9/14/21

Different Atomic Theories

Theory - is an explanation of a large number of related observations

Model - a representation of a theoretical concept

Greek Model:
- Democritus was greek philosopher
- found the idea of 'democracy'
- found the idea of 'atomos'
  - 'atomos' = 'indivisible'
- his model was
  - no protons, electrons, and neutrons
  - solid and indestructible
- he had no experiments to support his idea
  - reason why his model and theory weren't successful

- Aristotle:
  - discovered that all matter is made up of 4 elements water, fire, earth and air

Dalton's Theory (1803):
- expanded upon the atomic theory proposed by Democritus

sub-atomic particles → not true anymore → I: all matter is composed of tiny indivisible particles called atoms

not true → isotopes → II: all atoms of an element have identical properties

still true → III: atoms of different elements have different properties

still true → IV: atoms of two or more elements can combine in constant ratio to form new substances

still true → V: in chemical reactions, atoms join together or seperate from each other but are not destroyed

Two Important Laws:

Law of Conservation of Mass: matter is neither created nor destroyed

Law of Constant Composition: compounds always have the same percentage composition by mass

Thomson's Theory (1897):

- believed that atoms are spheres with embedded electrons
- net charge of zero
- no p^+ or n^0

Nagaoka's Theory (1904):

- positive sphere with a ring of electrons
- no p^+ or n^0

Rutherford's Model (1914):

- small positive nucleus surrounded by electrons
- prediction based on Thomson's model and belief that the atom is mostly empty space
- no n^0
- couldn't explain many concepts (problem with charges)

Bohr's Theory (1921):

- nucleaus is positively charged and electrons move around it
- magic numbers of electrons in quantized energy levels
- explained periodic table

Chadwick's Theory (1932):

- discovered the nucleus
- filled in a lot of missing blanks
- $p^+ = e^-$
- neutrons also in nucleus

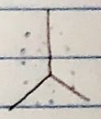
The Quantum Mechanical Theory:

- Bohr's theory was limited in the ability to predict the line spectra of other atoms (couldn't explain it)

① - Max Planck suggested in his quantum theory of light that light has both particle like properties and wave length characteristics

② 1924→ - Louis de Broglie suggested that if light can have both, wave and particle like characteristics, then maybe particles (electrons) could have the same
  - he later verified this experimentally by diffraction patterns

③ 1927 - Heisenberg said that it is impossible to precisely know the position and motion of an electron at the same time



- the electron does not move in circular orbits (3D)