

Notes Present Day Atomic Theory and Electron Configuration

I. Modern Atomic Theory

- i. The nucleus is composed of protons and neutrons
- ii. Electrons travel around the nucleus in energy levels
 1. All the energy levels together make up the electron cloud

II. Energy levels

- i. A total of 7 energy levels exist, the closest to the nucleus is level 1
- ii. Each element needs a specific number of energy levels to hold all of its electrons
- iii. The last level, or the outermost, is called the **valence shell**.
 1. Valence electrons possess the most energy; they are the furthest from the nucleus.
 2. Valence electrons are involved in bonding.

III. The exact location of a particular electron cannot be pinpointed

- i. They are too small, too fast, and have way too much energy
- ii. Heisenberg's uncertainty principle

IV. Orbitals

- i. A region of space within the electron cloud where there is a high probability of finding an electron.
 1. Where we think to our best knowledge where they are.
- ii. Orbitals are named s, p, d, and f
 1. Each s-orbital can hold 2 electrons
 2. Each p-orbital can hold 2, but there are 3 different shapes

3. Each d-orbital can hold 2, but there are 5 different shapes
4. Each f-orbital can hold 2, but there are 7 different shapes

V. So What does this have to do with chemistry

- i. On the atomic level how an atom's electrons are arranged controls how it will behave in a chemical reaction.

VI. Electron configuration

- i. A detailed "address" for the electrons of any given element
- ii. Rules to follow when completing an atoms electron configuration
 1. Electrons must fill the lowest energy level first
 - a. **Aufbau Principle**
 2. A maximum of 2 electrons can fit in an orbital, each orbital must have one electron before doubling up.
 - a. **Pauli's Exclusion Principle**
 3. Electrons that are doubled up must have opposite spins
 - a. **Hund's Rule**

Examples

Write the electron configurations for the following elements

- | | | |
|------|-----------|----------------------------|
| I. | Nitrogen | $1s^2 2s^2 2p^5$ |
| II. | Lithium | $1s^2 2s^1$ |
| III. | Carbon | $1s^2 2s^2 2p^4$ |
| IV. | Sodium | $1s^2 2s^2 2p^6 3s^1$ |
| V. | Argon | $1s^2 2s^2 2p^6 3s^2 3p^6$ |
| VI. | Magnesium | $1s^2 2s^2 2p^6 3s^2$ |