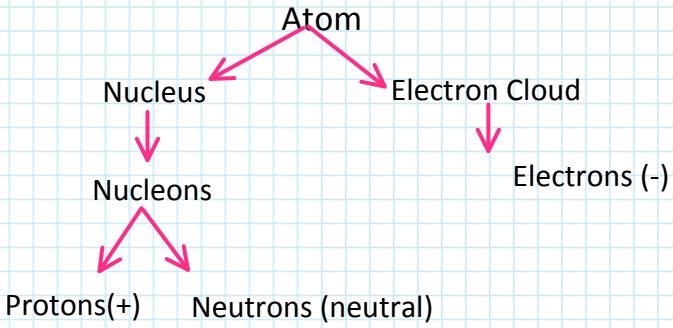
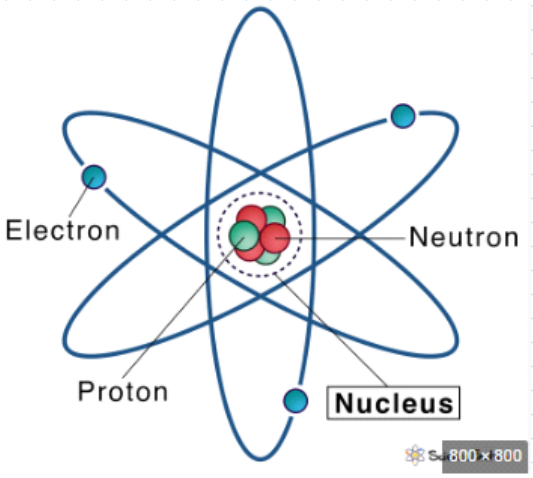
Chem "Atom" Summary

Wednesday, December 14, 2022 11:16 AM

1. Atom:

is the smallest particle that can't be seen by the naked eye.





Particle	Symbol	Relative Charge	Charge	Mass (Kg)	Location
Proton	p^+	+1	$+1.6 \times 10^{-19}$	1.67×10^{-27}	Inside the nucleus
Neutron	n^0	0	0	1.67×10^{-27}	Inside the nucleus
Electron	e^-	-1	-1.6×10^{-19}	9.11×10^{-31}	Outside the nucleus n the electron cloud

REMARK!!!!!!

→ Composition of atom:

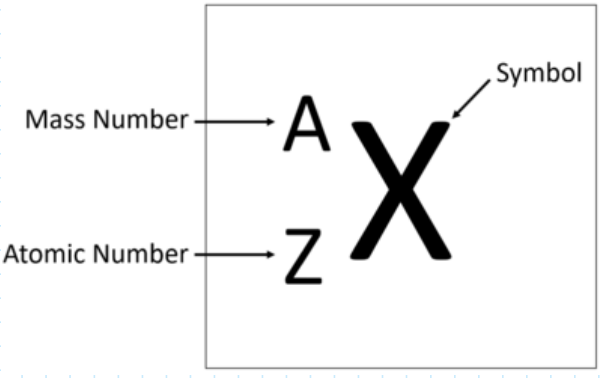
1. Number of protons
2. Number of neutrons
3. Number of electrons

→ Composition of nucleus

→ In a neutral atom, Z= atomic number = number of protons = number of electrons

→ In case of ion: number of protons ≠ number of electrons

2. Atomic symbol:



- A= Z+N
- N=A-Z
- Z=A-N

3. **Short-hand notation:**

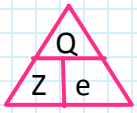
X-A

4. **Charge of Nucleus:**

$Q_{nucleus} = Q_{protons} + Q_{neutrons}$

$\Rightarrow Q_{nucleus} = Q_{protons}$

$\Rightarrow Q_{nucleus} =$ Z x e



Where: Q= nuclear charge

Z= number of protons

e= electric charge = 1.6 x $10^{-19}C$

5. **Charge of electron cloud:**

$\Rightarrow Q_{electron\ cloud} = Q_{electrons}$

$\Rightarrow Q_{electron\ cloud}$ =-Z x e

Where: Q= nuclear charge

Z= number of electrons

e= electric charge = 1.6 x 10^{-19}C

6. **Charge of the atom:**

$Q_{atom} = Q_{nucleus} + Q_{electron\ cloud}$

But the atom is electrically neutral, Z= atomic number = number of protons= number of electrons

$\Rightarrow Q_{atom} = 0$

7. **Isotopes:**

Are atoms od the same element having same atomic number (Z) but different mass number (A) and different number of neutrons (N)

8. **Average atomic mass**

Average atomic mass = $\frac{(A_1 \times \%_1)+(A_2 \times \%_2)\ldots}{100}$ ★ Average atomic mass in a.m.u or a.u

9. **Electron configuration:**

It is the distribution of the electrons in energy levels and sublevels.

a. **Energy levels:**

They are 7: K,L,M,N,O,P and Q

b. **Sublevels:**

→ They consist of orbitals, each orbital can only occupy 2 electrons.

→ They are noted by: s,p,d and f

- s^2 : has 1 orbital
- p^6 : has 3 orbitals
- d^{10} : has 5 orbitals
- f^{14} : has 7 orbitals

Hund's Rule:

According to Hund's rule, each orbital can't be paired unless all the orbitals are occupied by a

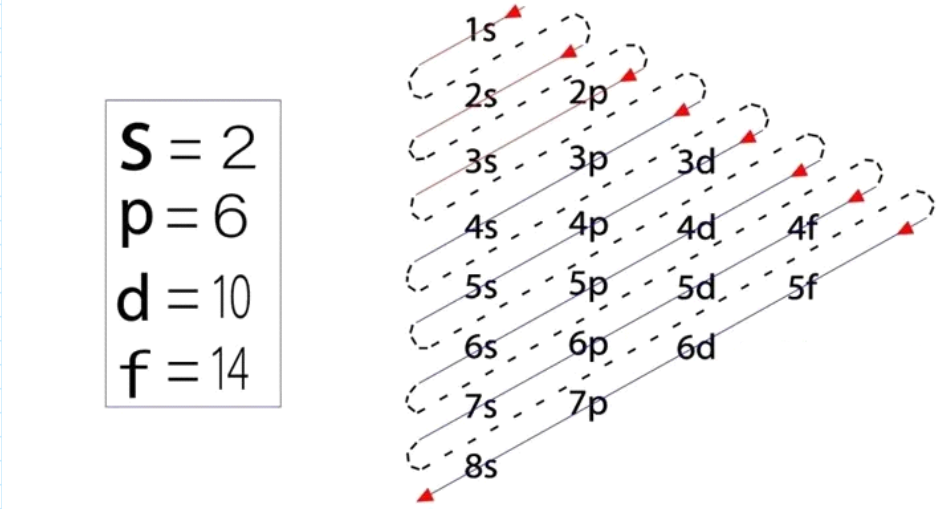
single electron.

Stoner's Rule:

According to Stoner's rule, an energy level can occupy a maximum number of electrons= $2n^2$.

Electron configuration by diagonal rule:

S sp sp sdp sdp sfdp sfdp



10. **Determination of the row and the column:**
    a. **Row:** it is the number preceding the last "S" sublevel shown in the electron configuration.

    b. **Column: 3 cases**
    i. If the electron configuration ends with s^x : column x
    ii. If the electron configuration end with p^x : column x +12
    iii. If the electron configuration end with d^x : column x +2

11. **Valance electron:** it is the number of electrons on the outer energy level.
    If the electron configuration ends with valance electron s^x = x
    If the electron configuration ends with valance electron p^x= x +2

12. **Valance or valency:**
    Number of electrons lost, gained or shared by an atom to attain stability.

13. **Lewis dot symbol:**
    It is the symbolic representation of valance electrons of an atom.

14. Main families in the periodic table:
    Alkali metals Alkaline earth metals

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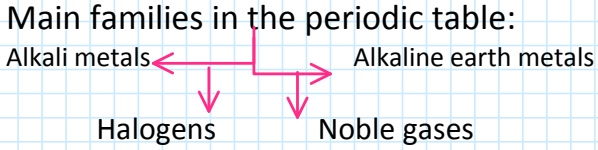


a. <u>Alkali metals:</u>

→ They are elements of column 1

→ Their electron configuration end with s^1

→ They tend to lose 1 electron to attain stability

$$M \longrightarrow M^+ + 1\ electron$$

b. <u>Alkaline earth metals:</u>

→ They are elements of column 2

→ Their electron configuration ends with s^2

→ They tend to lose 2 electrons to attain stability

$$M \longrightarrow M^+ + 1\ electron$$

c. <u>Halogens:</u>

→ They are elements of column 17

→ Their electron configuration ends with p^5

→ They tend to gain 1 electron to attain stability

$$M \longrightarrow M^+ + 1\ electron$$

d. <u>Noble gases:</u>

They are elements of column 18

Their electron configuration ends with p^6 except Helium.

They are: Helium / Argon / Neon

15. **<u>Relation between n and N:</u>**

$$n = \frac{N}{N_A}$$

where:

→ n: number of moles(mol)

→ N: number of atoms (atom)

→ A : Avogadro's number (atoms/mol)

16. **<u>Relation between m and N:</u>**

$$\frac{m}{n} = \frac{N}{N_A}$$

where:

→ M: Molar mass (g/mol)

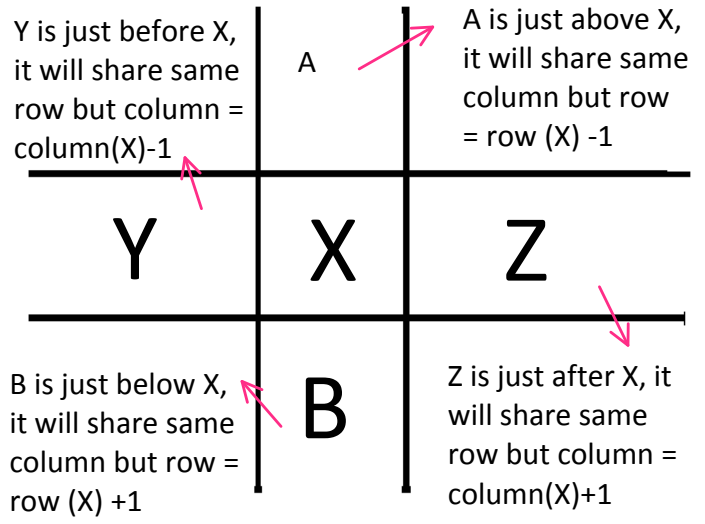
→ m: mass number (g)

→ N: number of atoms (atom)

→ A : Avogadro's number (atoms/mol)

<u>REMARK!!!</u>

Y is just before X, | A | A is just above X, it will share same


Y is just before X, it will share same row but column = column(X)-1
A
A is just above X, it will share same column but row = row (X) -1
Y
X
Z
B is just below X, it will share same column but row = row (X) +1
B
Z is just after X, it will share same row but column = column(X)+1