

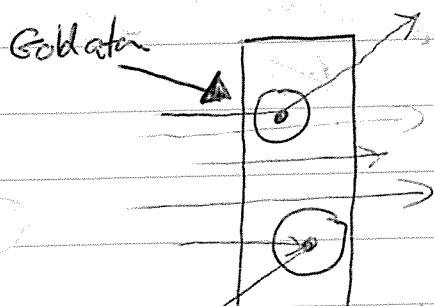
Models of the Atom

Rutherford Model - (By Ernest Rutherford)

Bombarded Gold foil with large positive charged particles known as alpha particles

Observed

- 1) Most particles passed through the foil w/out being deflected
- 2) Small number of particles were deflected at very large angles



- (Proved)
- 1) Most atom is empty space
 - 2) Mass of atom is concentrated in a dense, positively charged nucleus, with negative electrons orbiting

~~Point~~ - Orbiting electrons are accelerating charges, produce electro-magnetic radiation. Release of energy causes orbit to decrease collapsing the atom

Bohr Model - (By Niels Bohr)

Proposed Hydrogen atom has distinct orbits. At any time, a single electron can be associated with only 1 orbit. Each orbit a specific amount of Energy (Energy level)

First Energy Level - Ground State All other levels - Excited State

★ Energy is emitted ~~or absorbed~~ as photons, when atom goes from a higher energy level to a lower energy level
Energy is absorbed as photons when atom goes from lower energy level to higher energy level.

Energy level (Excited state) $n=2$ ↑ ~~excited~~ Absorb Photons ↓ Emit Photons
1 (Ground State) $n=1$

Example

In a hydrogen atom, an electron goes from $n=2$ to $n=1$. How much energy was released? -3.4eV
 -13.6eV

$$E_{\text{photon}} = E_i - E_f \\ = -3.4\text{eV} - (-13.6\text{eV}) \\ = 10.2\text{eV}$$

What is the frequency of the emitted photon?

$$E = hf \\ 1.63 \times 10^{-18} \text{ J} = 6.63 \times 10^{-34} \text{ J}\cdot\text{s} \cdot f$$

$10.2\text{eV} \cdot \frac{1.6 \times 10^{-19} \text{ J}}{1\text{eV}} = 1.6 \times 10^{-18} \text{ J}$

$$2.46 \times 10^{15} \text{ Hz}$$

The electron Cloud Model

- * Electrons are not confined to specific orbits, but are spread out to form an electron cloud. The electrons are densest in regions where the probability of finding electrons is greatest.

The Nucleus

Core of an atom, made up of protons & neutrons. (nucleons \rightarrow refers to protons & neutrons in nucleus)

Protons in nucleus are separated by 10^{-15} m, Result
Small distance \rightarrow large repulsive force
(Gravity not strong enough to do this alone)

Nuclear Force - A force that keeps protons & neutrons together in the nucleus

From past experience, it's the strongest force, but acts only over a very small distance

Mass-Energy Relationship (Einstein)

Mass and Energy are different forms of the same thing

$$E = mc^2 \quad E = \text{Energy (J)} \quad m = \text{mass (kg)}$$

Ex 1. If 1 proton is converted to Energy, find the amount of Energy produced

$$E = (1.66 \times 10^{-27} \text{ kg}) (3 \times 10^8 \text{ m/s})^2 \\ = 1.5 \times 10^{-10} \text{ J}$$

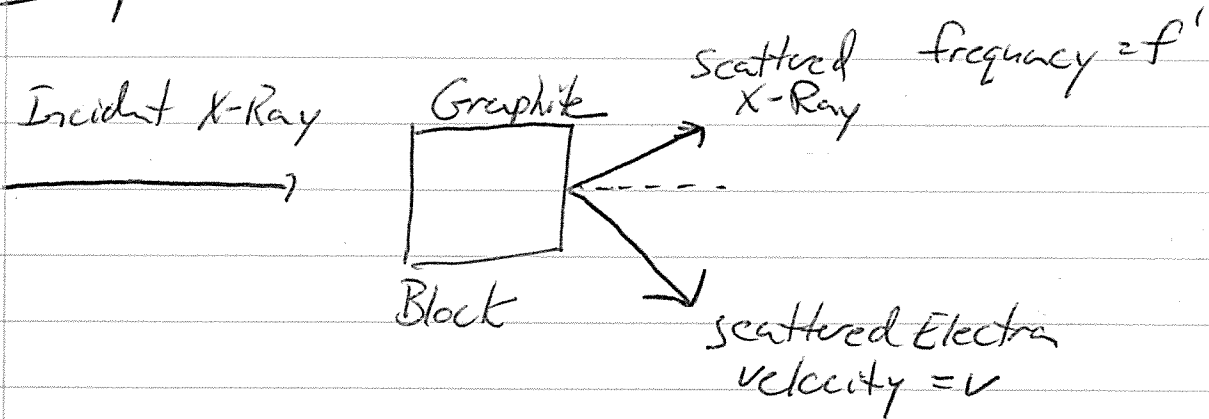
Electron Cloud Model

- Most current Model

Quantum Model - It does not place electrons in a specific orbit, rather it indicates the probability that an electron will be in a region or space near the nucleus

- Not a specific orbit, but a cloud

Compton Effect



- Bombed Graphite w/ X-Rays of known Frequency

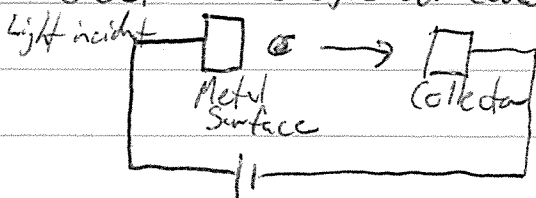
Result: Both X-Rays and Electrons Emerge

~~Star~~ Scattered X-Ray had lower freq. than incident X-Ray
Momentum Conserved Energy Conserved

Like pool ball  After collision both move

Photoelectric Effect

- When light strikes the surface of ~~some~~ certain materials electrons are ejected causing current.



Gate door open

* All energy is transferred

Review

Review

Most Energy $E = hf$ Biggest
↑ ↑ Freq.

— Ionization lines electron no longer assoc. w/
atom

Balmer Series — visible light seen at these pts.

What color produces the greatest energy?
Red, Green, blue, Violet