

PERIODIC CLASSIFICATION OF ELEMENTS

Lavoisier's classification of elements

- In 1789, Lavoisier first attempted to classify the elements into two divisions namely Metals and Non-metals.

Dobereiner's classification of elements

- In 1817, Johann Wolfgang Dobereiner grouped three elements into what he termed triads.
- In each case, the middle element has an atomic mass almost equal to the average atomic masses of the other two elements in the triad.

Newland's classification of elements

- Newland referred to his arrangement as the Law of Octaves.
- If elements be arranged in ascending order of their atomic masses then every eighth element was a kind of repetition of the first one either succeeding or preceding it like eighth note on octave of music.

Lothar Meyer's classification of elements

- In 1864, Lothar Meyer plotted atomic weight against atomic volume of various elements.

Mendeleev (1834 – 1907)

- Mendeleev, a Russian chemist who was the first to propose that the seemingly different chemical elements can be sorted out according to certain similarities in their properties.
- The arrangement he proposed is called the periodic table. His table proved to be a unifying principle in chemistry and led to the discovery of many new chemical elements.

Mendeleev's Classification of Elements

- Mendeleev's periodic law which states that, "The physical and chemical properties of elements are the periodic functions of their atomic masses".

Characteristics of Mendeleev's Periodic Table

- Mendeleev made an eight – column table of elements.
- The difficulty in the Mendeleev's periodic table is overcome by introduction of Modern periodic table.
- It is also known as Long form of periodic table. In this table, properties of elements are dependent on their electronic configurations (distributions).
- Hence, modern periodic law is defined as the properties of elements are the periodic function of their atomic numbers.

Characteristics of Modified Mendeleev's Periodic table

1. Elements are arranged in the increasing order of their atomic masses.
2. Vertical columns are called 'groups' and horizontal rows are called 'periods'.
3. There are 'nine groups' numbered from I to VIII and O.
4. I to VII groups are sub divided into sub groups A and B.
5. There are 'seven period'.
6. The series of 'fourteen elements' following lanthanum is called 'Lanthanide series'.
7. The series of 'fourteen elements' following actinium is called 'Actinide series'.

Limitations of modified Mendeleev's periodic table

- Few elements having a higher atomic mass were placed before elements having a lower atomic mass.
- No provisions for placing isotopes.
- Position of hydrogen in the periodic table.
- Chemically dissimilar elements were placed in the same group.

Metals and Non-Metals

- Metals
- Non-metals
- Semi-metals (Metalloids)

Metals

- All metals (except mercury) are solids under ordinary conditions of temperature and pressure.
- Metals usually conduct heat and electricity well and can be rolled or hammered into sheets and pulled into wires.
- Gold and Platinum are used in jewellery because they do not react with water or oxygen in the air.
- Rubidium not only reacts violently with water but begins to burn if it is exposed to air.

Non-metals

- Yellow-sulphur, Whit-Phosphorous, Red-Bromine, Black-Carbon.

Metalloids (Semi-metals)

- Elements that have some metallic properties and some nonmetallic properties are called metalloids.
- They are all solids and look rather like metals.

Physical Properties of Metals and Non-Metals

Physical state

- Metals exist in solid state except mercury. Non metals may exist in solid, liquid or gaseous state.

Conductivity

- Metals are good conductors of heat and electricity.
- Non-metals are poor conductors or non-conductors of heat and electricity.

Metallic Lusture

- The property is known as metallic lusture.
- Generally non-metals have no lustrous character. However graphite is a non-metal with lustrous character.

- Among metals, silver is the best conductor of electricity.
- Among nonmetals, graphite is the only conductor of electricity.
- Mercury is a metal with a very low melting point and it becomes liquid at room temperature.

Malleability

- Malleability is the ability of metals to be hammered or squeezed. Hence metals are malleable.

Ductility

- Ductility is the ability of metals to be pulled or stretched into different shapes. Hence metals are ductile. Nonmetals are non-ductile.
- Tungsten has the highest melting point of any metal – over 3300°C.
- The lightest metal is lithium.
- Osmium is the heaviest metal. It is about 22 times heavier than water and nearly 3 times heavier than iron.

Sonority

- Metals are sonorous in nature.
- Nonmetals are nonsonorous.

Hardness

- Metals are hard. Hence they have high melting point except mercury.
- Nonmetals have low density and hence they are soft.

Chemical properties of metals and non metals

- Magnesium burns in oxygen.
- Iron wool (made into thin fibres) burns in oxygen to produce both heat and light energy.

Nonmetals

- Carbon reacts with water to



Action of acids on metals

- Metals such as sodium, magnesium, aluminium react with dilute hydrochloric acid and liberate hydrogen gas.

Nonmetals

- Sulphur reacts with hydrogen to form hydrogen sulphide.

Reactivity series

- At room temperature, sodium reacts with water more vigorously.

Reactivity series of metals

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