

Ch#1 : INTRODUCTION TO CHEMISTRY

DEFINITION

Chemistry is the branch of natural science which deals with the study of composition of matter and properties of matter. It also deals with the laws and principles governing these changes.

BRANCHES OF CHEMISTRY

Due to wide range of study of matter, chemistry has been divided into various branches. The main branches of chemistry are:

1. Physical chemistry
2. Organic Chemistry
3. Inorganic Chemistry
4. Analytical Chemistry
5. Bio Chemistry
6. Industrial/Applied Chemistry
7. Nuclear Chemistry
8. Environmental Chemistry
9. Polymer Chemistry

1. Physical Chemistry:

It is the branch of chemistry which deals with the physical properties of substances and their dependence on chemical bonding. It also explains the laws and principles governing the combination of atoms and molecules in chemical reaction.

2. Inorganic Chemistry:

It is the branch of chemistry which deals with the study of elements and their compounds generally obtained from non-living organisms i-e from minerals.

3. Organic Chemistry:

It is the branch of chemistry which deals with the study of carbon containing compounds with the exceptions of carbonates (CO_3^{2-}), bicarbonates (HCO_3^{-1}), cyanides (CN^{-1}), cyanates (CNO^{-1}), thiocyanate (CN_5), carbides (C^{-4}) and oxides of carbons (CO and CO_2). Actually it is the study of hydrocarbons and their derivatives.

4. Analytical Chemistry:

It is the branch of chemistry that deals with the study of methods and techniques involved to determine the kinds, quantity and quality of various compounds in a given substance.

5. Bio Chemistry:

It is the branch of chemistry which deals with the study of compounds and their reaction (metabolism) occurring in the bodies of living organisms i-e plants and animals.

6. Industrial Chemistry:

It is the branch of chemistry which deals with the study of different chemical processes involved in the chemical industries for the manufacture of synthetic products like glass, cement, paper, soda ash, fertilizers, medicines etc.

7. Nuclear Chemistry:

It is branch of chemistry which deals with the study of changes occurring in the nuclei of atoms, accompanied by the emission of invisible radiations.

8. Environmental Chemistry:

It is the branch of chemistry that deals with the study of the interaction of chemical materials and their effects on the environment of plants and animals. Personal hygiene, pollution and health hazards are important areas of environmental chemistry.

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9.Polymer Chemistry:

It is the branch of chemistry that deals with the study of process of polymerization and products obtained through the process of polymerization such as plastics, synthetic fibers etc.

IMPORTANCE OF CHEMISTRY

Chemistry plays an important role in the society as it is the study of materials and substances and we are surrounded by them.

Chemistry has helped us in improving the quality of life and is very important to us. Fertilizers, medicines, plastics, clothing polymers, cement, glass, detergents, paints and thousands of various chemicals all add to the comfort of society and improve our way of living.

ROLE OF CHEMISTRY IN SOCIETY

Chemistry plays an important role in our daily life. It has not only changed the standard of living but also has improved our health conditions. There are many lifesaving drugs.

There are many chemicals which have become essential ingredient of our lives. For instance Chlorine has become an important chemical substance. Nowadays thousands of useful chemical substances are made from chlorine which has great importance in chemical industry like Poly Vinyl Chloride (PVC) which is a plastic and is used in making pipes.

Chemistry plays an important role for the modern world e.g. food synthetic fibers, plastic, medicines, soaps, explosives all are gifts of chemistry.

LANDMARKS IN THE STUDY OF CHEMISTRY

Chemistry is as old as human civilization. Over the centuries chemistry has under gone remarkable progress. The development of chemistry can be divided into following periods.

- a) The Greek Period
- b) The Muslims or Al- Chemical Period
- c) The Modern Period

THE GREEK PERIOD

- I) The Greek philosophers Plato, Aristotle and Democritus and few others took part in the early development of chemistry.
- II) They presented the concept of elements, atoms and chemical reactions.
- III) They believe that the universe was made of four elements i-e air, water, earth and fire and that one material could be converted into another.
- IV) The Greeks were the first to use the word atom.
- V) Unfortunately, the Greeks presented sciences as a theory subject. They were not serious about the experiments and chemistry is basically a practical (experimental) science. Therefore chemistry could not make great progress during this period.

THE MUSLIM PERIOD / AL- CHEMICAL PERIOD

- I) During the Muslim period (600-1600) foundation of modern science took place. The Muslim scientist made rich contribution to various branches of science.
- II) They made use of scientific methods and treated chemistry as an experimental science.
- III) Muslim scientists developed laboratory equipment such as funnels, beakers, balances, weighing scales, crucibles (for melting metals) etc.
- IV) They discovered fundamental methods of chemistry like filtration, distillation, sublimation, crystallization and fermentations.

THE MODERN PERIOD

Modern chemistry began in the 17th and 18th century as a result of experimentation, free discussion and communication of work of chemists through out the world.

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CONTRIBUTION OF MUSLIM CHEMISTS

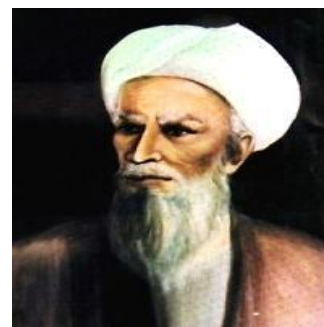
JABIR BIN HAYYAN (721- 803 A.D)

He is known as the father of chemistry. He built first chemical laboratory. He developed various chemical methods such as filtration, distillation, sublimation and crystallization. He discovered the methods for the extraction of metals from their ores. He was familiar with the making of steel and dyeing of clothes. He invented experimental methods for the preparation of mineral acids like nitric acids and hydrochloric acid. He also discovered the method for the preparation of white lead.



Al- RAZI (862-930 A.D)

Al- Razi was a physician, chemist and philosopher. He was an expert surgeon. He was the first who used opium as an anesthesia. He divided the substances on the basis of living and nonliving organisms. He prepared sulphuric acid. He prepared alcohol by the fermentation process.



ABU REHAN Al- BERUNI (973-1048 A.D.)

He contributed in chemistry, physics, geography, history and mathematics. He measured the circumference of the earth. He determined the densities of various.



IBN-E-SINA (980-1037)

Ibn-e-Sina was an expert physician. He described the composition and function of more than 760 medicines. He was probably the 1st scientist who rejected the idea that a base metal can be converted into gold. He wrote more than 100 books on different subjects related to science.



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THE MODERN PERIOD

Following are the contribution of modern scientists to the field of chemistry.

1. **ROBERT BOYLE (1627-1691)**
He is considered as the Father of Modern Chemistry. He studies the behavior of gases.
2. **JOSEPH BLACK (1728-1799)**
He described the study of CO₂ gas.
3. **SCHEELE (1742-17868)**
He Discovered Chlorine Gas.
4. **LAVOISER (1743-1794)**
He discovered that oxygen gas constitutes about one fifth of the air. He invented the physical balances.
5. **JOHN DALTON (1786-1844)**
He proposed the famous atomic theory.
6. **CAVENDISH (1731-1810)**
He discovered and explained the properties of Hydrogen Gas.
7. **GAY LUSSAC (1778-1850)**
He studied the diffusion of gases. He also proposed a law which is called as law of combining volumes.
8. **AVOGADRO (1776-1856)**
He studied the relative atomic masses of different substances
9. **BERZELLIUS (1779-1848)**
He introduces the idea of symbols and chemical formulae of different substances.
10. **MENDELEEV (1824-1907)**
Dimitri Mendeleev published the periodic table of elements.
11. **ARRHENIUS (1859-1927)**
He explained the behavior of electrolyte. He gave the concept of acids and bases.
12. **MICHAEL FARADAY (1791-1867)**
He put forwarded law of electrolysis.
13. **J.J THOMPSON (1856-1940)**
He studied the properties of cathode rays and discovered electrons.
14. **HENRY BECQUEREL (1852-1908)**
He studied the properties of radioactive substances.
15. **MADAM CURIE (1867-1934)**
She discovered the nature and properties of radioactive substances.
16. **RUTHERFORD (1891-1937)**
He discovered nucleus and proposed a model of atom.
17. **NEIL BOHR (1885-1962)**
He put forwarded a model of atom by improving the Rutherford's model.
18. **JOSEPH PRIESTLY (1733-1804)**
He discovered Oxygen gas, sulphur dioxide gas, and hydrogen chloride gas.

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SCIENTIFIC METHOD

It is a systematic manner in which scientists' works or their methods of inquiry which involves resolving the scientific problems are called scientific method.

STEPS OF SCIENTIFIC METHODS

➤ OBSERVATION

Scientists make observations when they note and record facts about natural phenomenon.

➤ HYPOTHESIS

It is an "Intelligent Guess" which explains "how" or "why" something happens. Then experiments are made.

➤ THEORY

If the hypothesis held true under any circumstances, with only very few exceptions then it is called a theory. If a hypothesis does not hold true, it is either modified or finally rejected.

➤ SCIENTIFIC LAW

A scientific law is a concise statement that summarizes the results of wide variety of observations and experiments.

DIFFERENTIATES

HYPOTHESIS	THEORY
❖ A hypothesis is simply a guess or an intelligent guess.	❖ A theory is thoroughly tested hypothesis.
❖ A hypothesis follows repeated experiments.	❖ A theory also follows further experiments.
❖ A hypothesis can become a theory or be modified or even discarded.	❖ A theory can become a scientific law or be discarded.

THEORY	SCIENTIFIC LAW
❖ A theory is a thoroughly tested model that explains why experiments give certain results	❖ A scientific law is different form of theory in that it only describes a natural phenomenon
❖ A theory can never be proved.	❖ A scientific law can often be expressed or proved by simple mathematical relationships.
❖ A theory follows a hypothesis	❖ A scientific law follows a theory

FILL IN THE BLANKS

1. The early Greeks believe that everything in the universe was made up of four elements **earth, air, fire, and water.**
2. Al- Razi chemical substances on the basis of their **origin.**
3. **Organic chemistry** is the branch of chemistry which deals with the carbon compounds.
4. Biochemistry is the backbone of **medical sciences.**
5. PVC which is a plastic is the short name of **Polyvinyl chloride.**
6. Oxygen was discovered by **Priestley.**
7. The best disinfectant is **chlorine.**
8. The periodic arrangement was the result of **Mendeleev** work.