# SCIENCE NOTES – PART II
# CHEMISTRY

## 37. CHEMISTRY

Chemistry is a branch of science concerned with the study of matter. Chemistry deals with the structure & the composition of matter and with the changes that matter undergoes.

## 38. MATTER

Everything in this universe is made up of matter. Matter is defined as anything which
- occupies space
- has mass
- may be perceived by our senses

## 39. NON-MATTER

Heat, light, electricity and sound are not matter.
- they have no mass
- they do not occupy space

## 40. ATOMS

All matter are composed of very small tiny particles. Democritus named these tiny particles as ATOMS.
A drop of water has $10^{21}$ particles.

## 41. CHARACTERSTICS OF PARTICLES

- are very very small
- have spaces between them
- are constantly moving
- attract each other

## 42. STATES OF MATTER

There are three physical states of matter
- Solid. Steel, stone
- Liquid  Oil, water
- Gas  Air

## 43. PHYSICAL PROPERTIES OF SOLIDS LIQUIDS AND GASES

| PROPERTIES | SOLIDS | LIQUIDS | GASES |
|---|---|---|---|
| Shape | Definite | Acquires the shape of the container | Acquires the shape of the container |
| Compressibility | Not possible | Very little | Highly compressible |
| Fluidity | Not possible | Can flow | Can flow |
| Density | High | Lower than solids | Very low |
| Packing of Particles | Densely packed | Less closely packed | Least closely packed |
| Interparticle force | Strongest | Weaker than solid | Negligible |

## 44. CHANGES IN STATE OF MATTER

**Melting**: The process of change of a solid substance into its liquid state when heated is called melting.

Melting of a substance happens at a particular temperature. This specific constant temperature is called MELTING POINT of that solid.
The Melting Point is a characteristic property of solids.
The Melting Point increases when the pressure is increased.

| Solids | Melting Point |
|---|---|
| Ice | 0 °C |
| Silver | 961° C |
| Iron | 1535° C |
| Salt | 800° C |

The melting point of a substance is a fixed temperature. But if there are impurities in a substance it changes considerably.
The melting point of a mixture of ice and salt is -15°C. It is considerably lower than that of pure ice which is 0°C.

Freezing or Solidification: The process of change of matter from the liquid to the solid state, at a particular temperature is called freezing or solidification

***Boiling***: Boiling is the process of change of a liquid in to a vapour, at a particular temperature. The temperature at which a liquid changes to vapour is called boiling point. Pure liquids have fixed boiling point.

| Liquids | Boiling Point |
|---|---|
| Water | 100°C |
| Alcohol | 78° C |
| Sulphuric Acid | 280°C |
| Chloroform | 62° C |

***Evaporation***: The process of conversion of a substance from the liquid state to its vapour state at any temperature below its boiling point is called evaporation or vaporization

***Condensation***: is the process of change of a state of a substance from its gaseous to liquid state at a particular temperature.

***Sublimation***: Sublimation is the process by which a solid on heating directly changes into its vapour (Gaseous state). This happens without changing in to liquid. Conversely the gas directly changes into solid.
Example:- Camphor, Naphthalene, solid carbon dioxide

## 45. LAW OF CONSERVATION OF MASS

It states that mass can neither be created nor destroyed in a chemical reaction.
OR
During any change physical or chemical matter is neither created nor destroyed. However it may change from one form to another.

$CaCO_3 \rightarrow CaO + CO_2$

If 100g of Calcium Carbonate is heated it will give 56 g of Calcium oxide and 44 g of Carbon dioxide.
Some matter may get converted in to form of energy.

## 46. GASES

In a gas inter-particle attraction is weak and inter-particle space is very large. The particles are free to move randomly in the entire available space.
All gases show uniform behaviour under similar conditions of temperature and pressure irrespective of their chemical nature or colour or odour.

*Properties of Gases:*
- Gases are made up of tiny particles moving randomly.
- Gases have neither a fixed volume nor a fixed shape
- Gases exert pressure in all direction
- Gases are highly compressible
- Gases are highly expansible
- Gases have low density
- Gases have a natural tendency of mixing with one another (Diffusion)
- Gases can be liquified

## 47. ABSOLUTE ZERO

The particles (Molecules) of matter (Solid, Liquid and Gas) are in constant motion. Thus we can say the molecules have energy (Kinetic).
As the temperature increases, the molecular motion increases, and when the temperature decreases, the molecular motion also decreases.
This suggests that when the temperature is zero, the molecules motion will stop completely.
This fact is used to define temperature scale Kelvin.
On this scale the temperature at which the molecular motion completely stops is called absolute zero.
With increase in pressure and lowering of temperature the volume of gas decreases. The temperature at which the volume of hypothetical gas becomes zero is absolute zero of temperature.
This temperature is minus (-) 273° C.
This is the lowest temperature that can ever be reached.
However, practically speaking, this temperature. Is impossible to attain.
All gases liquefy or solidify before reaching this temperature.

## 48. GAS LAWS

1. An increase in pressure at constant temperature causes a decrease in the volume of a gas: conversely, if the volume of a fixed mass of a gas at constant temperature is Decreased, the pressure of the gas Increases.

2. A decrease in pressure at constant temperature causes an increases in the volume of a gas, conversely, if the volume of a fixed mass of a gas at constant temperature is Increased, the pressure of the gas Decreases.

3. An increase in temperature at constant pressure causes an increase in volume and a decrease in temperature at constant pressure causes a decrease in volume.

4. The volume of a given mass of a gas is inversely proportional to its pressure at constant temperature.

5. The density of gas decreases with increase in temperature.

## 49. SIGNIFICANCE OF GAS LAWS

On increasing pressure, volume decreases. The gas becomes more dense. Thus at constant temperature, the density of a gas is directly proportional to its pressure.

Atmospheric pressure is low at high altitudes, so air is less dense. Hence a lesser volume of oxygen is available for breathing. This is the reason why mountaineers have to carry oxygen cylinders with them.

As the density decreases with increase in temperature, this the reason why hot air is filled in balloons.

## 50. KELVIN SCALE OF TEMPERATURE VIZ A VIZ CELSIUS SCALE

| CELSIUS SCALE | KELVIN SCALE |
|---|---|
| Zero | 273 |
| 100 | 373 |
| Ex 20 degree Celsius (C) | 273 + 20 = 293 K |
| Ex 50 degree Celsius (C) | 273 + 50 = 323 K |