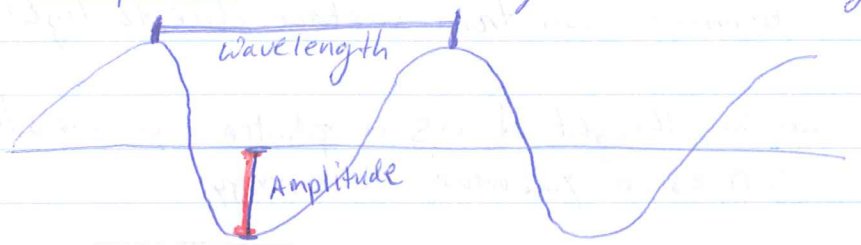
5.1 Light & Quantitized Energy

*Visible light is only 1 example of the electromagnetic (EM) spectrum - it is a wave-like energy that travels through space
- other ex) microwaves, x-rays, & U.V. light

Waves have the following characteristics:

- Wavelength (λ = lambda) - distance between equivalent pts. on a continuous wave - crest to crest - measured m, cm, or nm
- frequency (ν = nu) - # of waves that pass by a pt. per second - SI Unit = Hz - 1 wave/sec.
- Amplitude - wave's height from the origin to a crest



*All EM waves travel @ 3.00×10^8 m/sec in a vacuum

- Speed of light (c) = $\lambda \times \nu$ $\boxed{c = \lambda \times \nu}$

low freq. →

high freq. →

- Because all EM waves travel @ same speed in a given medium, you can use $c = \lambda\nu$ to solve for λ or ν of any wave.

- Light also acts like particles, so wave model isn't fully correct

The Quantum Concept - illustrates that light also has particle-like behaviors, seen as visible light when elements are heated to high temps ex) Iron = red when heated

- Matter can gain or lose energy in small specific amounts called Quanta

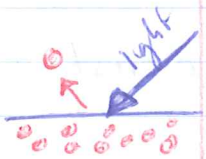
A Quantum = the minimum amount of energy that can be gained or lost by an atom.

To determine Energy of a Quantum

$E_{quantum} = h \times \gamma$

h = planck's constant = 6.626×10^{-34} J·s
γ = frequency

Photoelectric effect - electrons, called photoelectrons, are emitted from a metal's surface when light of a certain frequency, or higher, shines on the surface



- bounces them from surface due to light

Light can be thought of as a photon - or massless particle that carries a quantum of energy

Energy of photon = $E_{photon} = h\gamma$

- photons must have a certain threshold value to cause Photo Elec. effect

Atomic Emission Spectrum - set of frequencies of EM waves emitted by atoms of an element
- has individual lines of color corresponding to frequency of radiation - not continuous range of colors
- each A.E. spectrum is different for each element

- Elements can also absorb same specific energy frequencies they emit, making an absorption spectrum

- Emission & Absorption spectrum add up.