

TERMINOLOGY 1



Qualitative Analysis: (What's in it?)

- Deals with the identification of the constituents of a substance, mixture of substances as solutions and the way in which component element as a group of elements are constituted

Quantitative Analysis: (How much?)

- The determination of quantitative contents of individual elements or group of elements or compounds present in substance
- This branch is of enormous importance in agricultural science and industry
 - Volumetric / Titrimetric Analysis
 - Gravimetric Analysis
 - Colorimetric / Spectrometric Analysis
 - Chromatographic Analysis
 - Radiometric Analysis

Terminology

Matter:

Matter is anything that occupies space and has mass

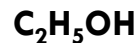
Substance:

- Matter that has a definite or constant composition and distinct properties
- Matter that has a particular set of characteristics differs from the characteristics of another kind of matter

Eg.



Ag



NaCl

Mixture:

A combination of two or more substances in which the substances retain their distinct identities.

Eg. air, soft drinks, milk, cement

(mixtures do not have constant composition)

□ Homogeneous Mixture: The composition is same throughout the mixture Eg. Sugar + H₂O

□ Heterogeneous Mixture :

(The composition is not uniform)

Eg. Sand + iron fillings

Atomic Number (Z):

- The number of protons in the nucleus of each atom of an element
- (The chemical identity of an atom can be determined solely by its atomic number)
- When the atom is neutral, i.e. not electrically charged, the atomic number equals the number of electrons in its shells

Mass Number (A):

- The total number of neutrons and protons present in the nucleus of an atom of an element.
- Mass number = no. of protons + no. of neutrons
- = atomic number + no. of neutrons
- \therefore No. of neutrons = (A-Z)

Isotopes:

- Atoms that have the same atomic number but different mass numbers

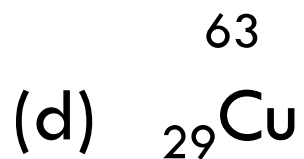
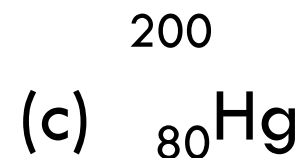
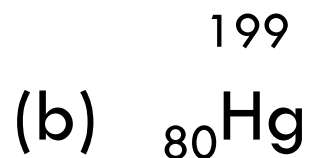
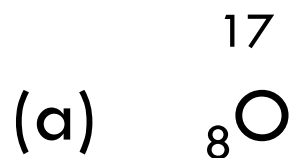
- Eg. isotopes of H:

□		2	3
□	${}^1_1\text{H}$	${}^2_1\text{H}$	${}^3_1\text{H}$
□	hydrogen	deuterium	tritium

-
- isotopes of U:

□	235	238
□	${}^{235}_{92}\text{U}$	${}^{238}_{92}\text{U}$

- Give the number of protons, neutrons and electrons in each of the following species;



Atom:

- The smallest particle of an element which retains its property and takes part in chemical reaction

Molecule:

- The smallest particle of an element or chemical compound which can exist in the free state and still have all the properties of that element or compound. A molecule is made up of one or more atoms
 - an aggregate of at least two atoms in a definite arrangement held together by chemical forces.
 - a molecule may contains atoms of the same element or atoms of two or more elements joined in a fixed ratio
 - (diatomic/polyatomic)

Ions:

- An ion is a charged species formed from a neutral atom or molecule when electrons are gained or lost as the result of a chemical change.
- Cation : an ion with a net positive charge
- Anion : an ion with a net negative charge

- Positive ions are called cations because they are attracted by the negative electrode, the cathode, during electrolysis. Negative ions are called anions because they are attracted by the positive electrode, the anode, during electrolysis
- Monoatomic ions/Polyatomic ions

Acids:

- A substance that yields hydrogen ions (H^+) when dissolved in water
- Acids that contain hydrogen, oxygen and another element (the central element) are called “Oxoacids”.
- Eg. H_2CO_3 , HNO_3 , H_2SO_4

Bases:

- A substance that yields hydroxide ions (OH^-) when dissolved in water
- Eg. NaOH $\text{Ba}(\text{OH})_2$ KOH NH_3

Chemical Formula:

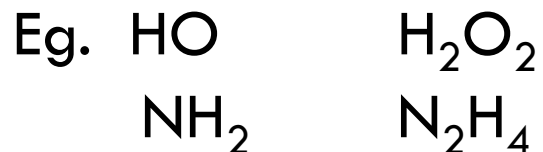
- To express the composition of molecules and ionic compounds in terms of chemical symbols

Molecular formula:

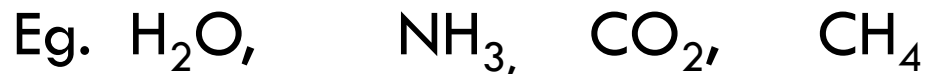
- Show the exact numbers of atoms of each element in the smallest unit of substance (True formulae of molecules)

Empirical formula:

- Shows which elements are present and the simplest whole number ratio of their atoms, but not necessarily the actual number of atoms present in the molecule. (simplest chemical formulae)



- For many molecules, the molecular formula and the empirical formula are the same



□ Write the empirical formulae for the following molecules.

- - (a) Acetylene (C_2H_2)
 - (b) Glucose $(C_6H_{12}O_6)$
 - (c) Nitrous oxide (N_2O)
 - (d) Caffeine $(C_8H_{10}N_4O_2)$

The Periodic Table:

-
- A chart in which elements having similar chemical and physical properties are grouped together
- Elements are arranged by atomic number
-
- Horizontal rows called “periods” and in vertical columns known as “groups or families” according to similarities in their chemical properties
-
-

□ The elements can be divided into three categories; metals, non-metals and metalloids.

□

□ Metal - is a good conductor of heat and electricity

□ Non-metal - is a poor conductor of heat and electricity

□ Metalloid - has properties that are intermediate between those of metals and non metals.

□ (majority – metals; 17 – non metals & 08- metalloids)

□ Elements are often referred to collectively by their periodic table group number. (group 1 A, 2A ...)

□ For convenience, some element groups have special names.

Group 1A - Alkali metals

Group 2A - Alkaline earth metals

Group 7A - Halogens

□ Group 8A - Noble/Inert/Rare gases

Chemical Properties:

- Properties which cause specific behavior of substances during chemical reactions

- **Chemical Reaction:**

Any change which alters the chemical properties of a substance or which forms a new substance. During a chemical reaction, products are formed from reactants



- **Reactants:**

The substances present at the beginning of a chemical reaction

- **Products:**

The substances formed in a chemical reaction

Atomic Weight:

- The average weight of atoms of an element relative to weight of carbon atom taken as 12.
Units = a.m.u atom⁻¹
(atomic mass unit per atom)
-
- The atomic weight expressed in grams is known as gram atom:
- Eg. 24g of Mg means 1 gram atom
- 16g of O means 1 gram atom
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Molecular Weight:

- The weight of one molecule of the substance relative to the weight of carbon atom taken as 12
- The molecular weight is the sum of the atomic weights of the elements present in one molecule of the substance
- When molecular weight is expressed in grams, it is termed as gram molecule
- Eg. 32g of O_2 = 1 gram molecule.

Avogadro's Number:

- The actual number of molecules present in one mole of substance.
- 6.024×10^{23}
- \therefore One mole of every substance contains 6.024×10^{23} molecules
- This quantity also expresses the number of atoms in one gram atom of an element.
- \therefore 1 gram atom of every elements contains 6.024×10^{23} atoms.

Mole:

The SI unit of measuring the quantity of a substance.
It is equal to the amount of substance which contains
 6.024×10^{23} particles

Solution:

The solutions prepared in laboratories are often two component mixtures. In a two component solution, the component present in large quantity is usually designated as the solvent and the other component as the solute.

- **Solvent:**

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- The substance in which the solute dissolves to form a solution

- **Solute:**

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- The substance which dissolves in the solvent to form a solution

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- **Dilute:**

- Describes a solution with a low concentration of solute

- **'Concentrated' :**

- Describes a solution with a high concentration of solute

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- **'Saturated':**

- Describes a solution that will not dissolve any more solute at a given temperature (any more solute will remain as crystals).

□ **ONLINE MATERIALS:**

[http://www.rjt.ac.lk/agri/online materials.php](http://www.rjt.ac.lk/agri/online%20materials.php)

Practical Handout

Terminology

From 03.03.2016