

Chapter 8: Electronic Configurations, Element Properties and the Periodic Table

Filling Electrons (spdf notation and box configurations)

1. Aufbau principle: building up of atom from bottom up i.e. electrons occupy orbitals of the lowest energy available.
 2. Pauli's exclusion principle: no two electrons in an atom have the same quantum number, i.e. an atomic orbital that has two electrons must have the opposite spins (magnetic spin number)
 3. Hund's Rule: electrons are filled in the empty orbital first before pairing up. The singly filled electrons have the same magnetic spin.
- Electronic configurations can be also filled as noble gas configuration. Select the noble gas just before the element.
 - Transition metal electrons (d) go in the penultimate core shell.
 - Periodic table has s, p, d and f blocks
 - Electronic configuration of ions:
 - Anions: add electrons in the p orbitals or d in case of expanded shell.
 - Cations: for main group remove electrons from s or p. For transition metals remove valence s electrons first and then the d.

Periodic Properties

1) Radius:

- a) Atomic radii: decreases across and increases down the PT
- b) Ionic radii: cations smaller than original atoms while anions larger than original atom.

2) Ionization Energy (IE): energy required to remove an electron from ground state atom or ion in a gas state. Increases across and decreases down the PT.

3) Electron Affinity: energy change associated with an atom when it gains an electron in a gas state. More energy is released across the PT

4) Metallic Character: increases top to bottom in a group and decreases from left to right within a period.

5) Also compare – ionic size vs atomic size.

Properties of elements according to groups.

Group I – low IE; all are M^+ ions; react with oxygen and water readily to give oxides and hydroxides.

Group II – less reactive than group I; reactions with water varies; they still give hydroxides. Free metals react with acids to give hydrogen gas.

Group III – Al forms an oxide coating in presence of oxygen.

Group IV – has non metals and metals. Don't react with water but with acids to give hydrogen gas.

Group V – has non metals and metals. Oxides of elements will react with water to form acids.

Group VI – most are non metals. Non metal oxides of elements will react with water to form acids.

Group VII – high IE. Form mostly ionic compounds with metals; hydrogen halides are acids and electrolytes.

Group VIII – noble elements – unreactive.

Key words:

Metals, Nonmetals, Metalloids and Noble Gases	Isoelectric	Allotropes
Effective nuclear charge	Valence electrons	Core electron

Non metal oxides + water = acids; Metal oxides + water = bases