

Topic 3: Periodic Table Outline

1. The placement of an element on the Periodic Table gives an indication of the chemical and physical properties of that element.

- ✓ Elements to the left of the stair step line are metals, and therefore are easily oxidized (lose electrons) in bonding situations, are good electrical conductors, are shiny, malleable, ductile, and have low ionization energies and electronegativities.
- ✓ Elements to the right of the stair step line, but not in Group 18 are nonmetals, and therefore react to gain electrons (get reduced), are not conductors, are dull appearing, brittle, have high ionization energies and electronegativities.
 - ✓ Some of the elements along the stair step line have properties of both metals and non-metals and are known as "metalloids" or "semi-metals".
- ✓ Elements in Group 18 are the noble gases and they are chemically inert (unreactive) and have extremely high ionization energies.

2. Elements are arranged in order of increasing atomic number (NOT MASS!)

3. The number of protons in an atom (atomic number) identifies the element.

- ✓ The number of protons in an atom only changes through nuclear reactions.

4. The atomic mass is the sum of protons and neutrons in the nucleus.

- ✓ The mass number given on the periodic table is a weighted average of the different isotopes of that element.
- ✓ Electrons do not significantly add to the atomic mass.

5. Isotopes of an element are identified by the sum of protons and neutrons.

- ✓ Isotopes of the same element have the same number of protons and a different number of neutrons.
- ✓ Examples of isotopic notation are: $^{14}_6\text{C}$, $^{14}_6\text{C}$, carbon-14, C-14

6. Elements can be classified by their properties and their location on the Periodic Table as metals, non-metals, metalloids, and noble gases.

7. Elements may be differentiated by their physical properties.

- ✓ Ex: Density, conductivity, malleability, hardness, ductility, solubility

8. Elements may be differentiated by their chemical properties.

- ✓ Chemical properties describe how an element behaves in a chemical reaction.

9. Elements are arranged into periods and groups.

10. Elements of the same period have the same number of occupied energy levels. 18

11. Elements of the same group have the same valence configuration and similar chemical properties.

- ✓ Group 1 elements other than H are alkali metals.
- ✓ Group 2 elements are alkali earth metals.
- ✓ Group 17 elements are halogens.
- ✓ Alkali metals, alkali earth metals, and halogens all are highly reactive and do not exist as free elements in nature (they are all found in compounds).
- ✓ Group 18 elements are noble or inert gases. These elements have filled valence levels and do not normally react with other substances.

12. The succession of elements within a group demonstrates characteristic trends in properties.

As you progress down a group:

- ✓ atomic radius increases.
- ✓ electronegativity decreases.
- ✓ first ionization energy decreases.
- ✓ metallic character increases.

13. The succession of elements within a period demonstrates characteristic trends in properties.

As you progress across a group from left to right:

- ✓ atomic radius decreases.
- ✓ electronegativity increases.
- ✓ first ionization energy increases.
- ✓ metallic character decreases.

14. Some elements may exist in two or more forms in the same phase. These forms differ in their molecular or crystal structure, hence their different properties. These different forms are called "allotropes,"

- ✓ Ex: Solid carbon exists in three different forms: graphite, diamond (a network solid) and coal.
- ✓ Ex: the element oxygen can exist in two different forms: O₂ gas and ozone (O₃ gas)