

Objectives:

- Be able to describe what light is
- Be able to draw the order of the EM spectrum
- Describe the uses of the EM spectrum

Electromagnetic Spectrum

What is Light?

- Light is a Wave
 - Light is refracted in lenses
 - Light diffracting around two fingers (look close) causes lines of darkness
 - This is called destructive interference
 - *Light must be a wave!*

What is light?

- Light is a Particle
 - Light can travel through the vacuum of space
 - Does space have a medium for the wave to travel through?
 - *Light must be a particle!*

What is Light?

- Confused yet?
 - This contradiction perplexed scientists for many, many years, but the evidence must be believed:
 - *Light is both a wave and a particle*
 - *Packets of light we call photons*



The Speed of Light

- Sound is Fast:
 - 340 meters/second
- Light is Faster:
 - 3×10^8 meters/second
 - That's 3 with 8 zeros or 300,000,000 meters/second
- Scientists now believe that nothing can go faster than the speed of light

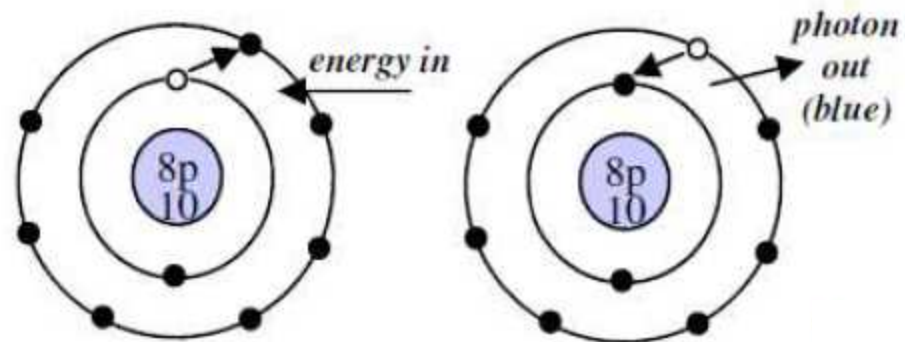
Light is the Ultimate Speed Limit

Origins of Light and Color

- Photons (light) come from electrons falling from high electron orbits to low orbits or energy levels

The sky is blue because oxygen atoms give off blue photons

Photons (light) come from electrons falling from high electron orbits to low orbits. These orbits are also called energy levels.



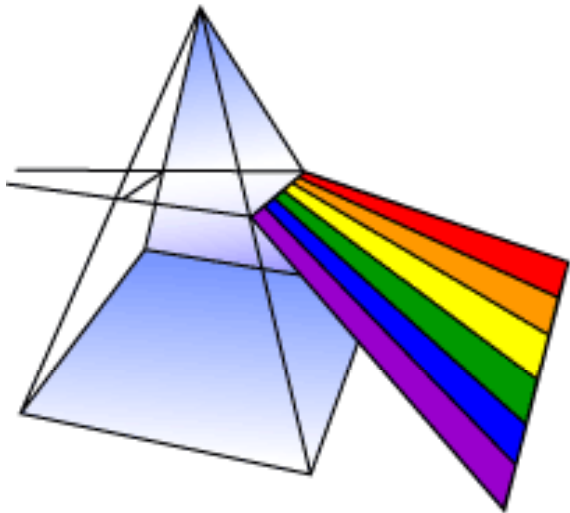
Energy can raise an electron to a higher energy level.

When the electron falls back, a photon is given off: light!

Visible Light

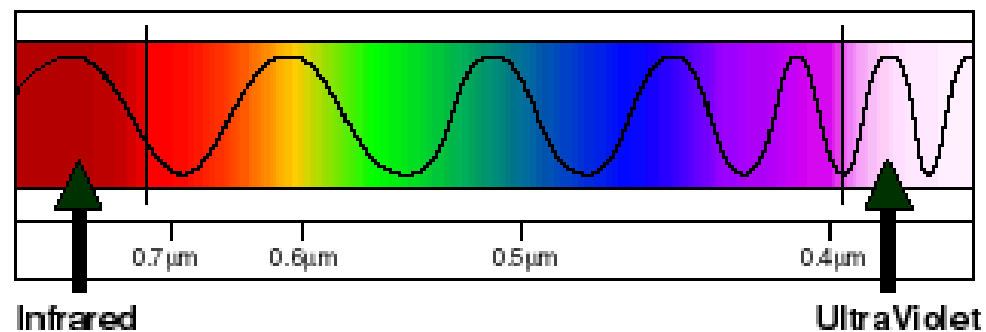
- What we call “visible light” is made of many different colors
- Each color has a different wavelength and frequency
- White light is a mixture of all of these colors
- What are the three primary colors?
 - Red
 - Blue
 - Green

ROY-G-BIV



- Red
- Orange
- Yellow
- Green
- Blue
- Indigo
- Violet

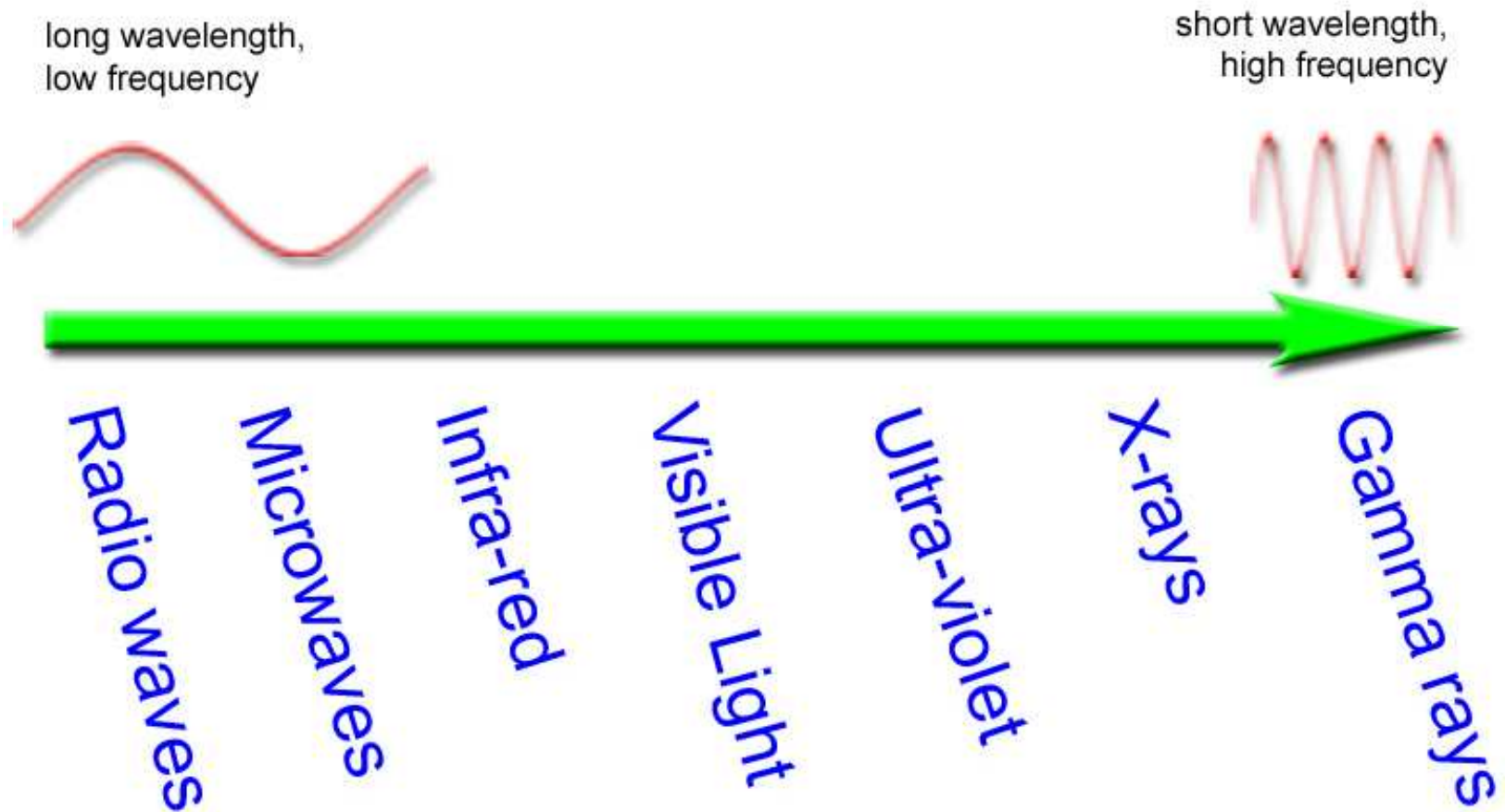
Visible Light Region
of the Electromagnetic Spectrum



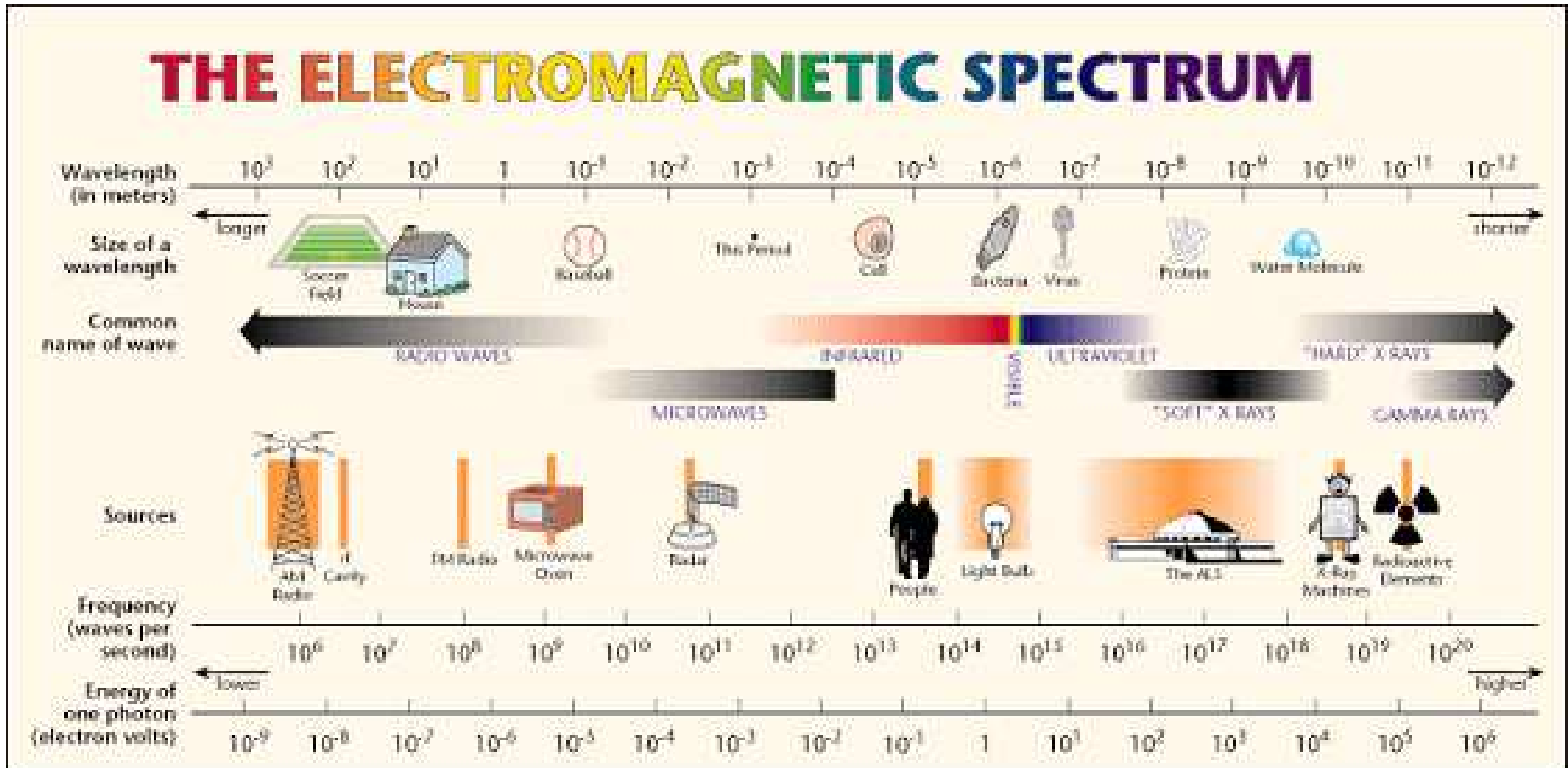
Colors have different energies

- Conduction Demonstration
 - Where was the hottest part of the flame?
- Red flames are the coolest
- Blue flames are the hottest
- White light is made up of all the colors
 - That is why white flame is the hottest!

EM Spectrum

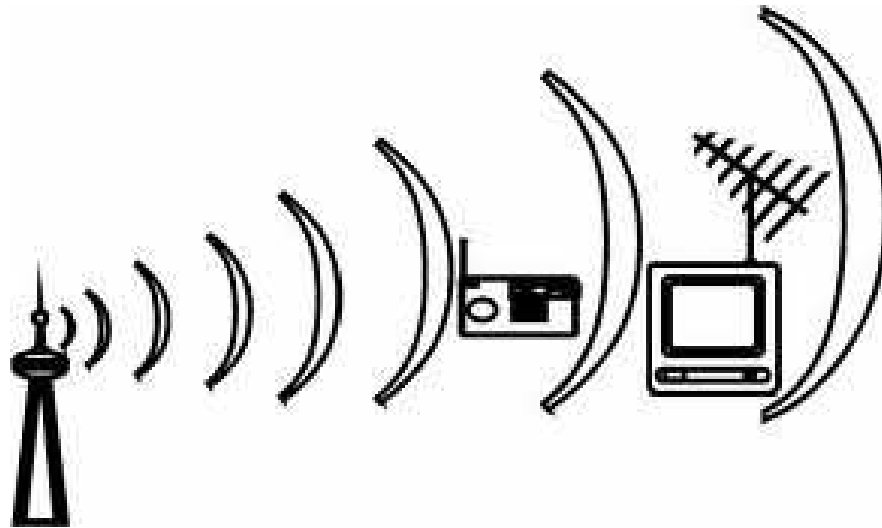


EM Spectrum Basics



Uses of the EM Spectrum

- Radio Waves
 - Used to transmit radio and television signals
 - Wavelengths range from hundreds of meters to less than a centimeter



Uses of the EM Spectrum

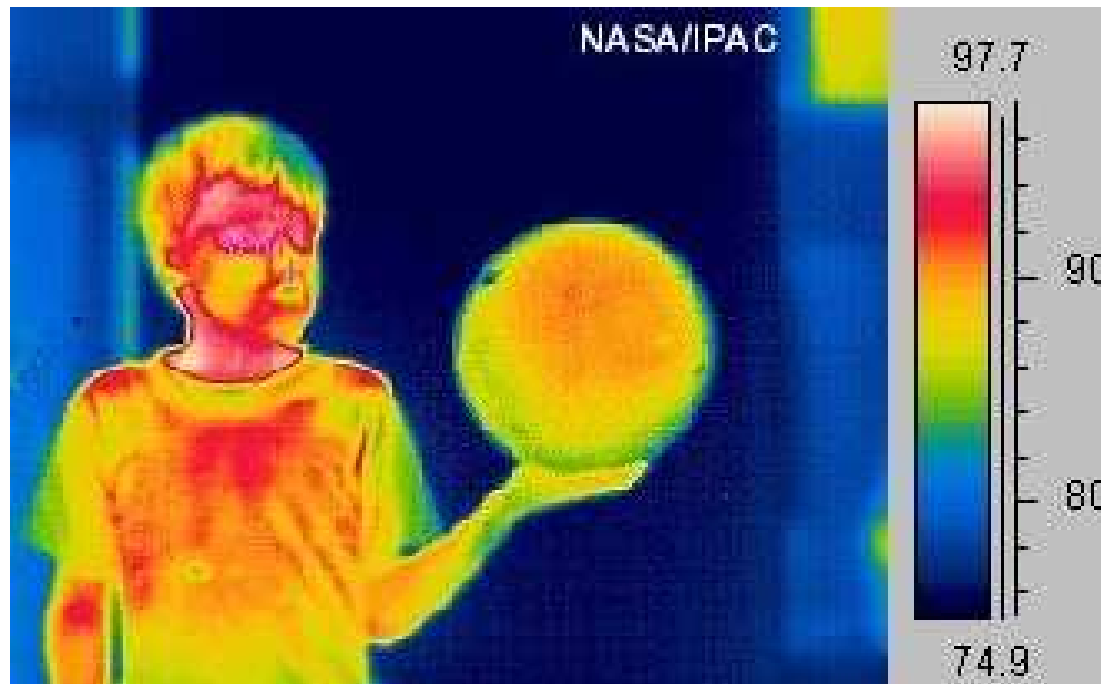
- Microwaves
 - Used to cook food and cell phones
 - Wavelengths range from 30 cm to 1 mm



**"If you're worried about cell phone microwaves,
stick a piece of popcorn in your ear.
When it pops, it's time to hang up."**

Uses of the EM Spectrum

- Infrared (invisible heat)
 - Wavelengths 1mm to 700 nm

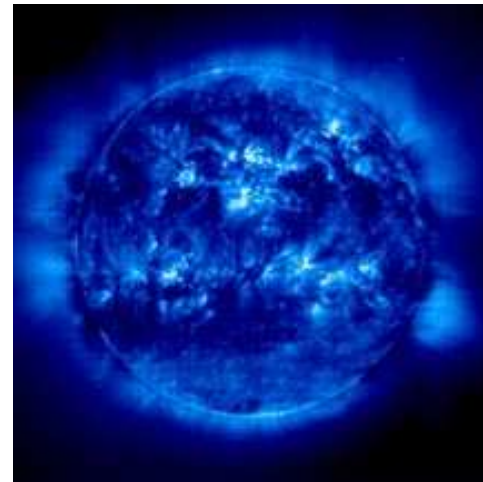


Uses of EM Spectrum

- Visible Light
 - Wavelengths from 700 to 400 nm

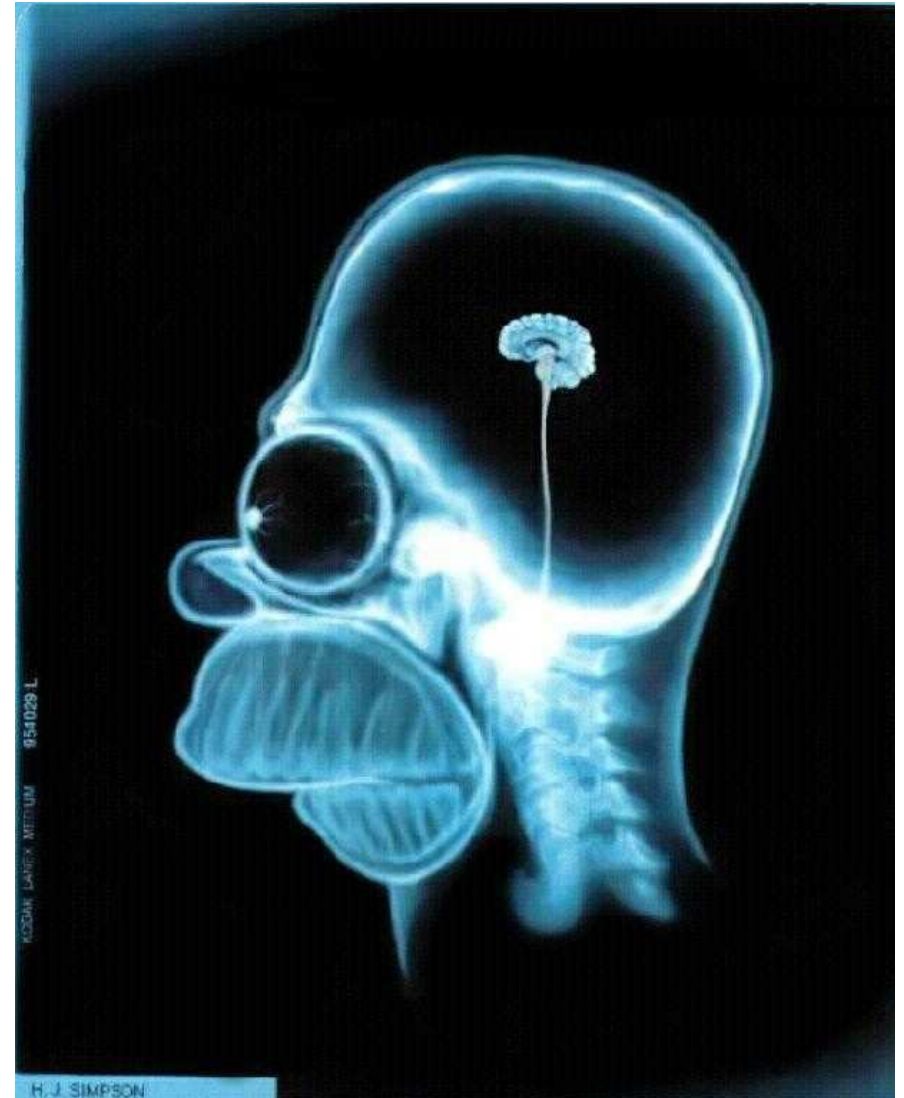
Uses of EM Spectrum

- Ultraviolet Light
 - Invisible wavelengths from 400 nm to 10 nm
 - Part of the sunlight burns your skin and can cause cancer
 - The ozone layer protects us from most of the sun's ultraviolet light.



Uses of the EM Spectrum

- X-Rays
 - Used in medicine and industry
 - Wavelengths are from 10 nm to 0.01 nm (10 trillionth of a meter)



Uses of the EM Spectrum



- Gamma Rays
 - The most powerful and dangerous form of radiation
 - Wavelengths less than .01 nm
 - Emitted by nuclear radiation
 - They can break chemical and nuclear bonds