

Chapter 2:- The Components of a Matter

Element :-

- Consists of only one Type of atom
- Cannot be broken Down to a simpler substance.

Ex:- Na , O_2

Compound :-

- Composed of two or more elements
- Chemically Combined
- Present in fixed mass ratio
- Their properties are Different from it's elements Prop.

Ex: NaCl , NH_3

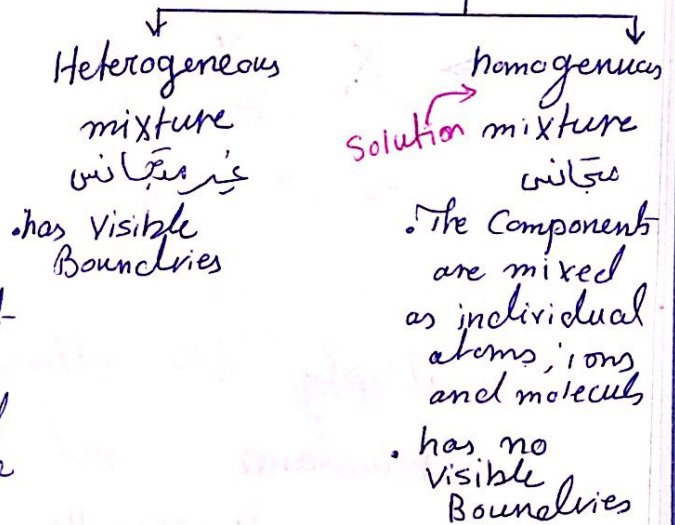
Mixture :-

- Two or more elements / compounds
- Physically intermingled
- Can be separated by a physical change

Ex: $\text{NaCl} + \text{Mg}$
 $\text{NaCl} + \text{H}_2\text{O}$

Notes :-

- Solutions in water = aqueous solutions
- Mass of Components = Mass of product
- A particular Compound is composed of the same elements with the same percentage of masses



Law of multiple Proportions :-

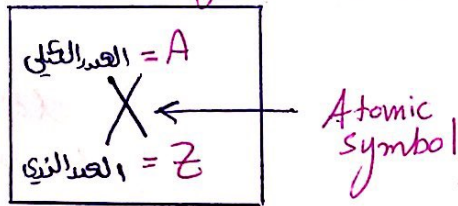
Two atoms A, B that composes two compound where in the first one:- The percentage of A = $x\%$ and B = $y\%$

Then in the second compound The percentages ratio should be proportional to the first compound's mass ratio

$$r_1 = \frac{x}{y} \quad \text{so} \quad r_2 = \left(\frac{1}{2} \right) \frac{x}{y}$$

Constant

Atomic Symbol :-



- Z: number of protons • في الذرة المتعادلة = عدد الإلكترونات
- N: number of neutrons
- $Z + N = A$: mass number • مجموع عدد البروتونات والنيوترونات

Isotopes - Same numbers of protons (Same Z) • النظائر

→ $\overset{X_1}{\underset{Z_1}{}}, \overset{X_2}{\underset{Z_2}{}}, \overset{X_3}{\underset{Z_3}{}} :- X_1, X_2, X_3 \text{ are isotopes only if } Z_1 = Z_2 = Z_3$

- How to Calculate the Atomic Mass of an Element
- multiply the mass of each isotopes with its Abundance and Add the answers

	Isotopic Mass	Abundance
Ex. ^{28}Si	27.97	92.23
^{29}Si	28.97	4.67
^{30}Si	29.97	3.10

Atomic mass of Silicon

$$= (27.97 \times 0.9223) + (28.97 \times 0.0467) + (29.97 \times 0.0310)$$

To find the Abundance: Average = molar mass of 1st isotope (X) +
find X $\Rightarrow$ molar mass of 2nd isotope (1-X)

Predicting The ion of an Element:-

• ننظر إلى العدد الذري ثم نحدد العنصر اليسل ذو العدد الذي الأقرب لعنصرنا مثال :-

Calcium (20)

• العدد الذري للعنصر = 20 والعنصر اليسل ذو العدد الذري الأقرب هو Ar 18
أيونه هو Ca^{+2} لأنه إذا فقد العنصر الكثر من أي أنه

Bonds:-

Ionic Bonds:-

- happens Between two ions
- if the charge increased, The Attraction increases
- if the size decreases, The Attraction increases
- No molecules exist in an ionic compound

Covalent Bond:-

- occurs between nonmetals
- forms molecules

• Molecules Can Be :-
2 Molecules $\rightarrow$ Diatomic $\rightarrow H_2, F_2, O_2, N_2, Cl_2, Br_2, I_2,$
4 Molecules $\rightarrow$ Tetratomic $\rightarrow P_4$
8 ~ $\rightarrow$ Octatomic $\rightarrow S_8, Se_8$

Chemical Formulas

→ Ion's Chemical formula

• Cations first, anion second

الأيونات الموجبة أولاً ثم السالبة

• Cations :- same name as metals that ends with in - ium

• anions :- named by adding suffix -ide to the root of the nonmetal name

Note: Monatomic ion:

عنصر واحد من الذرات

Na^+ , Ca^{+2} etc

Polyatomic ion:

عنصر من أكثر من ذرة

(الذرات)

NO_3^{-2} مثال

• Most main group elements form one monatomic ion

• Transition elements form two monatomic ions

Naming Acids:-

There are two types of Acids

• Contains Oxygen

- anion Contains Oxygen
- You don't use The prefix hydro
- Suffix:- It depends on the name of the original oxyanion
- Ends with -ate ^{suffix is} $\rightarrow$ -ic
- ~ ~ -ite $\rightarrow$ -ous
- Ex:- HNO_3 :- nitric acid
 HNO_2 :- nitrous acid

Binary Acids

• Does not Contain Oxygen

- You use the prefix hydro
- acid suffix -ic
- Ex: Hydrochloric Acid

Naming Binary Covalent Compounds:-

• The element with the lower group no in the periodic table is first in the name and formula

two non-metals (Ex: Water)

$\rightarrow$ Prefix: Numerical

The Second Element :-

Prefix :- Numerical / indicates the number of atoms
di- , tri- - - - - deca-

Suffix :- -ide

Ex: N_2O_3 is dinitrogen trioxide

• Naming Straight-Chain Alkanes

Methane	CH_4	Hexane	C_6H_{14}
Ethane	C_2H_6	Heptane	C_7H_{16}
Propane	C_3H_8	Octane	C_8H_{18}
Butane	C_4H_{10}	Nonane	C_9H_{20}
Pentane	C_5H_{12}	Decane	$C_{10}H_{22}$

• Molecular Mass from chemical formulas Sum of atomic masses

Ex:- H_2O :- $2 \times 1.008 + 1 \times 16.00 = 18.02$

• نأخذ أربع منازل من الكتلة الذرية والجواب يساوي
من أربع منازل

NAMES, FORMULAE, AND CHARGES OF SOME COMMON IONS

* Aqueous solutions are readily oxidized by air.
** Not stable in aqueous solutions.

Positive Ions (Cations)

Al^{3+}	Aluminum	Pb^{4+}	Lead(IV), plumbic
NH_4^+	Ammonium	Li^+	Lithium
Ba^{2+}	Barium	Mg^{2+}	Magnesium
Ca^{2+}	Calcium	Mn^{2+}	Manganese(II), manganous
Cr^{2+}	Chromium(II), chromous	Mn^{4+}	Manganese(IV)
Cr^{3+}	Chromium(III), chromic	Hg_2^{2+}	Mercury(I)*, mercurous
Cu^+	Copper(I)*, cuprous	Hg^{2+}	Mercury(II), mercuric
Cu^{2+}	Copper(II), cupric	K^+	Potassium
H^+	Hydrogen	Ag^+	Silver
H_3O^+	Hydronium	Na^+	Sodium
Fe^{2+}	Iron(II)*, ferrous	Sn^{2+}	Tin(II)*, stannous
Fe^{3+}	Iron(III), ferric	Sn^{4+}	Tin(IV), stannic
Pb^{2+}	Lead(II), plumbous	Zn^{2+}	Zinc

Negative Ions (Anions)

Br^-	Bromide	OH^-	Hydroxide
CO_3^{2-}	Carbonate	ClO^-	Hypochlorite
ClO_3^-	Chlorate	I^-	Iodide
Cl^-	Chloride	HPO_4^{2-}	Monohydrogen phosphate
ClO_2^-	Chlorite	NO_3^-	Nitrate
CrO_4^{2-}	Chromate	NO_2^-	Nitrite
CN^-	Cyanide	$\text{C}_2\text{O}_4^{2-}$	Oxalate
$\text{Cr}_2\text{O}_7^{2-}$	Dichromate	O^{2-}	Oxide**
H_2PO_4^-	Dihydrogen phosphate	ClO_4^-	Perchlorate
CH_3COO^-	Ethanoate, acetate	MnO_4^-	Permanganate
F^-	Fluoride	PO_4^{3-}	Phosphate
HCO_3^-	Hydrogen carbonate, bicarbonate	SO_4^{2-}	Sulphate
HC_2O_4^-	Hydrogen oxalate, binoxalate	S^{2-}	Sulphide
HSO_4^-	Hydrogen sulphate, bisulphate	SO_3^{2-}	Sulphite
HS^-	Hydrogen sulphide, bisulphide	SCN^-	Thiocyanate
HSO_3^-	Hydrogen sulphite, bisulphite		