Periodic Table

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1. Electron Configuration

The order of filling electrons in atomic orbitals, is roughly as follows;

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6$ must be known.

Example 1

Ca: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$

S: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$

Al^{+3}: $1s^2\ 2s^2\ 2p^6$

Cl^{-1}: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

- Highest number of energy level gives period number and sum of the numbers of electrons in the highest energy level gives group number.
- If the electron configuration of an atom ends with s or p orbitals means that element is in A group (main group).
- If the electron configuration of an atom ends with d or f orbitals means that element is in B group (secondary group).

Example 2

Ca: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$ 4^{th} period and 2A group

S: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$ 3^{rd} period and 6A group

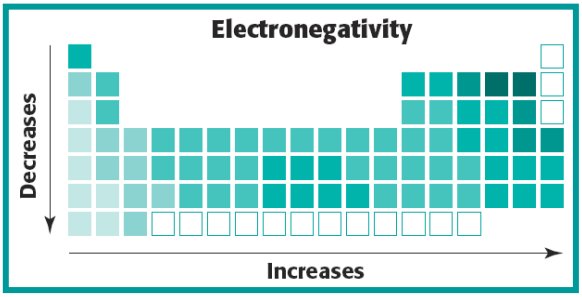
2. General Knowledge about PT

- Elements are arranged according to increasing atomic number (proton number) in PT
- Horizontal rows are called periods. There are 7 periods beginning with a metal and ending with a noble gas.
- Vertical columns are called groups or family. There are 8A and 8B groups. The group 8B contains 3 columns. A groups are called main or representative groups. And B groups are called transition metals.
- There are 92 natural elements, most of them are metals.
- The elements which have almost similar chemical and physical properties are put in the same groups. They have similar electron configurations as well.

3. Periodic Trends

A. Electronegativity

- Electronegativity is a measure of the ability of an atom in a chemical compound to attract electrons.
- Electronegativity increases from left to right across a period and decreases from top to bottom in a group.

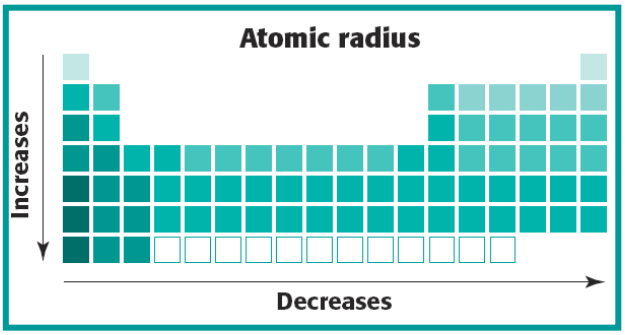


B. Metallic and Nonmetallic Properties

- About 80% of the elements in the periodic table are metals.
- Only the eleven elements, H, C, N, O, P, S, Se, F, Cl, Br, I and noble gases are nonmetals.
- However B, Si, Ge, As, Sb, Te, Po and At are metalloids.
- Metalloids have some chemical and physical properties of metals and other properties of nonmetals.
- As we get closer to Fr among metals from right and top of periodic table metallic properties increase, and closer to F from left and bottom of periodic table nonmetallic properties increase.

C. Atomic Radius

- Atomic radius is the distance between the nucleus and the outermost electron. It affects the melting point, boiling point, density of elements and the ability of losing or gaining electrons by atoms.
- Two factors affect the atomic radius of elements: number of energy level and proton number.
- Atomic radius increases from top to bottom within a group, and it decreases from left to right across a period in the periodic table.



D. Acidity and Basicity

- Acidity and basicity of an oxide of an element depends upon the electronegativity of that element. The greater the electronegativity the more acidic oxide of the element, and the less the electronegativity, the more basic oxide of the element.
- The acidity of the oxides of elements increases from left to right in a period, and the basicity of the oxides of elements decreases.
- In a group acidity of the oxides of elements decreases, and the basicity of the oxides of elements increases from top to bottom.
- Form of oxides from left to right in periods as follows

E_2O EO E_2O_3 EO_2 E_2O_5 EO_3 E_2O_7

4. Review Questions

Example 1

Encircle the letter T, if the statement is true, and the letter F, if it is false.

1. T F Atomic size of calcium atom is smaller than that of potassium atom.
2. T F Electron configuration of calcium atom is 1s2 2s2 2p6 3s2 3p6 3d6 4s2.
3. T F Formula of superior oxide of an element with atomic number 16 is similar to E2O3.
4. T F Electron configuration of secondary group elements ends with "d" type of orbitals.
5. T F In the order of atomic numbers 14-15-16 acidic character of oxides decreases.
6. T F In the order of atomic numbers 11-12-13 basic character of oxides decreases.
7. T F In the order of atomic numbers 7-15-33 acidic character of oxides increases.
8. T F Superior oxide of the element in subgroup principal group 6 has the composition of E2O3.
9. T F The element with an electron configuration of 1s2 2s2 2p6 3s2 3p6 3d5 4s2 is placed in the 4th period and sub group secondary of the periodic table.
10. T F Zinc element is placed in 5th period and subgroup principal group 2 in the periodic table.
11. T F Superior oxide of an element in sub group principal IV is composed of EO2.
12. T F Hydroxide solution of an element with +15 charge in its nucleus turns the color of litmus paper to red.

Example 2

Following elements are given;

H, Na, Si, Fe, O, F.

Complete the following statements with formula of substances formed from these elements with corresponding indicated characteristics.

1. Substance …….. is formed from the atoms containing 8 protons in the nucleus.
2. In the composition of substance …… there are ions with electron configuration of 1s2 2s2 2p6.
3. One of the elements in the substance …… is in the sub group secondary elements.

Example 3

Active component in garlic has the following elements;

K, P, S, F, Mg, H.

Complete the following statements with formula of substances formed from these elements with corresponding indicated characteristics.

1. Substance …….. is formed from the atoms containing 10 neutrons in the nucleus.
2. In the composition of substance …… there are ions with electron configuration of 1s2 2s2 2p6 3s2 3p4.
3. In the substance …….. there is an ion that has an electron configuration similar to argon's electron configuration.

Example 4

The essential phytochemical content, consisting of the following elements:

K, N, O, Cl, H, Mn.

Complete the following statements with formula of substances formed from only these elements with corresponding indicated characteristics.

1. The compound …….. contains atoms with electron configuration of 1s2 2s2 2p3.
2. One of the element in the compound ……. is from "d" block.

Example 5

Complete the statements below;

1. The element placed in the periodic table in the 4th period, subgroup secondary 6, contains in nucleus ..... protons.
2. The chemical element with a 80 g/mol relative atomic mass, form the superior oxide with a chemical formula of ..... and has a gaseous compound with hydrogen with a chemical formula of .....
3. The electron configuration of an atom with 34 protons in its nucleus is ……
4. In the range of elements N- P- As nonmetallic properties …….. , reducing properties .....
5. The element in the third period, with atomic number of ..... forms basic oxide.
6. The atom with an electron configuration of 1s2 2s2 2p6 3s2 3p3 corresponds to the element with the symbol ……
7. In the range of elements Na- Mg- Al metallic properties …….. , reducing properties .....
8. The element in the third period, with atomic number of ..... forms an acid oxide.
9. Symbol of element with Z = 13 is ……, its superior oxide has the formula of …… and possesses ……character.
11. Formula of the compound formed from the atom containing 17 protons in its nucleus is …….
12. Hydroxide of the element with 1s2 2s2 2p6 3s2 3p4 electron configuration has the formula of ……., and medium of the solution is ……