Chapter "7"

Quantum numbers:

1. Principle Quantum Number: "n" (الرقم الرئيسي)
   - → refers to Energy and size
   - → Smaller n ..... smaller Energy
   - → n can be any positive value but it can't be zero
     n = 1 ... ∞ but n ≠ 0

n	1	2	3	4
Letter	K	L	M	N

→ Energy For atoms:

Single e⁻: only depends on n
ex: H / Li^{+2} / He^{+}

More than one e⁻: it depends on n and L
Fe
↑↓ ↑↓ ↑ ↑ ↑

→ Large n ..... Large orbital size
→ orbitals with same n ⟶ same shell

n = shell

② Angular momentum Q.N: "ℓ"
- → refers to the shape of the orbital
- → [0, n-1]

ℓ	0	1	2	3	4
Letter	s	p	d	f	g

→ Shell n ⟶ has n different kinds of orbitals (sub shells)

n = subshell

s ○
p ∞
d ∞

③ Magnetic Q.N: "m_ℓ"
- → refers to the orientation
- → (-ℓ, ℓ)
- → ℓ sub shell has "2ℓ+1" orbitals.

④ Spin Q.N: "m_s"
- → refers to the orientation of the spin axis
- → $\frac{1}{2}$ or $-\frac{1}{2}$

Note:

- All orbitals in same subshell have the same Energy
- p ⟶ n=2
  d ⟶ n=3
  f ⟶ n=4

Chapter "8"

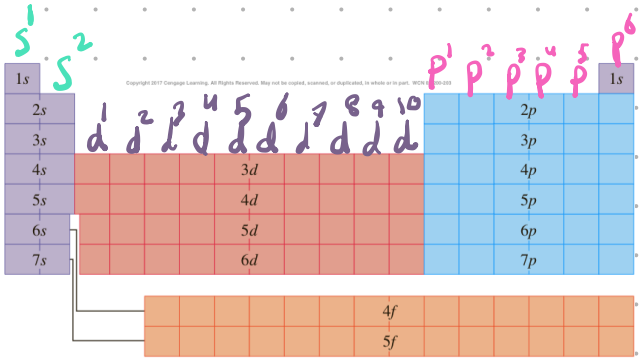
- **Pauli Exclusion Principle:**
  no two electrons can have the same four quantum numbers

- **building up Principle (Aufbau Principle)**

Note:
- S → 2e̅
- p → 6e̅
- d → 10e̅
- f → 14e̅

$1S\ 2S\ 2P\ 3S\ 3P\ 4S\ 3d\ 4P\ 5S\ 4d\ 5P\ 6S\ 4F\ 5d\ 6P\ 7S$

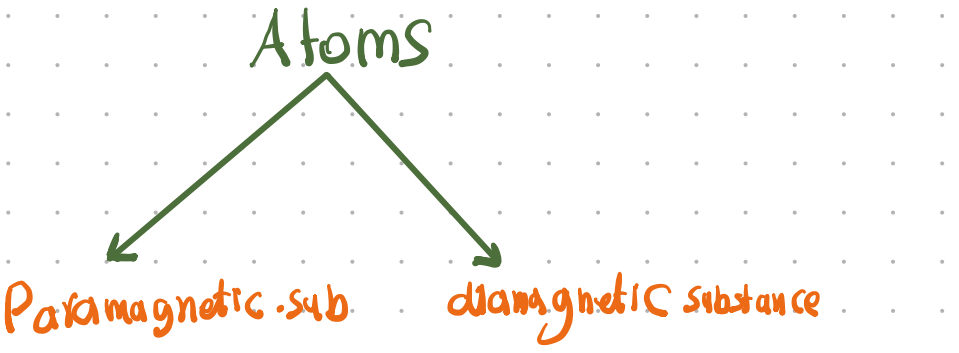
Lowest energy orbitals are filled first.



Exceptions:
- Cr: [Ar] $4s^2 3d^4$
  : [Ar] $4s^1 3d^5$
- Cu: [Ar] $4s^2 3d^9$
  : [Ar] $3d^{10} 4s^1$
- group: the largest n
  : period: ve̅

- **Hunds Rule:**

States that the Lowest energy arrangement of electrons in a subshell is obtained by putting electrons into separate orbitals of the sub shell with the same spin before pairing electrons



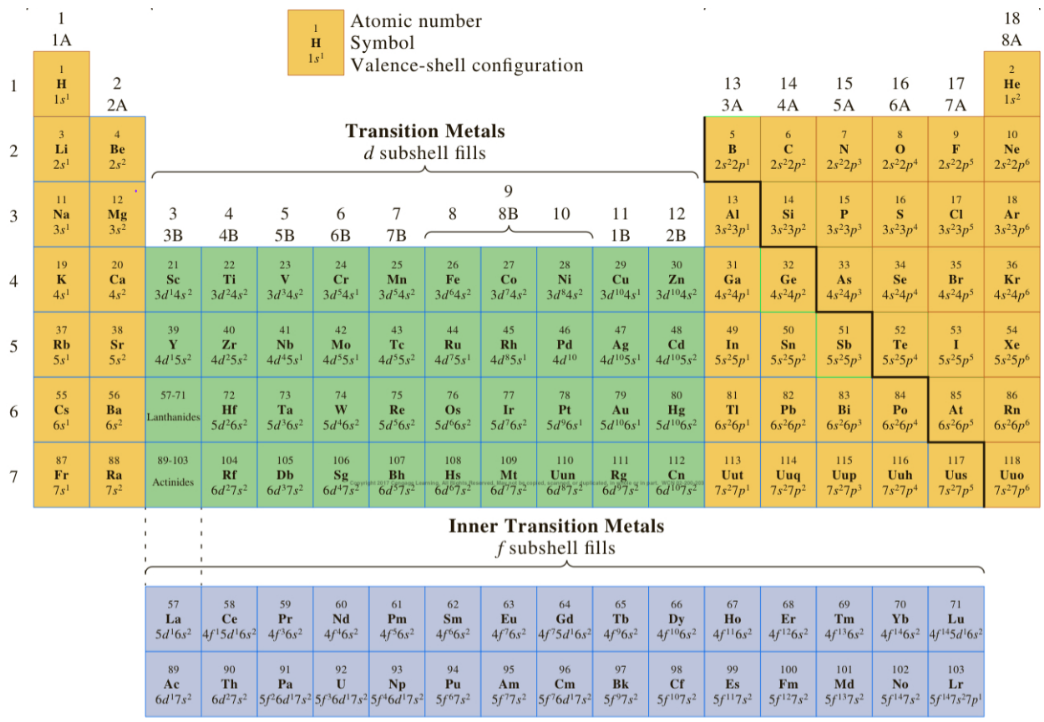
electron affinity تزداد

يقل نصف القطر طاقة التأين تزداد →

يزداد نصف القطر ↓

طاقة التأين تقل

electron affinity تقل



- the atomic radius tends to decrease with increasing atomic number within each period and it increase with period number

- high values of first ionization energy → noble gases

- Very Low of first ionization energy → group 1

Exception:

- B < Be + Al < Mg → 3A < 2A
- O < N + S < P → 6A < 5A

ionization energy: the minimum energy needed to remove the highest energy ē from neutral atom in gasous state ← Note: اشارتها دائما +

Electron affinity: the energy required to remove an ē from negative ion ← دائما +

Exception:

4A > 5A

2A = 2e/6 صفر

تنخفض منتهي باحرف 2 و 5

6A + 7A → have the largest EA

E.A اعلى Cl

Chapter "9"

* ionic bond is a chemical bond formed by the electrostatic attraction between positive and negative ion

* Lattice energy: change in energy that occurs when an ionic solid is separated into isolated ions in gas phase

x Iso electronic: refers to different species having the same number and configuration of $\bar{e}$

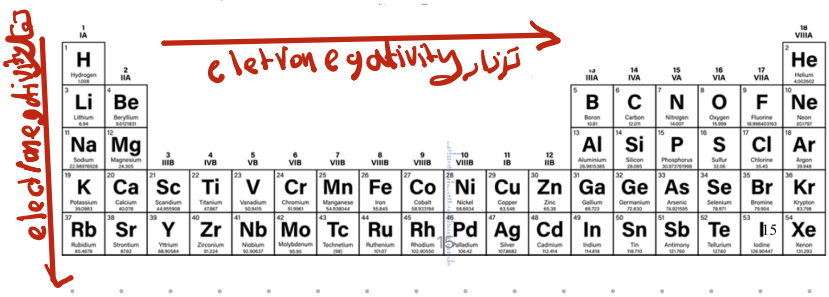
covalent bond:

* chemical bond formed by the sharing of a pair of electrons between atoms

* Electronegativity: is the measure of the ability of an atom in a molecule to draw bonding $\bar{e}$ to itself

→ Muliken electronegativity $X = \frac{IE \cdot EA}{2}$

→ Pauling electronegativity: bond enthalpies



* metal are the least electronegative
* non metal are the most electronegative

Electronegativity > 2 ⇒ ionic bond

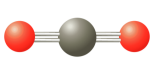
In general, the enthalpy of reaction is (approximately) equal to the sum of the bond enthalpies for bonds broken minus the sum of the bond enthalpies for bonds formed.

Chapter "10"

① AX_2:

Linear:

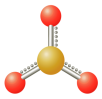
- 2 Bonding pairs
- 180°



② AX_3:

Trigonal Planar: مثلثي مستوي

- 3 Bonding pairs
- 120



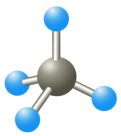
AX_2E:

- Bent
- 2 Bonding . 1 Non-bonding
- < 120°

③ AX_4:

Tetrahedral: رباعي الأوجه

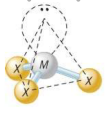
- 4 pairs
- 109.5



AX_3E:

Trigonal Pyramidal:

- 3 Bond . 1. Nonbond
- < 109.5

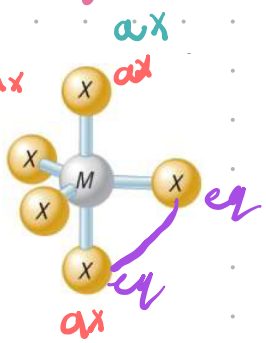


④ AX_5:

Trigonal bipyramid:

- 5 Bond
- 90/120/180

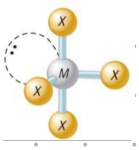
eq-ax eq-eq ax-ax



AX_4E:

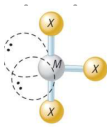
- < 90 . ax-ax = 180

Distorted Tetrahedron or Seesaw



AX_3E_2:

- T shape . 90



AX_2E_3:

Linear:

- 180

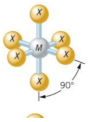
AX_2E_2:

Bent:

- 2 Bond . 2 non Bonding
- < 109.5

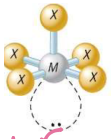
⑤ AX_6 : Octahedral

• 180 90



AX_5E_1 : Pyramidal

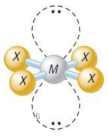
• 90



square

AX_4E_2 : Square Planar

• 90/180



Done By Noor Marzooq