UP AND ATOM

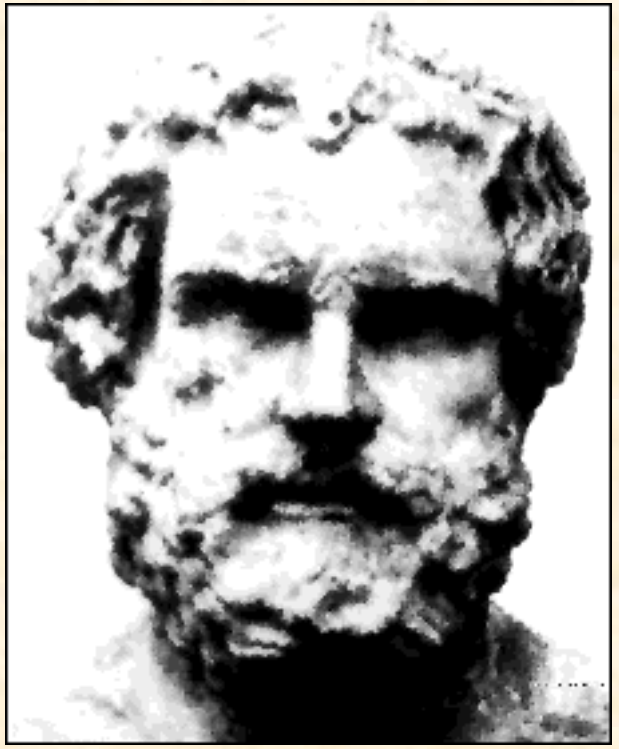
It's time for...

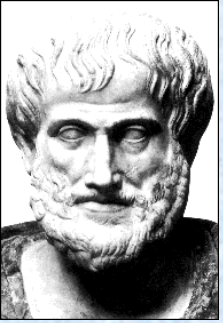
THE HISTORY OF THE ATOM

!

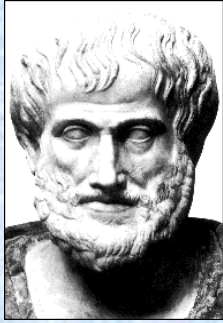
Democritus (400 B.C.)

- Despite having no evidence, proposed that matter is made of about 100 tiny particles called atoms that collide and combine to make everything.
- What does the word “atom” mean in Greek?
- His theory was not widely believed, even though it turned out to be correct.

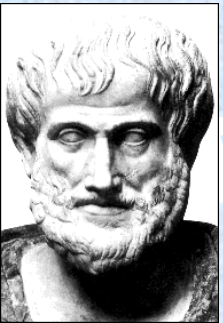




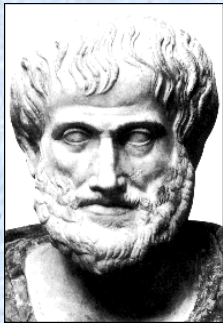
Aristotle -- 350 B.C.



- Denied the existence of atoms.
- Said matter consisted of combinations of only four elements -- air, earth, fire, and water.
- Was widely respected, and his ideas formed the basis of science for nearly 2000 years.
- Lead to alchemy and superstition.



EARTH FIRE WATER AIR



400 B.C. - 1600 A.D.

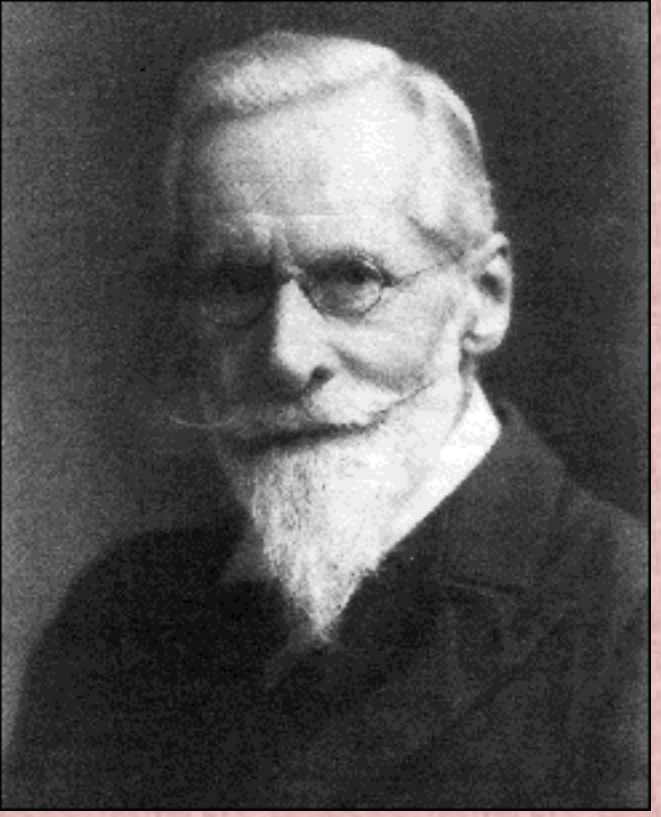
The Dark Ages of Chemistry

The idea of atoms

was lost

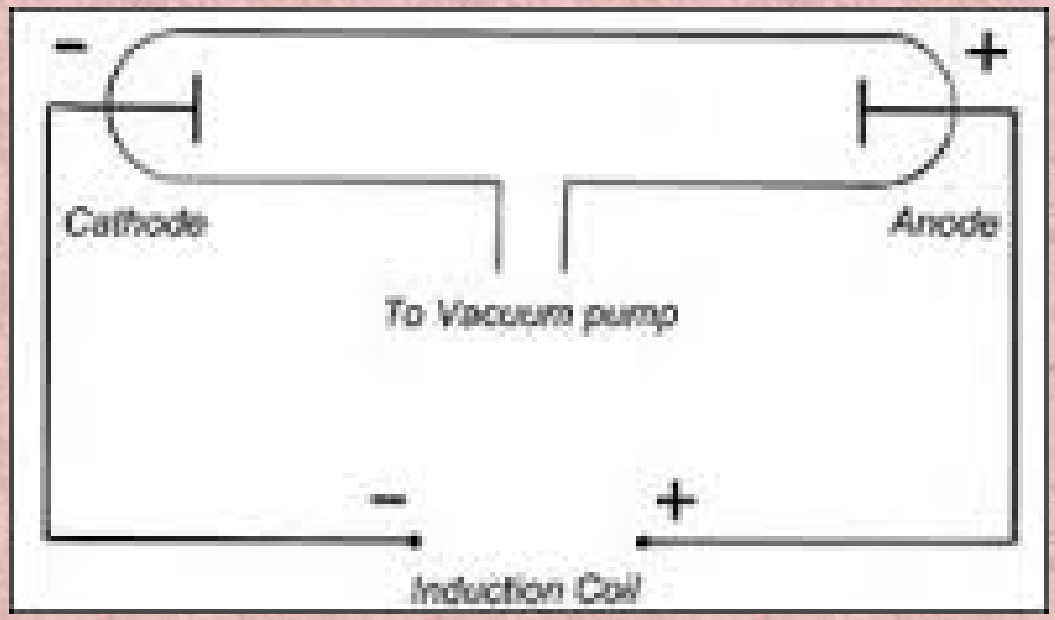
John Dalton's Atomic Theory (1800)

1. All elements are composed of atoms, which are indivisible and indestructible particles. Atoms are the smallest particles of nature.
2. All atoms of the same element are exactly alike; in particular, they all have the same mass.
3. Atoms of different elements are different; in particular, they have different masses.
4. Compounds are formed by the joining of atoms of two or more elements. They are joined in a definite whole-number ratio, such as 1 to 1, 2 to 1, 3 to 2, etc.
5. Chemical reactions involve the rearrangement of atoms to make new compounds.



1879
William Crookes

- Discovers a negatively charged beam in an electrified vacuum tube.

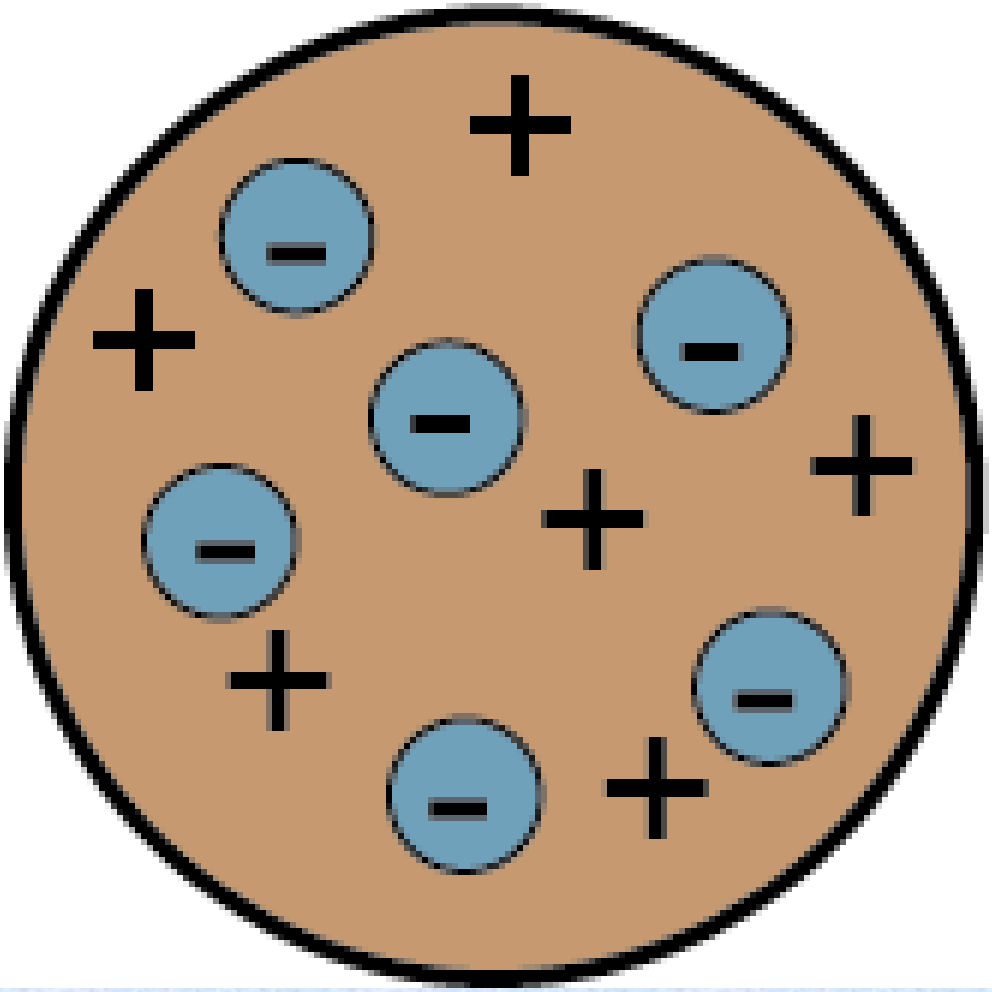


J.J. Thomson

1897

- Proved that Crookes' negative "beam" was really a stream of particles he called "electrons."
- Realized that these electrons must be smaller than the atom
- Developed the "Plum Pudding" model of the atom

Plum Pudding Model

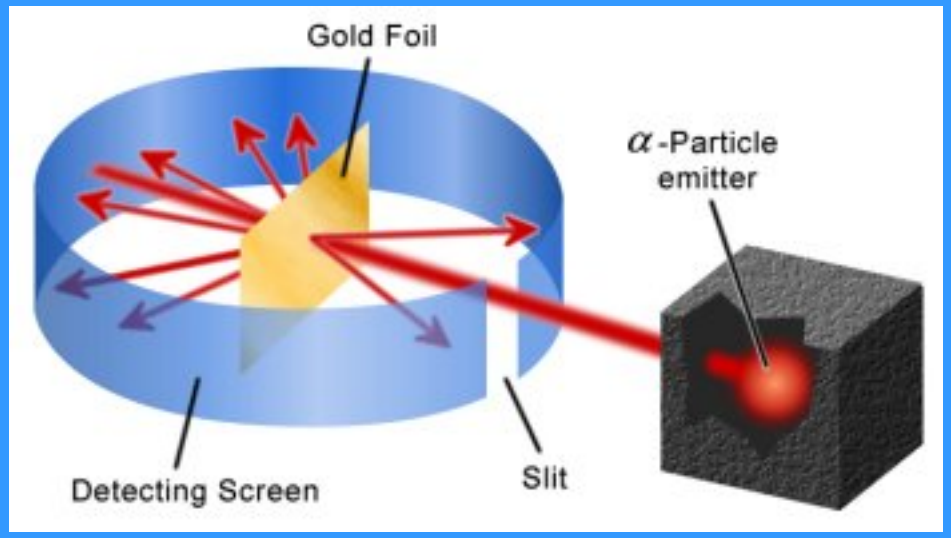


Ernest Rutherford - 1911

- Performed Gold Foil Experiment
- Won Nobel Prize for Chemistry

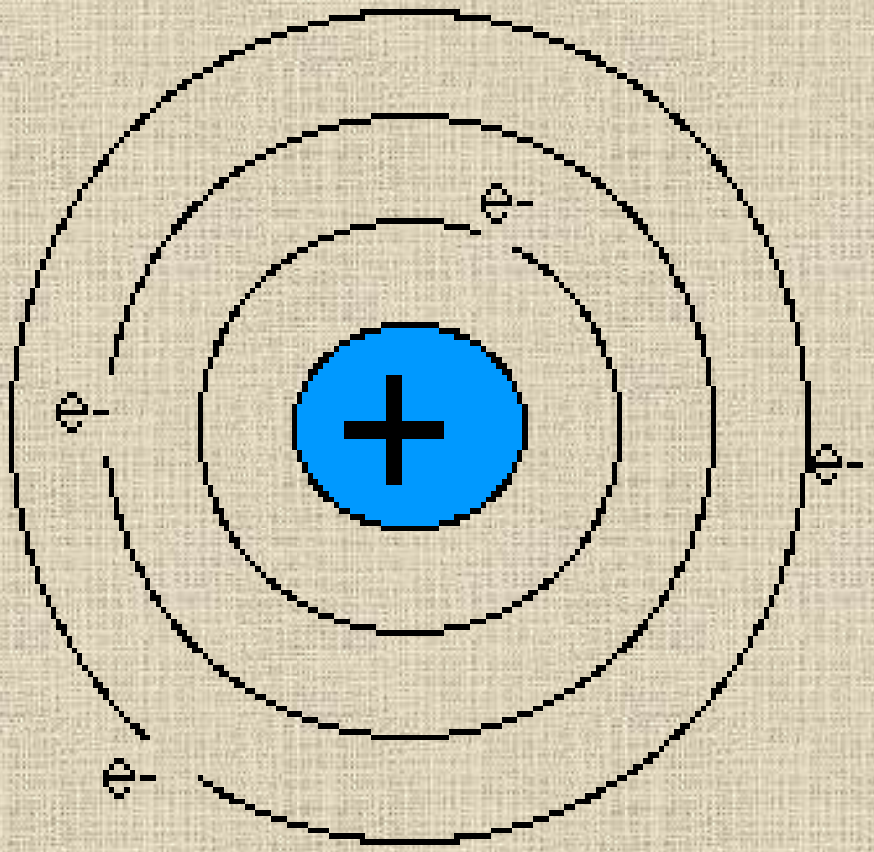
The Gold Foil Experiment

- **Bombard thin piece of gold foil with alpha particles**
- **Result: a few are deflected while most are unaffected**
- **What does it all mean?**



Rutherford's Planetary Model of the Atom

- Compares electrons orbiting the nucleus of an atom to planets orbiting around the sun.



BUT…

- If the nucleus is positive in the middle, and the electrons are negatively charged on the "edges" of the atom, what would YOU expect to happen to the atom?

Niels Bohr (1913)

- Supported Rutherford's model of the atom, but helped to explain its weakness.

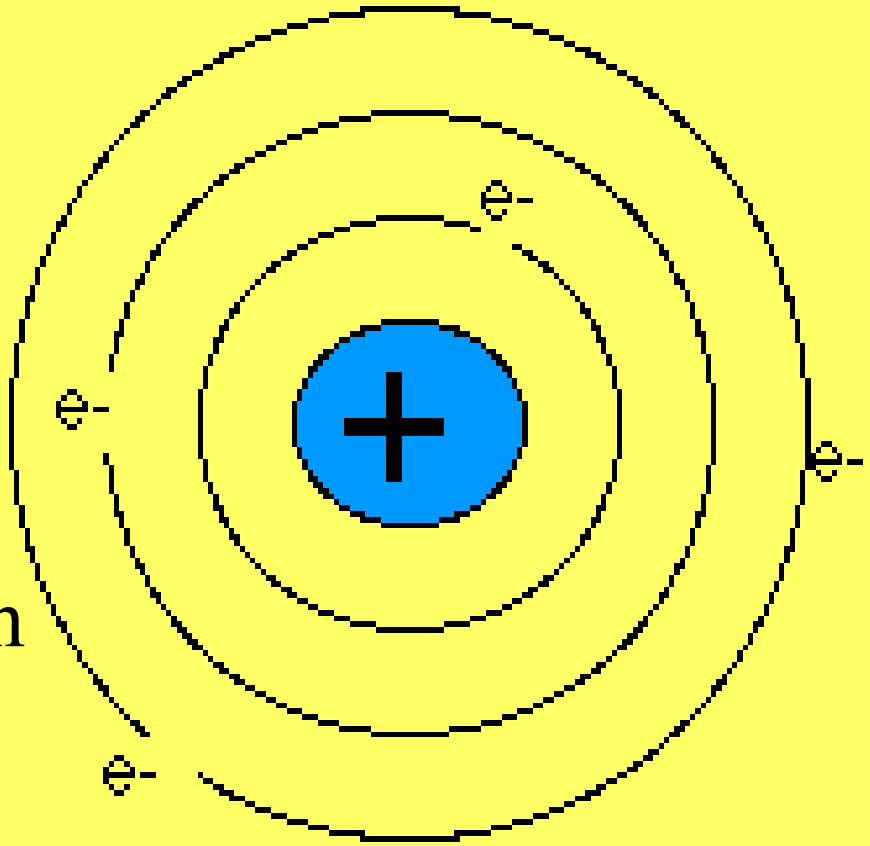
- Electrons are in "energy levels" at specific distances from the nucleus.

- Each energy level has specific amounts of energy.

- Electrons are only "allowed" to have certain amounts of energy.

The Bohr Model of the Atom

- Still compares electrons orbiting the nucleus to planets orbiting around the sun, but adds this idea…
- Electrons occupy distinct orbitals/energy levels.
- Orbitals have specific energies and distances from the nucleus.



Erwin Schrodinger (1925)

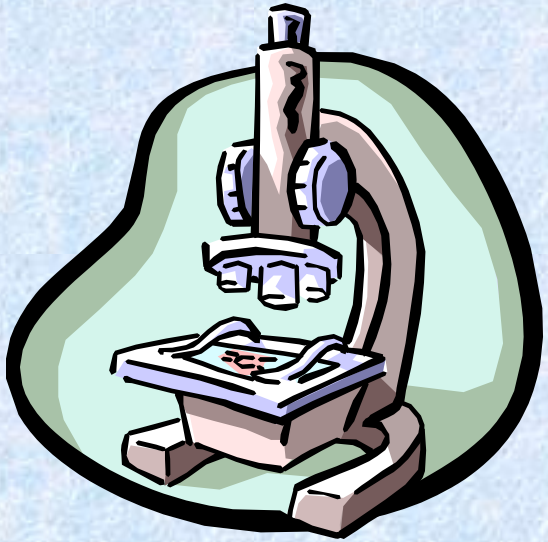
- Regions where electrons are most likely found are called “electron clouds” or “orbitals.”
- Different types of orbitals have different shapes and different levels of energy.
- This new model of the atom explained the physical properties of atom and the Periodic Table perfectly.

James Chadwick 1932

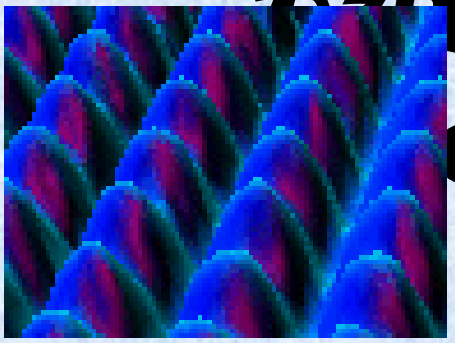
- **Discovered the neutron while doing experiments with radioactive elements**

- **Predicted by Rutherford in 1920, but very difficult to detect since it has no charge.**

1980's



- The first atoms are seen with scanning tunneling microscopes



<-- Picture of

1995

- Fermi lab scientists in Batavia, Illinois study and detect six types of quarks (up, down, charm, strange, top and bottom)

- Quarks are particles believed to make up protons and neutrons