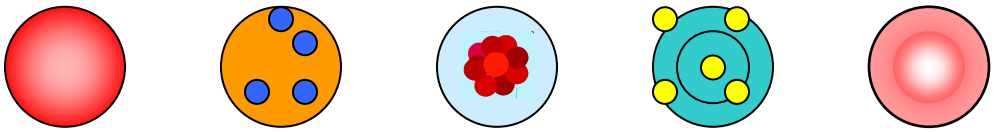
Study Guide on Atoms & Light

Building Blocks of ATOMS:

Electrons (-)
Protons (+)
Neutrons (~)

electrons = # protons in a neutral atom = Atomic Number
neutrons can vary (see: isotopes)

Models of Atoms:



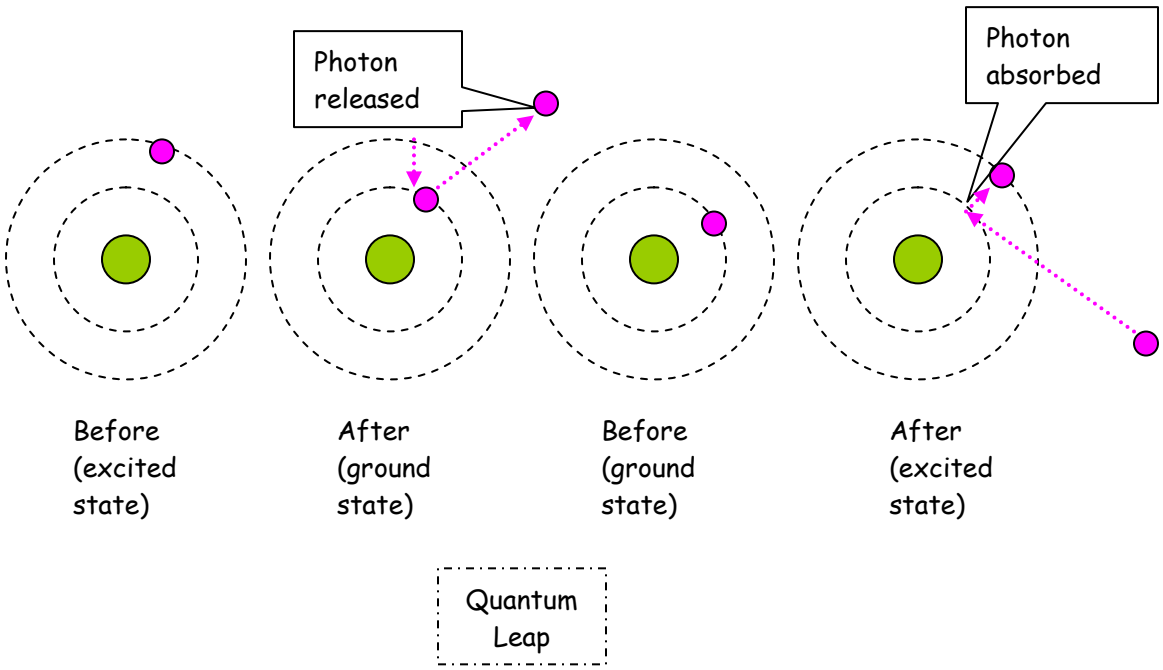
1. **Billiard Ball** – Dalton, 1807 (indivisible, solid particles): Matter can be divided into individual particles

2. **Plum Pudding** – Thompson, 1903: Elemental particles further divided (+ pudding with - raisins)

3. **Nuclear** – Rutherford, 1911 (alpha particles thru gold foil deflected by nuclei): Something small and hard in the center of the atom (atomic)

4. **Planetary** – Bohr, 1913 (Quantized energy): Particles orbit nucleus

5. **Electron Probability Cloud** – Schrodinger, 1926: Unknown location of electrons, density of "cloud" determines probability that they exist in a particular location



Atomic Excitation
Quantum leaps of electrons
Photons emitted or absorbed

Planck's hypothesis: E = hf
The higher the frequency of light, the greater the energy of its photons.
Plack's Hypothesis
Energy is "quantized"
Oscillators can have only discrete restricted amounts of energy
E=hf
Energy = Planck's constant * frequency

Heisenberg's Uncertainty Principle
– It is impossible to simultaneously know a particle's exact position and velocity.

Photoelectric effect
Direct conversion of radiant light energy into electrical energy by shining high frequency light onto metal surface: photons are absorbed and cause energized electrons to leave the metal atoms, thereby causing a flow of electrons carrying charge, or electric current.

Dual Nature of Light (and particles/electrons)
Waves/particles
Dual Nature of Light

- Light sometimes must be described as a wave, and sometimes as a particle (or packet) in order to explain certain phenomena.
- Wave nature explains:
  - Diffraction
  - Interference
  - Polarization
  - Refraction
- Particle nature explains:
  - Photoelectric effect

Emission/Absorption Spectra
Glowing hot items give off EM photons as electrons return to ground state.