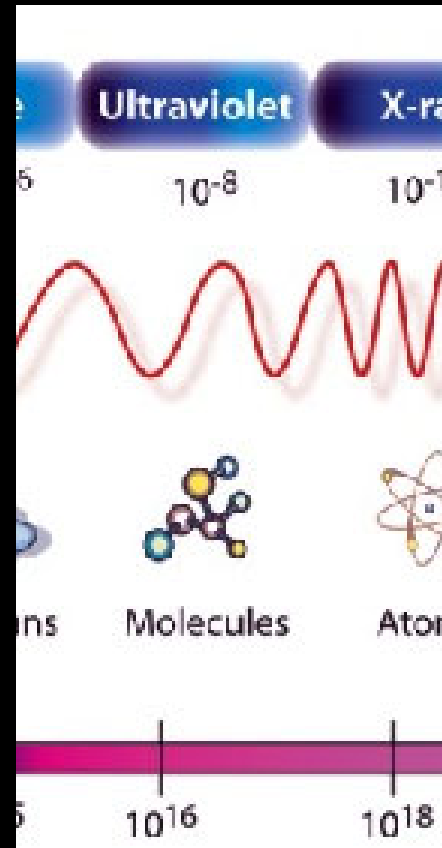


When light enters  
a new medium it  
bends (refracts).  
Each wavelength  
bends a different  
amount allowing  
white light to  
separate into it's  
various colors  
**ROYGBIV.**

# ULTRAVIOLET RAYS

Shorter  
wavelength and  
higher  
frequency than  
visible light

Carry more  
energy than  
visible light



Used to kill  
bacteria.  
(Sterilization  
of  
equipment)

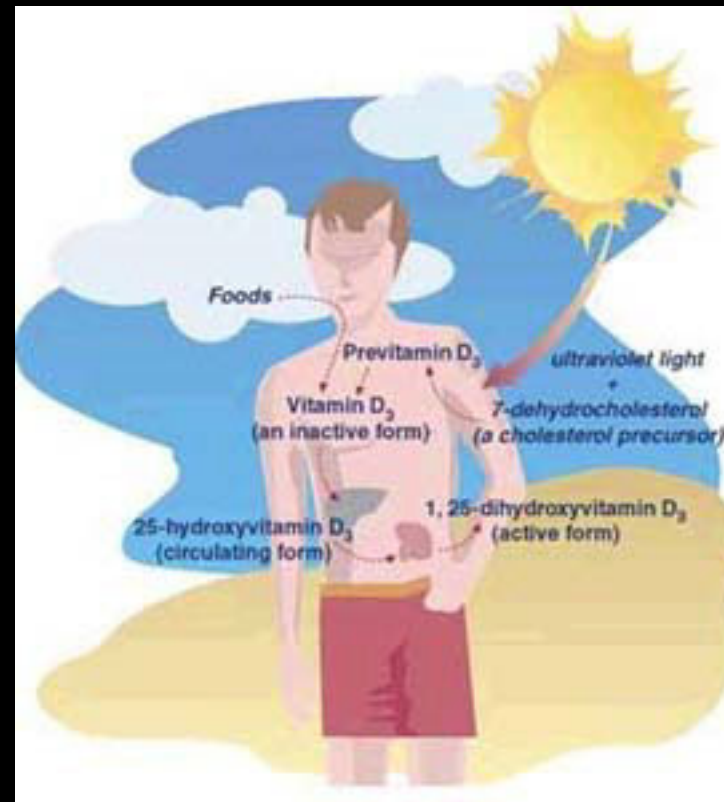


Too much can cause skin cancer.  
Use sun block to protect against  
(UV rays)





Causes your  
skin to  
produce  
vitamin D  
(good for  
teeth and  
bones)

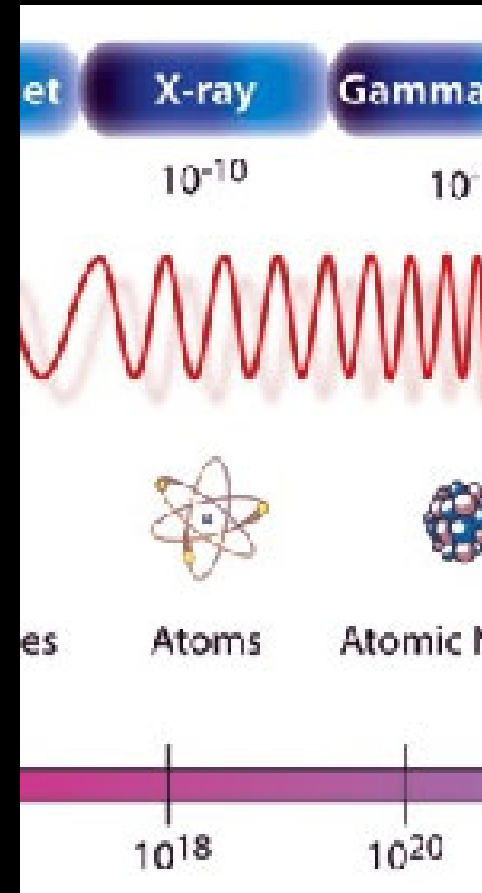


# X- RAYS

Shorter  
wavelength and  
higher  
frequency than  
UV-rays

Carry a great  
amount of  
energy

Can penetrate  
most matter.



Bones and teeth absorb x-rays. (The light part of an x-ray image indicates a place where the x-ray was absorbed)

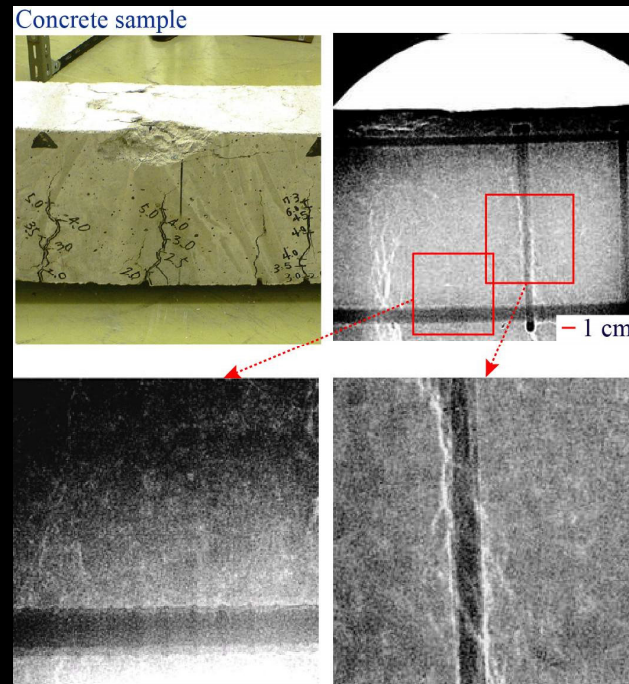


Too much exposure  
can cause cancer  
(lead vest at  
dentist protects  
organs from  
unnecessary  
exposure)



Used by engineers to check for tiny cracks in structures.

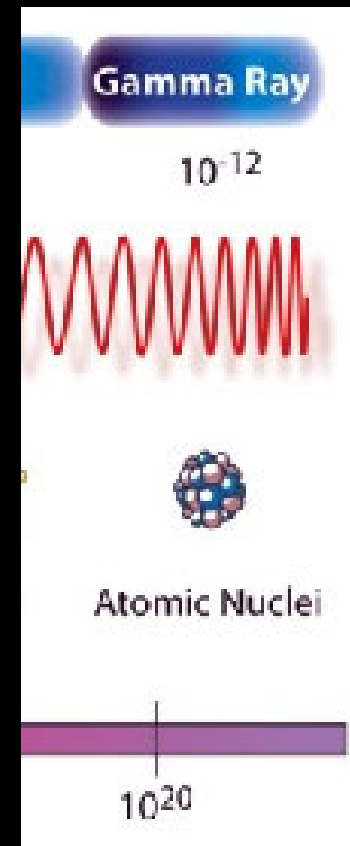
- The rays pass through the cracks and the cracks appear dark on film.



# GAMMA RAYS

Shorter wavelength  
and higher frequency  
than X-rays

Carry the greatest  
amount of energy  
and penetrate the  
most.



Used in radiation treatment to kill cancer cells.

Can be very harmful if not used correctly.



The Incredible  
Hulk was the  
victim of  
gamma  
radiation.





Exploding  
nuclear  
weapons emit  
gamma rays.



# Brief SUMMARY

- A. All electromagnetic waves travel at the same speed. (300,000,000 meters/second) in a vacuum.
- B. They all have different wavelengths and different frequencies.
- Long wavelength → lowest frequency
  - Short wavelength → highest frequency
  - The higher the frequency the higher the energy.