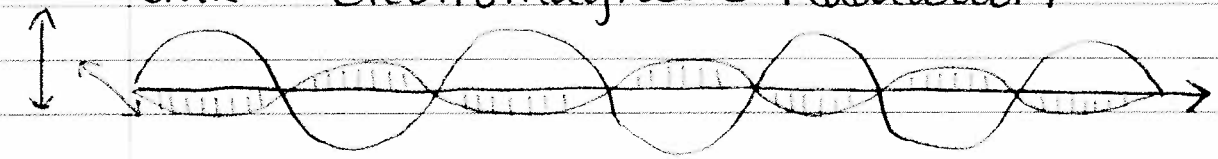
EMR + Scientists

EMR = Electromagnetic Radiation



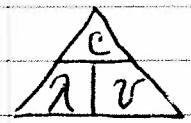
↕ Electric Field ↪ Magnetic Field → forward progression

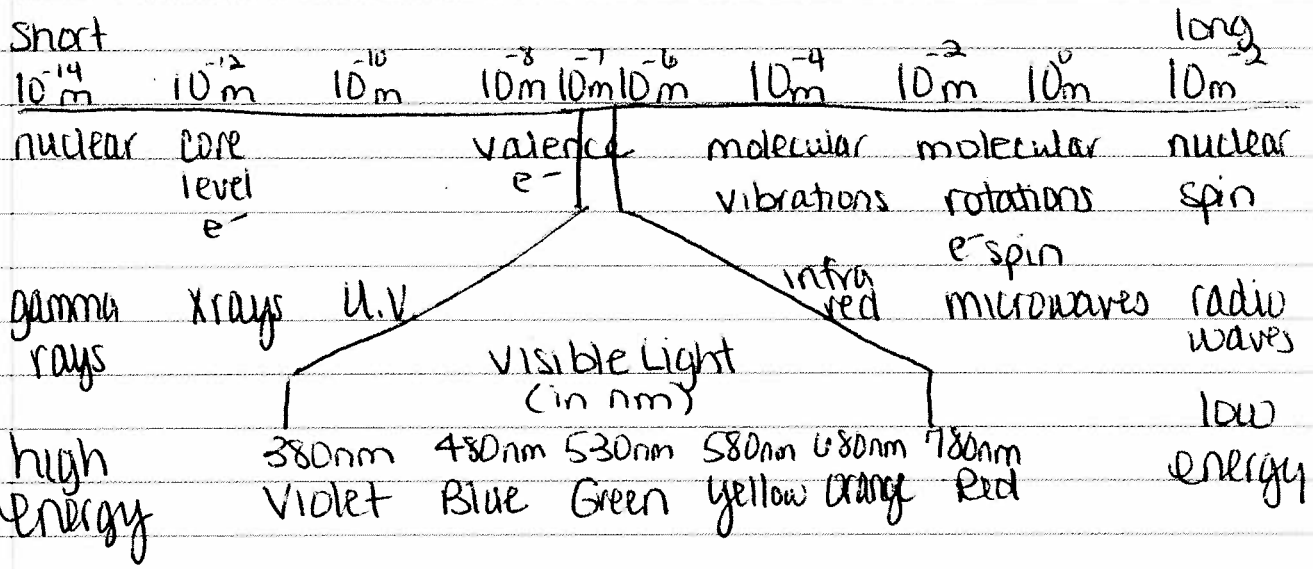
λ = lamda = wavelength = measured in meters or nm.

ν = frequency = measured in cycles per second s^{-1}, 1/s or Hertz (hz)

C = Speed of light = $3.00 \times 10^{8} \frac{m}{s}$

$\lambda = \frac{c}{\nu}$





Wavelength & frequency have an inverse relationship
Wavelength & energy have an inverse relationship
frequency & energy have a direct relationship

Practice Problems: $\lambda = \frac{c}{\nu}$ (* save for class time)

① Determine the wavelength if the frequency is $102\ s^{-1}$.

② Determine the frequency if the wavelength is 4.5×10^{-9} m.

③ Determine the speed of light based on the following student data:

$\lambda = 4.41 \times 10^{7}$ nm $\qquad \nu = 6.9 \times 10^{9}\ \frac{1}{s}$

What is the percent error?

Quantum Mechanics - the study of the behavior of very small things. (like an e⁻!)

Quantum Scientist	Theory/ Experiment	How to Remember (Memory Tool)
Max Planck	• "Quanta" discrete amount of energy $E = h\nu$	
Einstein	• Photons - packets of light that are particles travelling in waveform. • Photoelectric Effect	
Bohr	• worked with the line spectra for Hydrogen & Helium • discovered Energy levels (n)	
Compton	photons → e⁻ e⁻ e⁻ e⁻ → e⁻ • proved that photons are particles when photons collided w/ e⁻	
DeBroglie	• <u>Dual Nature</u> - all matter has mass (particle) & waveform, the larger the particle the less you can see the waveform (vibration)	
Heisenburg	• <u>Uncertainty Principle</u>: it is impossible to simultaneously measure speed (momentum) & location. * You must choose one or the other to study *	

Pauli

- Pauli Principle: the two e⁻ that share an orbital must have opposite spins.

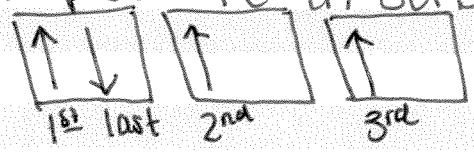
written as: $+\frac{1}{2}, -\frac{1}{2}$ or ↑↓

Hund

Hunds Rule

- e⁻ must be placed w/ topspin ($+\frac{1}{2}$ or ↑) in each available orbital before the second e⁻ can be added

Example: 4e⁻ in 3 orbitals



Aufbau

- Aufbau Principle: in the ground state of an atom e⁻ fill orbitals of the lowest available energy requirement before filling higher energy requirements