



Prof/ Ayman Mansour
CHEMISTRY



Prof/ Ayman Mansour
KING OF
EXCELLENCE



Basic Chemistry (26/27)



PROF / AYMAN MANSOUR

Name :

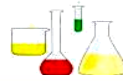
Centre:

Tel.:

اهداء الى ابنائي الطلبة والطالبات الاعزاء

- هيا معنا نجعل مادة الكيمياء مادة حياة وابداع وتفوق
- الكيمياء هي اساس كل الحياة وكل لحظة من حياتنا كيمياء
- فهمكم واهتمامكم بالكيمياء يجعلها ممتعة وتوفيقك فيها باذن الله مضمون
- اهمالكم لها والاعتماد علي الحفظ لا يؤهلك حتي للنجاح
- لا تنسوا مقولة الكينج (الكيمياء لعبة ممتعة عايزة لعيب متمكن)

هي دي الكيمياء وفقكم الله



Chemistry syllabus

Organic

inorganic

Topic Feed Back :-

- 1-Physical properties & Chemical properties of matter
- 2-Structure of atom
- 3-Mass number & Atomic number
- 4-Mole , Molecules & Atoms
- 5-Element, Compound & Mixture
- 6-Types of elements
- 7-Acids, Bases & Salts
- 8-Chemical bonds
- 9-Electronic configuration of elements by different methods
- 10-Graduation of Properties of elements in periodic table
- 11-Redox reactions (Oxidation & Reduction)
- 12-Chemical formula of any compound
- 13-Balance chemical equations
- 14-Basic rules of chemical equations
- 15-Basic of Organic Chemistry

الرموز اللاتينية للارقام:-

1 **2** **3** **4** **5** **6** **7** **8**
I **II** **III** **IV** **V** **VI** **VII** **VIII**

The periodic table is color-coded to show the following groups:

- Metals (Blue):** Groups 1, 2, and 3-10.
- Metalloids (Green):** Groups 13-16.
- Nonmetals (Yellow):** Groups 17 and 18.

The elements are arranged in rows and columns, with atomic numbers 1 through 118 shown. The groups are labeled 'Metal', 'Metalloid', and 'Nonmetal' in boxes above the table.



1-Physical properties & Chemical properties of matter

Physical properties as

We can differentiate between substances by

By their different colour

By their different taste.

By their different odour.

Some substances have no colour, taste or smell.

We can differentiate between them by.....

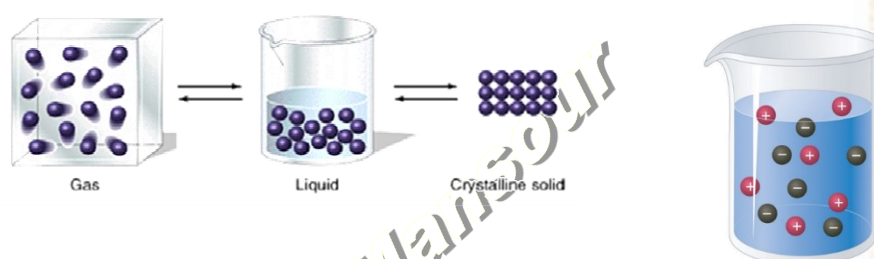
Matter exists in three states which are :

1-Solid state : (s)

2-Liquid state : (l).

3- Gaseous state : (g) or (v)

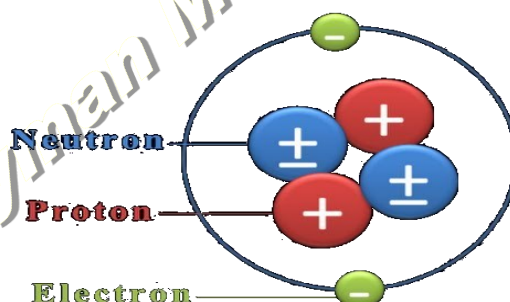
4-Aqueous (aq)



2-Structure of atom

The atom consists of:

a. nucleus contains positive **protons** & neutral **neutrons**.



b. Electrons are negative charged particles Which revolve around the nucleus in seven energy levels.

Principle energy levels:

K L M N O P Q

(n): 1 2 3 4 5 6 7

As (n) increase energy increase →

3-Atomic Number:

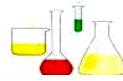
Number of **protons** inside the nucleus or number of **electrons** at the energy levels.

Mass Number:

${}_{11}\text{Na}^{23}$

Sum of **protons** and **neutrons** inside the nucleus.

For Na atomic no. = mass no. =





4-mole , molecules & atoms

Matter

Consists of

molecules

Consists of

atoms

5-Element , Compound & Mixture

Molecule

It is the smallest particle of matter that can exist freely & it carries the matter properties



Matter or substances can be

1-Elements

2-Compound

3-Mixture

Molecule of element & compound

Element

Its molecule consists of similar atoms,





Elements may be

- **Monoatomic:** composed of one atom (Iron ,copper)
- **Diatomic:** composed of two atoms (Oxygen , hydrogen)
- **Triatomic:** composed of three atoms (Ozone)

Do not forget the diatomic molecules of element when alone



Compound

consists of different elements or different atoms

How many elements and atoms in Na_2SO_4 molecule

Mixture

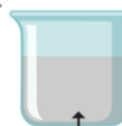


MIXTURE

Dissolving of sugar in water



Sugar

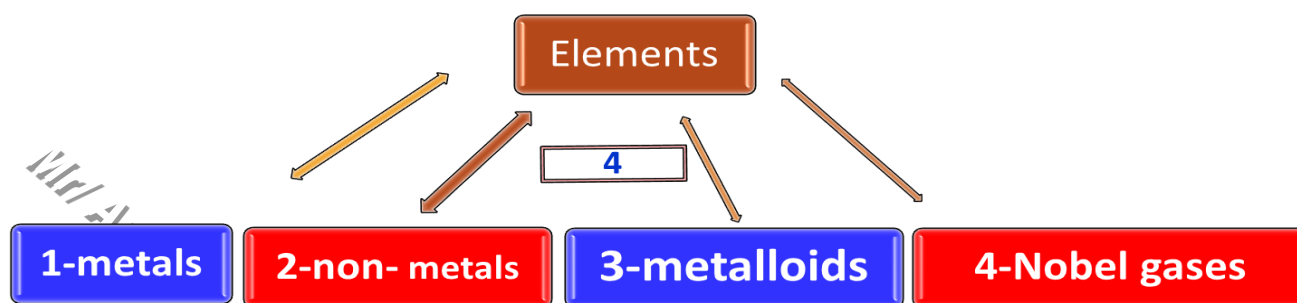


Sugar Solution

6-Types of elements

Elements

They are classified according to their properties and electronic structure into:





A-Metals

Solids at room temperature except mercury which is liquid.

The outermost energy level contains 1 or 2 or 3 electrons.

They **lose** electrons to form positive ion or cation



In chemical reaction:

Metals $\xrightarrow{\text{tend to}}$ lose electrons $\xrightarrow{\text{become}}$ positive ions

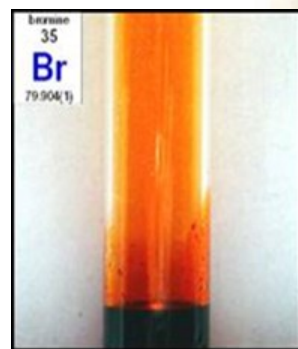
The number of electrons in the positive ion is less than the number of positively charged protons.

b-Non-metals

are solids (phosphorus) at room temperature, others are gases (oxygen, nitrogen)

Bromine is a liquid at room temperature

Non-metals are



The outermost energy level contains 5 or 6 or 7 electrons.

They **gain** electrons to form negative ion or anion

Non-metals

The number of electrons in the negative ion is more than the number of positively charged protons

In chemical reaction:

Non - Metals $\xrightarrow{\text{tend to}}$ gain electrons $\xrightarrow{\text{become}}$ negative ion





Chemistry is a branch of physical science that studies the composition, structure, properties and change of matter

1 H Hydrogen	2 He Helium
3 Li Lithium	4 Be Beryllium
5 B Boron	6 C Carbon
7 N Nitrogen	8 O Oxygen
9 F Fluorine	10 Ne Neon
11 Na Sodium	12 Mg Magnesium
13 Al Aluminum	14 Si Silicon
15 P Phosphorus	16 S Sulfur
17 Cl Chlorine	18 Ar Argon
19 K Potassium	20 Ca Calcium
21 Sc Scandium	22 Ti Titanium
23 V Vanadium	24 Cr Chromium
25 Mn Manganese	26 Fe Iron
27 Co Cobalt	28 Ni Nickel
29 Cu Copper	30 Zn Zinc
31 Ga Gallium	32 Ge Germanium
33 As Arsenic	34 Se Selenium
35 Br Bromine	36 Kr Krypton
37 Rb Rubidium	38 Sr Strontium
39 Y Yttrium	40 Zr Zirconium
41 Nb Niobium	42 Mo Molybdenum
43 Tc Technetium	44 Ru Ruthenium
45 Rh Rhodium	46 Pd Palladium
47 Ag Silver	48 Cd Cadmium
49 In Indium	50 Sn Tin
51 Sb Antimony	52 Te Tellurium
53 I Iodine	54 Xe Xenon
55 Cs Cesium	56 Ba Barium
57-71 Lanthanoids	72 Hf Hafnium
73 Ta Tantalum	74 W Tungsten
75 Re Rhenium	76 Os Osmium
77 Ir Iridium	78 Pt Platinum
79 Au Gold	80 Hg Mercury
81 Tl Thallium	82 Pb Lead
83 Bi Bismuth	84 Po Polonium
85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium
89-103 Actinoids	104 Rf Rutherfordium
105 Db Dubnium	106 Sg Seaborgium
107 Bh Bohrium	108 Hs Hassium
109 Mt Meitnerium	110 Ds Darmstadtium
111 Rg Roentgenium	112 Cn Copernicium
113 Nh Nihonium	114 Fl Flerovium
115 Mc Moscovium	116 Lv Livermorium
117 Ts Tennessine	118 Og Oganesson

Atomic number: 8, Atomic weight: 15.999, Symbol: O, Name: Oxygen

Legend: Alkali metal, Alkaline earth metal, Lanthanide, Actinide, Transition metal, Post transition metal, Metalloid, Polyatomic nonmetal, Diatomic nonmetal, Noble gas, Unknown chemical properties

c-inert gases are stable (Inactive) elements?

Because their last energy levels are completely with electrons

Symbols of inert gases

(He) helium
2

(Ne) neon
10

(Ar) argon
18

(Kr) krypton
36

(Xe) xenon
54

(Rn) radon
86

Q₁: the electronic configuration of ions of $_{20}\text{Ca}^{+2}$ is similar to..... ion

- a) $_{18}\text{Ar}$
- b) $_{10}\text{Ne}$
- c) $_{15}\text{P}^{3-}$
- d) $_{13}\text{Al}^{3+}$

Q₂: An atom becomes.....when it gains electrons.

- a) Positive ion
- b) Negative ion
- c) Neutral
- d) Invisible





7-Acids , Bases & Salts

Acids + Bases = Salts

8-Chemical bonds

Kinds of bonds

Chemical bonds

1-Ionic bond

2-Covalent bond

3-Co-ordination bond

Physical

4-metallic bond

5-hydrogen bond

a- Ionic bond

- 1- It occurs between a metal & a non-metal
- 2- The atoms of the metal lose electrons forming positive ions.
- 3- The atoms of the non-metal gain these electrons & become negative ions.
- 4- Positive ions attract negative ions.

Examples:

1-The formation of NaCl

(sodium chloride , table salt)

The formation of table salt

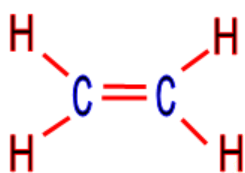
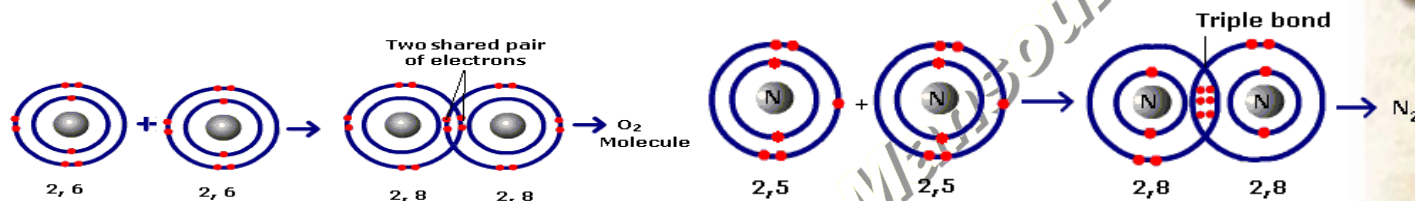
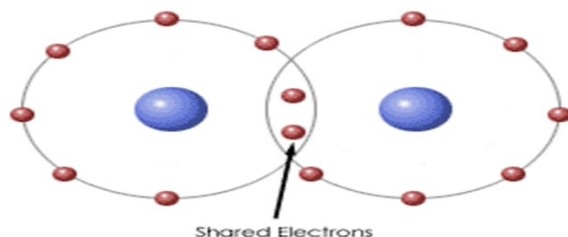




2- The formation of magnesium oxide MgO

b- The covalent bond

It occurs between non-metals where atoms share electrons to fill their outermost energy levels.



c-Co-ordination bond

It is a type of covalent bond but the difference between them in the source of the electrons pair which is shared between Nonmetallic atoms.

From donor atom to acceptor atom

e.g. (1) the hydroxonium ion (hydronium ion) $(H_3O)^+$

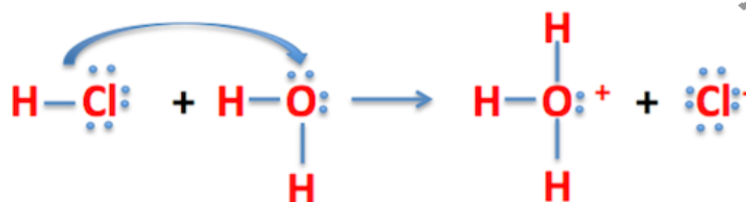
The bond is formed between:

The neutral water molecule (H_2O) and the positive hydrogen (H^+)





(Which produced on dissolving acids in water)



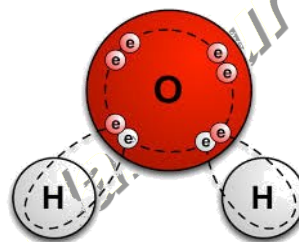
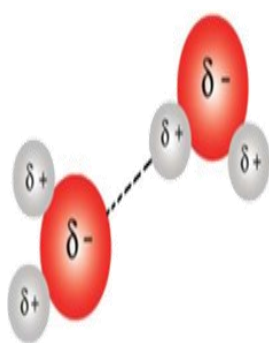
d-The hydrogen bond

It is a bond formed when hydrogen atom is located between two atoms that have high electro negativity.

One of them makes with hydrogen polar covalent bond and the other atom makes with hydrogen, hydrogen bond

water molecules

water molecule



Q1: Which of the following elements is least likely to form a hydrogen bond?

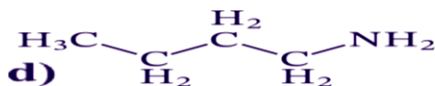
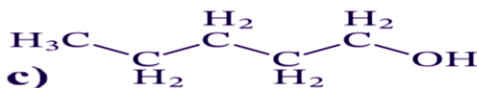
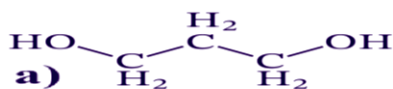
- a) Oxygen
- b) Nitrogen
- c) Fluorine
- d) Sulfur

Q2: The following compounds can form a hydrogen bond except for .

- a) H_2O
- b) NH_3
- c) H_2S
- d) HF

Q3: Which of the following organic molecules would you predict to have the highest boiling point?





9-Electronic configuration of elements by different methods

Building up principle

Electrons occupy energy sublevels in an ascending order the lowest energy sublevel is filled first.



1s

2s < 2p

3s < 3p

4s < 3d < 4p

5s < 4d < 5p

6s < 4f < 5d < 6p

7s < 5f < 6d < 7p

Sub level	S	P	d	F
Number of orbitals	1	3 P _x , P _y , P _z	5	7
Number of electrons	2 e ⁻	6 e ⁻	10 e ⁻	14 e ⁻





Hund's rule

No pairing of electrons takes place in a given sub level until each orbital contains one electron

According to Hund's rule we find that:

* each electron will be alone and occupy all orbitals of sublevel then pairing takes place

Symbols of inert gases

(He₂) 2S, 2p

(Ne₁₀) 3S, 3P

(Ar₁₈) 4S, 3d, 4P

(Kr₃₆) 5S, 4d, 5P

(Xe₅₄) 6S, 4f, 5d, 6P

(Rn₈₆) 7S, 5f, 6d, 7P

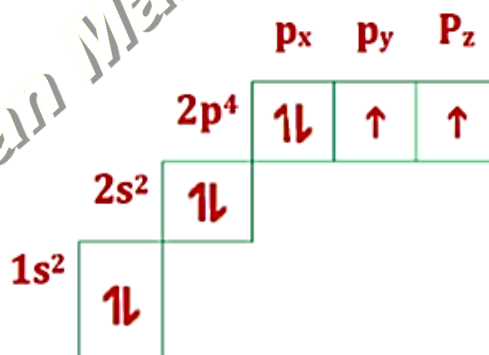
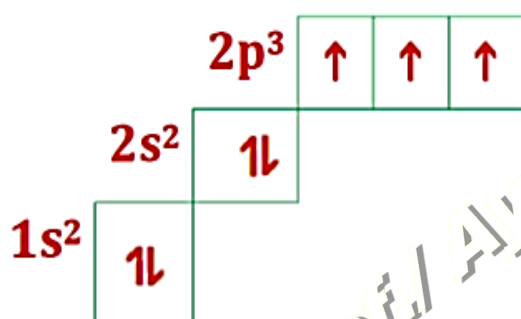
Ex:

${}^7\text{N}$

$1s^2, 2s^2, 2p^3$

${}^8\text{O}$

$1s^2, 2s^2, 2p^4$



Examples: draw the electronic configuration of

${}_{11}\text{Na}$

.....

${}_{20}\text{Ca}$

.....

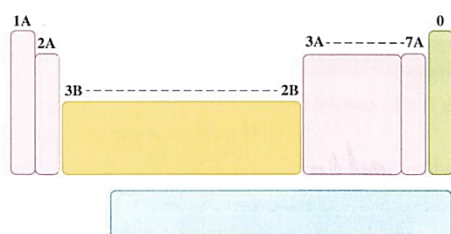
${}_{30}\text{Zn}$,

.....





10-Graduation of Properties of elements in periodic table



Types of elements of periodic table

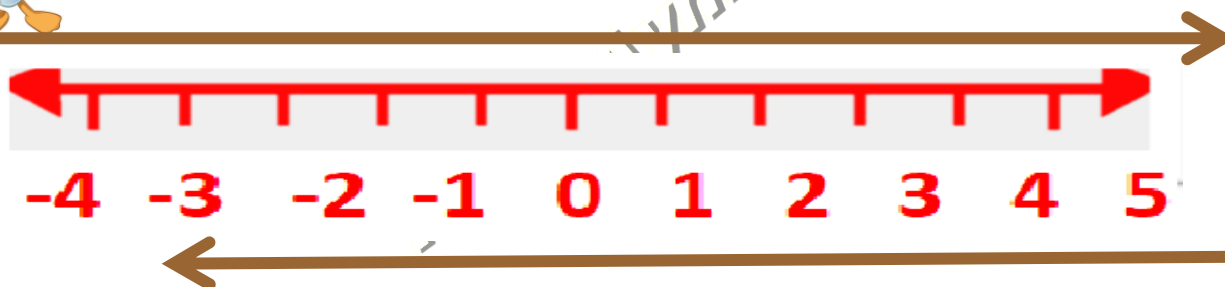
- 1 Noble elements
- 2 Representative elements
- 3 Main transition elements
- 4 Inner transition elements

11-Redox reactions

Ole or OiO



Oxidation



Remember rules to calculate the oxidation numbers

- 1-The oxidation number of all atoms in **compound** = zero.
- 2-The oxidation number of any **element** in its elementary form = zero .
- 3- The oxidation number of **atomic group** = its charge
- 4-The oxidation number of **oxygen** in its compounds = -2
- 5- Oxidation number of **Hydrogen** in its compounds = +1
- 6- Oxidation number of **Halogen** in its compounds = -1





Element	$_{21}\text{Sc}$	$_{22}\text{Ti}$	$_{23}\text{V}$	$_{24}\text{Cr}$	$_{25}\text{Mn}$	$_{26}\text{Fe}$	$_{27}\text{Co}$	$_{28}\text{Ni}$	$_{29}\text{Cu}$	$_{30}\text{Zn}$
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Scandium, titanium, vanadium, chromium, manganese, iron, cobalt nickel, copper & zinc

King of Excellence

من فضلك اهتم جدا بهذه المحاضرة تراجع باستمرار





12-Chemical formula

Radicals (atomic groups) (cannot exist freely)

(1) Monovalent radicals.	(2) Divalent radical
cyanate CNO^- Thio cyanate SCN^- Hydroxide OH^- Bicarbonate HCO_3^- Nitrate NO_3^- Nitrite NO_2^- Acetate CH_3COO^- permanganate MnO_4^-	Sulphate SO_4^{2-} Sulphite SO_3^{2-} thiosulphate $\text{S}_2\text{O}_3^{2-}$ Carbonate CO_3^{2-} dichromate $\text{Cr}_2\text{O}_7^{2-}$ Chromate $\text{Cr}_2\text{O}_4^{2-}$
	(3) Trivalent radicals Phosphate PO_4^{3-}
ammonium NH_4^+	

Don't forget

All atomic groups are negative except ammonium is positive
 Symbols of important elements and its general valency

Monovalent	divalent	Trivalent
Hydrogen H^+	Oxygen O^{2-}	Aluminum Al^{3+}
Chlorine Cl^-	Barium Ba^{2+}	Nitrogen N^{3-}
Lithium Li^+	Calcium Ca^{+2}	Phosphorus P^{3-}
Sodium Na^+	Magnesium Mg^{+2}	Iron III (ferric) Fe^{3+}
Potassium K^+	Zinc Zn^{2+}	
Silver Ag^+	Copper Cu^{2+}	
Bromine Br^-	Iron II (ferrous) Fe^{2+}	
Fluorine F^-	Lead Pb^{2+}	
	Sulphur S^{2-}	
	Mercury Hg^{2+}	





Very important

- 1-Any acid (inorganic) begins with H (positive hydrogen)
- 2-Any radical takes valency put it between two brackets
- 3-Any element ends by ide is element مدلع Carbide

As

دلع

Oxide	→	oxygen
Sulphide	→	sulphur
Chloride	→	chlorine
Nitride	→	nitrogen
Carbide	→	carbon
Phosphide	→	phosphurs



Examples

Write the chemical formula of the following

Copper nitrate



Sodium sulphide

.....
.....

potassium dichromate

.....
.....

Potassium hydroxide

sodium acetate

Copper hydroxide

Calcium hydroxide

sulphuric acid

Nitric acid

Copper carbonate

copper nitrate

sodium nitrite

Hydrogen chloride

potassium permanganate

table salt





Iron II sulphate

Iron III sulphate

ammonium sulphate

13-Balanced equation

Equation in which the **number of atoms** of **products** equals number of atoms of **reactants** for each element .

when
alone

Do not forget the diatomic molecules of element are



I-Balance the following chemical equations



II- Change the following word equations into balanced symbolic equations:

1- Sodium hydroxide + hydrochloric acid $\rightarrow$ sodium chloride + water

2- Iron + Chlorine $\rightarrow$ Iron III Chloride

3- Barium nitrate + Sulphuric acid $\rightarrow$ barium sulphate + nitric acid

4- Copper II nitrate $\rightarrow$ Copper II oxide + nitrogen dioxide + Oxygen

5- Potassium chloride + Silver nitrate $\rightarrow$ Potassium nitrate + Silver chloride





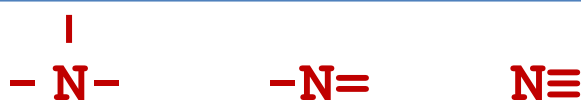
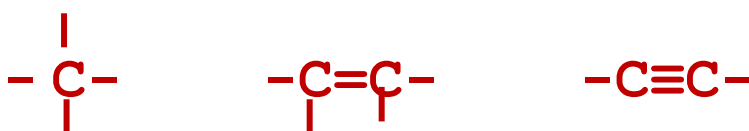
Basic of organic chemistry

أساسيات العضوية

Very important

**من فضلك ثبت خالتك صم وحياة خالتك

Element	Cl	H	O	N	C
Valency	1	1	2	3	4



Name	No. of carbon atoms	Name	No. of carbon atoms
Meth	C ₁	Hex	C ₆
Eth	C ₂	Hept	C ₇
Prop	C ₃	Oct	C ₈
But	C ₄	Non	C ₉
Pent	C ₅	Dec	C ₁₀

Alkanes (-)

General formula (C_nH_{2n+2})

C₁ → meth CH₄ → methane

C₂ →
 C₃ →
 C₄ →
 C₅ →
 C₆ →
 C₇ →
 C₈ →
 C₉ →





C_{10} —————>

Alkyl group (R) (mono valent cannot exist freely)

General formula (C_nH_{2n+1}) (R)

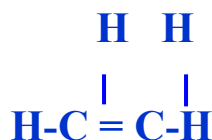
organic برنسية ال

	Alkane	formula	Alkyl	Formula		alkane	formula	alkyl	Formula
1	Methane	CH_4	Methyl	CH_3-	6	hexane	C_6H_{14}	hexyl	$C_6H_{13}-$
2	Ethane	C_2H_6	Ethyl	C_2H_5-	7	Heptane	C_7H_{16}	heptyl	$C_7H_{15}-$
3	Propane	C_3H_8	Propyl	C_3H_7-	8	octane	C_8H_{18}	octyl	$C_8H_{17}-$
4	Butane	C_4H_{10}	Butyl	C_4H_9-	9	nonane	C_9H_{20}	nonyl	$C_9H_{19}-$
5	Pentane	C_5H_{12}	Pentyl	$C_5H_{11}-$	10	decane	$C_{10}H_{22}$	decyl	$C_{10}H_{21}-$

Alkene or Alkyene (=)

General formula (C_nH_{2n})

e.g. Ethylene: or ethene C_2H_4



Alkyne ($\equiv$)

General formula (C_nH_{2n-2})

e.g. Ethyne(acetylene) C_2H_2





N	Alkane	alkyl	alkene	Alkyne
C	methane CH ₄			
C ₂	ethane C ₂ H ₆			
C ₃	propane C ₃ H ₈			
C ₄	Butane C ₄ H ₁₀			
C ₅	pentane C ₅ H ₁₂			
C ₆	hexane C ₆ H ₁₄			
C ₇	heptane C ₇ H ₁₆			
C ₈	octane C ₈ H ₁₈			
C ₉	Nonane C ₉ H ₂₀			
C ₁₀	decane C ₁₀ H ₂₂			

Hydrocarbons derivatives

The class	General formula	functional group name	IUPAC name	Example
Alcohols	R – OH	hydroxyl - OH	alkanol	methanol Methyl alcohol CH ₃ OH

ROH alcohols

