

**ATOMIC THEORY TIMELINE:** In each box, provide information on what the idea/discovery was and how it was made. Where possible, draw pictures or diagrams to explain the event.

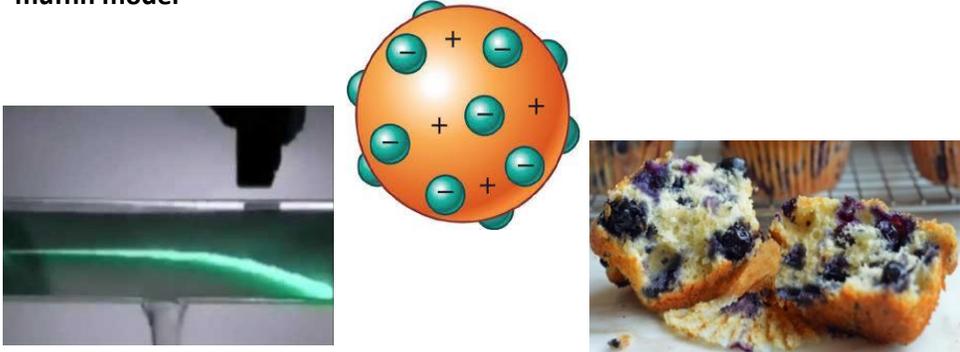
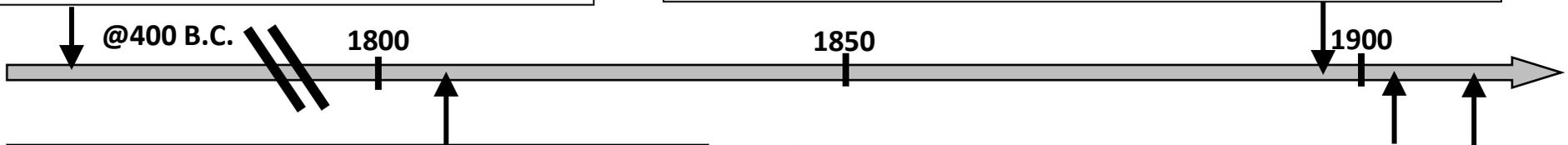
**Democritus (@400 BC):**  
**"ATOMOS"** means "uncuttable"

- Refers to the smallest individual unit of matter
- think of "cutting the cheese"

eventually, you are left with a piece of cheese too small to be cut



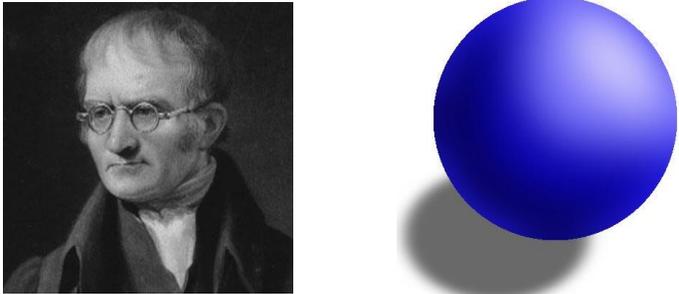
**Thomson (1897): DISCOVERY OF ELECTRONS**  
 Put a magnet near a cathode ray tube and bent the beam  
 Discovered ELECTRONS as tiny, negatively charged particles  
 "muffin model"

**Dalton (1808): EARLY ATOMIC THEORY**

- 1) All matter is composed of atoms
- 2) Atoms of each element have a unique type of atom
- 3) Atoms cannot be subdivided (cut) or destroyed

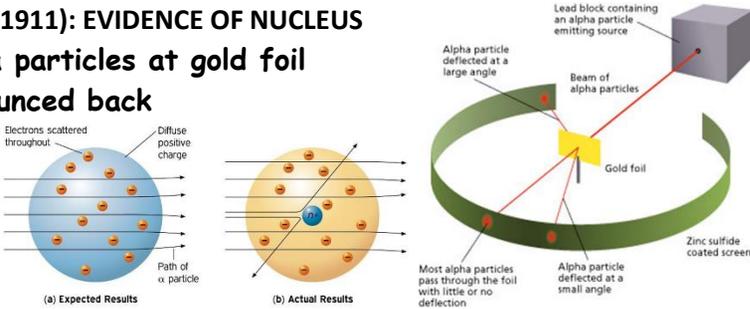
Envisioned atoms as tiny, solid balls of matter:



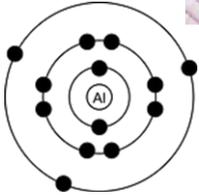
**Nagaoka (1904): PROPOSAL OF NUCLEUS**  
**Solar System Model w/ positively charged nucleus**



**Rutherford (1911): EVIDENCE OF NUCLEUS**  
**Shot alpha particles at gold foil & some bounced back**

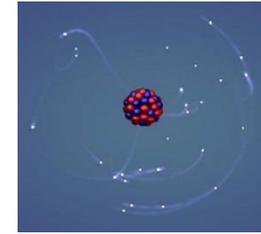


**Bohr (1913): ENERGY LEVELS & VALENCE ELECTRONS**  
 Electrons are more likely to reside in certain areas of the electron cloud  
 Electrons farthest from the nucleus ("outer shell") are called **VALENCE ELECTRONS**



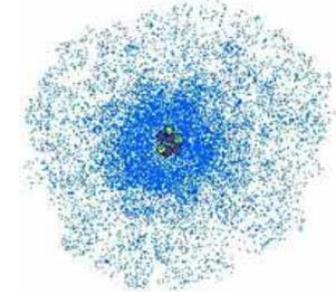
**Modern "Electron Cloud" Model (1920's-Present):**  
**NUCLEUS**

- Extremely small, dense
- Positive charge
- Contains protons and neutrons
- Basically ALL of the mass of the atom



**ELECTRON CLOUD**

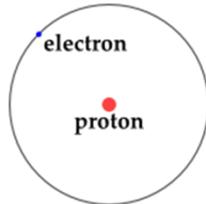
- Surrounds the nucleus
- Mostly empty space
- Contains negative electrons
- Electrons "live" in regions based on probability



**Rutherford (1917): DISCOVERY OF PROTONS**

Rutherford's alpha-particles were actually the nucleus of a hydrogen atom...later realized to be protons

- Positive charge
- 2000 times more mass than electrons
- Inside the nucleus



**Chadwick (1932): DISCOVERY OF NEUTRONS**

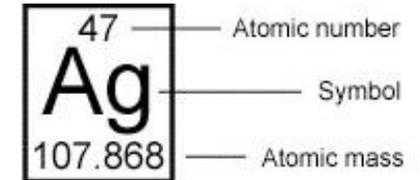
Actual mass of atoms was always at least twice what it was predicted to be based on the mass of protons...

Chadwick discovered that neutrons are inside the nucleus and have equal mass to protons.

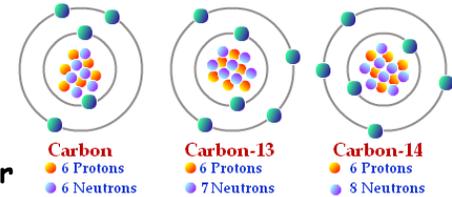


**ELEMENTS**

Atomic Number:  
# of protons



Atomic Mass:  
Avg. # of particles in nucleus (protons + neutrons)



Isotopes:  
Atoms of an element with a different number of neutrons

Ions:  
Charged atoms that have gained or lost valence electrons

