

CHEMISTRY CHAPTER -03 ATOMS AND MOLECULES





HISTORICAL INTRODUCTION

The idea of divisibility of matter was considered long back in India, around 500 BC

- An Indian philosopher Maharishi Kanad, postulated that if we go on dividing matter (padarth), we shall get smaller and smaller particles. Ultimately, a time will come when we shall come across the smallest particles beyond which further division will not be possible. He named these particles Parmanu
- Indian philosopher, **Pakudha Katyayama**, elaborated this doctrine and said that these particles normally exist in a combined form which gives us various forms of matter.
- Ancient Greek philosophers Democritus and Leucippus suggested that if we go on dividing matter, a stage will come when particles obtained cannot be divided further. Democritus called these indivisible particles atoms (meaning indivisible).



CONSERVATION OF MASS

Laws of conservation of mass

02

CONSTANT PROPORTIONS

Laws of constant proportions

03

DALTON'S ATOMIC THEORY

Features of dalton's atomic theory



SUMMARY

Summary of today's lecture



Laws of conservation of mass

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LAW OF CONSERVATION OF MASS

It was given by a French Chemist, Antoine Lavoisier in 1774. He was known as father of chemistry.

The law states that

" The total mass of the products in a physical change or a chemical reaction is equal to the total mass of the reactants that have combined"

OR

"The mass can neither be created nor destroyed in a physical change or a chemical reaction"

The law is also known as Law of Indestructibility of Matter

Que I : In a reaction 4.0g of sodium carbonate were reacted with IOg of hydrochloric acid solution. The product was a mixture of 2.5g of carbon dioxide and II.5g of sodium chloride solution. Is this data in agreement with the law of conservation of mass ?

Que 2 : If 6.3g of sodium bicarbonate are added to 15.0g of ethanoic acid (acetic acid) solution, the residue left is found to weigh 18.0g, what mass of CO_2 is released in the reaction?

Que 3 : In a reaction, 5.3g of sodium carbonate reacted with 6g of ethanoic acid. The products were 2.2g of carbon dioxide, 0.9g water and some sodium ethanoate. What is the expected weight of sodium ethanoate?



LAW OF CONSERVATION OF PROPORTIONS

It was given by a French Chemist, Joseph Proust in 1799.

According to this law :

"A pure chemical compound always consists of the same elements that are combined together in a fixed (or definite) Proportions by mass"

The law is also known as Law of Definite composition

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Ex : Water – H_2O combines in ration 1 : 8
Carbon Dioxide – CO_2 3 : 8
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This law is applicable only to pure compounds

Que 4 : The percentage of the three elements calcium, carbon and oxygen in a sample of calcium carbonate is given as : Calcium : 40% ; Carbon : 12% ; Oxygen : 48% If the law of constant proportions is true, what weights of these elements will be present in 1.5g of another sample of calcium carbonate ? (CBSE Board 2012) Que 5 : Hydrogen and oxygen combine in the ratio of I:8 by mass to form water. What mass of oxygen will be required to react completely with 4g of hydrogen?

Que 6 : When 5g of calcium is burnt in 2g of oxygen, 7g of calcium oxide is produced. What mass of calcium oxide will be produced when 5g of calcium is burnt in 20g of oxygen ? Which law of chemical combination will govern your answer? (CBSE 2016)

NOTE : In Above example, calcium is known as LIMITING REACTANT. It limits the participation of oxygen.





John Dalton, a British Chemist after a long study in this field came out with the satement that "*smallest portion of matter which cannot be divided further is an* **atom**"

Features of Dalton's Atomic Theory

The important features of the Dalton's Atomic Theory are :

- 1. Every matter is made up of very small particles known as atoms.
- 2. Atoms are the ultimate particles of matter and cannot be further sub-divided into smaller particles.
- 3. Atoms can neither be created nor destroyed during a physical change or a chemical change



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Features of Dalton's Atomic Theory

The important features of the Dalton's Atomic Theory are :

4. All atoms of a particular elements are identical in all respects. This means that they have same mass, size and also same chemical properties.

5. Atoms of different elements have different masses, sizes and also chemical properties.

6. Atoms are the smallest particles of matter which can take part in chemical combination.



John Dalton, a British Chemist after a long study in this field came out with the satement that "*smallest portion of matter which cannot be divided further is an* **atom**"

Features of Dalton's Atomic Theory

The important features of the Dalton's Atomic Theory are :

7. Atoms of the same or different elements combine in small whole number ratios to form molecules of a compound

Dalton's Atomic Theory expained Laws of chemical Combination



Drawbacks or Limitation of the Theory :

- Atoms have been found to be made of sub-atomic particles.
- Atoms of the same elements may have different masses (ISOTOPES)
- Atoms of different elements may have same mass (ISOBARS)
- Atoms of different elements may not always combine in simple whole number ratios to form molecules of a compound.
 - Ex: Molecule of Sucrose is represented by $\rm C_{12}H_{22}O_{11}$

"Atom is the smallest portion of matter which can take part in a chemical reaction. It may or may not exist independently."

SYMBOLS OF ELEMENTS

MODERN SYMBOLS OR CHEMICAL SYMBOLS OF ELEMENTS: The symbol suggested by Alchemist and Dalton had no logic and were also not systematic. Modern symbols for the elements were introduced by **J.J Berzelius**.

Chemical Symbols may be defined as 'Shorthand representation of the name of an element'

MODERN PERIODIC TABLE



