



Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group II Exam
Subject : Chemistry
Topic : **Elements and Compounds**

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**Commissioner,
Department of Employment and Training.**

ELEMENTS AND COMPOUNDS

- ❖ Elements are made up of same kind of atoms.

Classification of elements on the basis of physical state

1. Solid

- It occupies definite shape and definite volume
Ex: Carbon, Copper

2. Liquid

- It occupies definite volume but not definite shape
Ex: Gallium, Caesium, Mercury, Bromine

3. Gases

- It does not occupies definite shape and definite volume
Ex: Hydrogen, Oxygen

4. Plasma

- Super heated gaseous state

5. Condensate

- Bose – Einstein - Super cooled solids

Classification of elements on the basis of properties

- ❖ Among 92 elements, 70 are metals.
- ❖ Metals are generally lustre, hard, malleable and ductile.

- ❖ Metals are good conductor and sonorous.

Ex: copper, iron, gold

All the metals except Mercury exist in solid state at room temperature.

High density metals

Platinum



Gold



Silver



Mercury

Non- Metals

- ❖ Non metals are soft, brittle and have no lustre.
Ex: carbon, oxygen, chlorine

Metalloids

- ❖ Metalloids have the properties in between metals and non metals.
Ex: Arsenic, Antimony, Silicon, Boron, Germanium.

Dalton's atomic concept

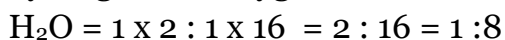
- ❖ According to John Dalton atomic concept, elements are made up of indivisible atoms. In addition to elements atoms are of same kind.

Air we breathe is not a pure substance but a mixture of gases. Milk is a mixture that contains liquid fat, protein and water.

Compounds

- ❖ Two (or) more elements combine in fixed ratio to form a compound.

Ex: water contains mass ratio of hydrogen and oxygen in 1:8



Classification of Compounds

Inorganic Compounds

- ❖ It is obtained from rocks and ores.

Ex: Baking soda, limestone

Organic Compounds

- ❖ It is obtained from plants and animals.

Ex: sucrose, protein, oil

Properties of compound

1. Components of compounds cannot be separated by physical method. It can be separated only by chemical method.
2. Formation of a compound is associated with evolution (or) absorption of heat.
3. Compound has a fixed melting and boiling point.
4. The properties of a compound are different from those of its component elements.
5. Compound is homogenous.

Uses of Compounds

Common Name	Chemical Name	Components	Uses
Water	Hydrogen monoxide H_2O	Hydrogen and Oxygen	For drinking and as solvent
Table salt	Sodium Chloride (NaCl)	Sodium and chlorine	Essential component of our daily diet, preservative for meat and fish
Sugar	Sucrose ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$)	Carbon, Hydrogen and Oxygen	Preparation of sweets, and fruit juices
Baking soda	Sodium bicarbonate (NaHCO_3)	Sodium, hydrogen, carbon and oxygen	Fire extinguisher, preparation of baking powder, cakes and bread.
Washing soda	Sodium Carbonate (Na_2CO_3)	Sodium, carbon and oxygen	As a cleaning agent in soap and softening of hard water
Bleaching powder	Calcium Oxy chloride (CaOCl_2)	Calcium, oxygen and chlorine	As a bleaching agent, disinfectant and sterilisation of drinking water
Gobar gas	Methane (CH_4)	Carbon and Hydrogen	Important component of natural gas
Quick lime	Calcium oxide (CaO)	Calcium and oxygen	Manufacturing of cement and glass

Elements & Compounds

Slaked lime	Calcium hydroxide Ca(OH)_2	Calcium, oxygen and hydrogen	Whitewashing of walls.
Lime stone	Calcium Carbonate CaCO_3	Calcium, Carbon and Oxygen	Preparation of chalk pieces

Atomicity

- ❖ The number of atoms present in one molecule of an element is called the atomicity of an element.

Monoatomic _ ONE ATOM

- ❖ Silver (Ag), Potassium (K), Carbon (C) and inert gases.

Diatomic – TWO ATOMS

- ❖ Hydrogen (H_2), Bromine (Br_2), Chlorine (Cl_2), Oxygen (O_2)

Triatomic - THREE ATOMS

- ❖ Ozone (O_3)

Polyatomic - MANY ATOMS

- ❖ Phosphorus (P_4), Sulphur (S_8)

Periodic classification of elements

Dobereiner's classification of elements

- ❖ In each case, the middle element has an atomic mass almost equal to the average atomic masses of the other two elements in the triads.
- ❖ Ex: Lithium 7, Sodium 23, Potassium 39

Law of octaves

- ❖ John Newland suggested law of octaves.
- ❖ If elements are arranged in ascending order of their atomic masses then every eighth element is a kind of repetition of the first one either succeeding (or) preceding it like eighth note in octave of music.

Limitation of Newland's classification

1. This classification failed with regard to the heavier elements. i.e. those lying beyond calcium.
2. After the discovery of the noble gases, the idea of octaves did not work.

Mendeleev's periodic table

- ❖ In 1869, Mendeleev, a Russian scientist, prepared the first periodic table. He arranged the periodic table with increasing order of atomic masses.

Modern Periodic Table (H.J. Mosley)

- ❖ In 1912, Moseley, an English physicist measured the frequencies of x-rays emitted by a metal, when the metal was bombarded with high speed electrons. He plotted square roots of the frequencies against atomic numbers.
- ❖ The plot obtained was a straight line. He found that the square root of the frequency of the prominent x-rays emitted by a metal was proportional to the atomic number and not to the atomic weight of the atom of that metal.

Concepts of the Periodic table

1. From top to bottom in **groups** the atomic size of the elements increase. From left to right in

- ♦.....♦
- period**, the atomic sizes of the elements decrease.
2. From top to bottom in **groups**, the ionization energy of the elements decreases, from left to right in period, the ionization energy of the elements increases.
 3. From top to bottom in **groups**, the electron affinity increases, from left to right in **period**, the Election Affinity of the elements decreases.

Law of constant composition (or)

Law of definite proportion

(Proust 1779)

- ❖ A pure chemical compound prepared by any method consists of the same

elements combined together in a fixed proportion by mass.

- ❖ Two (or) more elements and compounds are fixed in any ratio to form mixtures.

Types of mixtures

- Homogenous mixture
- Heterogenous mixture

Homogenous mixture

- ❖ It is available in the same phase.
Ex. Alloys, Air

Heterogenous mixture

- ❖ Two (or) more in different phases
Ex. water mixed in oil

Difference between elements and compounds

S.No.	Elements	Compounds
1.	Elements are physically mixed in any ratio and no new compound is formed.	Elements are chemically combined in a fixed ratio to form a new compound.
2.	They have no sharp (or) definite melting point, boiling point, density etc.	They have definite melting point, boiling point, density etc.
3.	A mixture exhibits the properties of its constituent (or) component elements	Property of a compound is different from its constituent (or) component elements.
4.	They are either homogenous (or) heterogeneous in nature.	They are always homogenous in nature.
5.	Constituents of a mixture can be separated by physical methods like filtration, magnetic separation etc.	Constituents of a compound cannot be separated by physical methods.

Atom

- ❖ In a greek language atom means “incapability of being cut”

Sub atomic particles

Protons

- ❖ It is a positively charged particles
- ❖ It is found in the nucleus

Rusting of iron is a chemical Change that increase the weight of iron.

Electrons

- ❖ It is negatively charged particles.
- ❖ It revolves around the nucleus.

Neutrons

- ❖ It is a neutral particles.
- ❖ It is found in the nucleus.

Atomic number (A)

- ❖ The number of protons in the nucleus (or) The number of electrons revolving around the nucleus.

Mass number (Z)

- ❖ The sum of the number of protons and neutrons in two nucleus of an atom.
- ❖ Mass number (Z) = Number of protons + number of neutrons.
- ❖ No. of neutrons = mass number - atomic number ($n = Z - A$)

1. The gas that can be used to fill party balloons is Helium
2. The gas that is used to make flash light is Krypton
3. The gas widely used in advertisement signs is Neon
4. The gas present in tungsten bulb is Argon
5. The gas present in the universe is Hydrogen
6. The gas used in high intensity lamp is Xenon
7. The gas which is used in tooth pastes to keep the teeth strong is Fluorine
8. The gas which helps to keep swimming pool clean is Chlorine
9. The radioactive gas is Neptunium
10. About 21% of earth's atmosphere consists of Magnesium

Approval by IUPAC

1. IUPAC allotted the symbol of element of atomic number 112. Name of the element is Copernicium (Cn-112).

Recently approved elements by IUPAC:

- | | | |
|--------|---|-----------------|
| 1. 113 | - | Nihonium (Nh) |
| 2. 115 | - | Moscovium (Mc) |
| 3. 117 | - | Tennessine (Ts) |
| 4. 118 | - | Oganesson (Og) |

Reactivity series of metals:

Potassium (K)	These metals react with water
Sodium (Na)	
Calcium (Ca)	
Magnesium (Mg)	These metals react with dilute acids.
Aluminium (Al)	
Manganese (Mn)	
Zinc (Zn)	
Chromium (Cr)	
Iron (Fe)	
Nickel (Ni)	
Tin (Sn)	These metals do not react with dilute acids.
Lead (Pb)	
Copper (Cu)	
Silver (Ag)	
Gold (Au)	

An atom is the smallest particle of an element. A molecule is made of the same kind of atoms or different kinds of atoms

◆.....◆
Isotopes

- ❖ Invented by T.W. Richards.
- ❖ Isotopes are atoms of the same element having the same atomic number but different mass numbers Ex. ${}_3\text{Li}^7$, ${}_3\text{Li}^6$

Uses

- Fe - 59 → treatment of anemia
- I – 131 → treatment of goiter
- Co-60 → treatment of cancer
- P-32 → Eye treatment
- C-11 → Brain scan

Isobars

- ❖ Same mass numbers, different atomic numbers are called isobars. Ex. ${}_{18}\text{Ar}^{40}$, ${}_{20}\text{Ca}^{40}$

Isotones

- ❖ Elements with Different mass number, different atomic number but same number of neutrons are called isotones. ${}_6\text{C}^{13}$, ${}_7\text{N}^{14}$

