CHM101 SUMMARY

IBN IDRIS

Any Substance that in water solution tastes sour, changes the colour of certain indicator reddens blue is regarded as ACID

Types of ACID

1. Organic acid such as Carboxylic acid, Sulphonic acid, and phenol group.

2. Inorganic acid: Such as H_2SO_4, Nitric acid, HCl, and H_2PO_4.

The action of acid on a metal usually results in reduction of acid.

* Nitric acid reacts with protien to produce XANTOPROTEN

* $NaNO_3$ is also known as chile saltpeter in chile & Peru

* KNO_3 is Sometime Called BENGAL SALTPETER in INDIA

* Nitric acid can be prepared in the Laboratory by HEATING a Conc. H_2SO_4.

ie $NaNO_3 + H_2SO_4 + Heat \rightarrow NaHSO_4 + HNO_3$

* Nitric acid is easily removed by DISTILLATION

* Any oxygen containing acid is Called OXY ACID

* Most Covalent non-metallic oxides react with water to form ACIDIC OXIDES

* Dark red at P.H 0 Colour is GREENISH YELLOW

* The Colour of Red in P.H 2 is NAVY BLUE

* The colour of Orange red in P.H 3 is PURPLE

* The colour of Red in P.H 1 is BLUE

* The Colour of Orange in P.H 4 is Dark purple

* The colour of Orange yellow in P.H 5 is DARK PURPLE

* The Colour of Greenish yellow in P.H 6 is VIOLET

* The Colour of Green in P.H 7 is VIOLET

Importance of P.H SCALE

(i) In agriculture
(ii) In Biological process
(iii) In Corrosion research

* The solution whose P.H does not change when small amount of an acid or base is added in it. is Called BUFFER SOLUTION

* Acetic acid is an example of effective BUFFER SOLUTION

* Acid Solution having LOW P.H is stronger than another solution having HIGHER P.H values.

* Acid having the P.H of 2 is stronger than an acid having P.H of 5.

An alkali solution having HIGHER PH value is a stronger than a solution of PH 10.

* Very Strg acid solution Can have PH values less than zero (0)

* Very strong base solution Can have a PH greater than 14.

* A PH of neutral water value is 7

A solution which is less than P.H 7 is ACIDIC SOLUTION

A Solution which is greater than P.H 7 is BASIC SOLUTION

Basic solution turns red litmus paper to BLUE

* Base turns Methyl orange to YELLOW

* Base turns Phenolphthalein to PINK

* The potential of hydrogen which measures the acidity or alkalinity of water soluble Substances is called P.H SCALE

* In 1909, a Danish Biochemist S.P.H SORENSON devised a scale PH to represent the H^+ ion Concentration of an aqueous solution.

* A Substance that donates hydrogen ions is Called ACID

* A Substance that accepts ~~electron~~ Hydrogen ion is Calle A BASE

* Acidity and alkalinity are measured with a logarithic scale called p.H

* The reaction which goes both ways is called REVERSIBLE REACTION

* free hydrogen ions do not exist in H_2O

* The amphiprotic ability of water to act as a proton donor and acceptor allows the formation of hydronium and hydronium ion evolves that of hydroxide ions is called SELF-IONIZATION OF WATER.

* When the temperature changes the p.H of the solution will change also.

* The measure of the concentration of hydroxide ions is called POH

* The decimal logarithm of the reciprocal of the hydrogen ion activity in a solution is called p H

* $$pH = -\log_{10}(aH^+) = \log_{10}\left(\frac{1}{aH^+}\right)$$

* p.H depends on temperature

* At 0°C the p.H of pure water is 7.47

* At 25°C the p.H is 7.00

* At 100°C the p.H is 6.14

* The pH scale is traceable to a set of standard solutions

MEASUREMENT OF PH ARE IMPORTANT IN

- Chemistry
- Agronomy
- Medicine
- Water treatment and
- Many other applications.

The Concept of P.H was first introduced by the DANISH CHEMIST SOREN PEDER LAWRITZ SORENSON at the CARLSBERG Laboratory in 1909 and revised to the modern pH in 1924

The exact meaning of "P" in "PH" is Disputed.

The state of Matter characterized by particles arranged such that their shape and volume are relatively stable is called SOLID

- Solids are generally held together by ionic or strong covalent bonding and the attractive forces between them are strong.
- Solids have definite shape and volume and are not compressible to any extent.

Types of SOLID

- Crystalline solid
- Amorphors solid

- A solid in which the atoms, ions or molecule exist in a regular, well defined arrangement is called CRYSTALLINE SOLID.
- A solid in which the molecules do not arrange in regular pattern is called AMORPHOUS SOLID

CRYSTALLINE SOLID ARE

a — Ionic
b — Metallic
c — Molecular
d — Network (Covalent)

* Objects that occupy space are called SOLID SHAPES

* The positive and negative ions held together by electrostatic attractions are called IONIC SOLIDS

* The molecules that held together with metallic bond are called METALLIC

* The molecules that held together by dipole-dipole force or hydrogen bonds are called MOLECULARS

* The atoms connected by covalent bond are called COVALENT NETWORK

CHARACTERISTICS OF SOLIDS

- Definite mass, volume & shape
- High density
- Incompressible and rigid
- Strong intermolecular forces
- fixed constituent particles

* The ordered array of points describing the arrangement of particles that form a crystal is called LATTICE STRUCTURE

* NaCl, $CuSO_4$, $KMnO_4$ are IONIC LATTICE

* Diamond, Quartz (SiO_2) are COVALENT LATTICE

* The lattice points generally represents the location of atoms or ions.

BRAVAIS LATTICES ARE

1. primitive cubic.
2. Body Centered Cubic (BCC)
3. face Centered Cubic (FCC)
4. primitive tetragonal
5. Body Centered tetragonal
6. primitive orthorhombic
7. Base Centered orthorhombic
8. Body Centered orthorhombic
9. face Centered orthorhombic
10. primitive monoclinic
11. Base Centered monoclinic
12. Triclinic
13. Rhombohedral
14. Hexagonal.

- When metal atoms are arranged with shapes in one layer directly above or below spheres in another layer, the lattice structure is called

SIMPLE CUBIC OR PRIMITIVE CUBIC

* The elastic scattering of X-ray protons by atoms in a periodic lattice is called

X-RAY DIFFRACTION (XRD)

* The experimental science determining the atomic and molecular structure of a crystal, in which the crystalline structure causes a beam of incident x-ray to diffract into many specific direction is called

X-ray Christallography

* The process where by some molecules escape from liquid to gaseous state is called

EVAPORATION

* Vapour pressure increases with temperature.

* If the temperature reaches 100°C, then the pressure will be 101.325 kpa

* Some particles escape when the temperature is at 25°C — 3.25 kPa pressure.

* The apparent elasticity is called SURFACE TENSION

* The force between the container and the molecules is called COHESIVE

* The force of the molecules is called ADHESIVE

* Surface Tension = force / volum

* The SI unit is NCm^{-3} or NM^{-3}

* Condensation of gaseous substances to form liquid is called LIQUIFACTION

* The pressure that liquify a gas at critical temperature is CRITICAL PRESSURE

* The Temperature that can cause a gas to liquify at critical pressure is called CRITICAL TEMPERATU

* The critical Temperature of H_2 is 33.2 k

* The critical pressure of H_2 is 1.30×10^3 kpa

* The Critical temperature of H_2O is 647.3 k

* The critical pressure of H_2O is 22.1×10^3 kpa

* The critical temperature of O_2 is 154.2

* The critical pressure of O_2 is 5.08×10^3 kpa

Critical temperature of N_2 is 126.0 K

The critical ~~temperature~~ pressure of N_2 is 3.39×10^3 Kpa

The critical temperature of SO_2 is 304.4K

The critical pressure of SO_2 is 7.39×10^3 kPa

The critical temperature of SO_2 is 430.6K

The critical press of SO_2 is 7.89×10^3 kPa

CHARACTERISTICS of LIQUID

Vapour pressure
Surface tension
Viscosity
Lattice Structure & diffraction

The resistance of liquid to flow is called VISCOSITY

LATTICE STRUCTURE & X-RAY DIFFRACTION

The arrange of crystals is called LATTICE

The rigid body in which particles are arranged in regular manner is called CRYSTALLINE

TWO CLASSES OF SOLID

1. Crystalline structure
2. Amorphors structure

PHYSICAL PROPERTIES OF CRYSTALS

- Reffractive index
- Thermal
- Electrical conductivity

Amorphors do not have a specific temperature and specific melting point.

* The amorphors substance is normally called SUPERCOOL LIQUIDS

* In 1912. A scientist VONLINS brought out an idea, he said that, an x-ray could be used to discover the arrangement of crystalline substances.

* A situation whereby one or more different compound have the same crystalline structure is called ISOMORPHISM

single

* A substance that has two or more compounds with the same crystalline structure is called POLYMORPHISM

* When the reaction is reversible it will undergo CHEMICAL EQUILIBRIUM

* Equilibrium constant is given as

$$K_c = \frac{[C]^+[D]^+}{[A]^-[B]^-} \text{ in}$$

$$A + B \rightleftharpoons C + D$$

* FACTORS THAT AFFECT THE RATE OF EQUILIBRUM

1- Temperature
2. pressure
3- Concentration
4- Catalytic effect

* Increase in volume leads to decrease in Concentration
* Decrease in volume, increase in Concentration
* Increase in volume, favours backward reaction

ecrease in Volume favours Forward reaction

* EXOTHERMIC REACTION

- Increase in temperature favours BACKWARD reaction.

* ENDOTHERMIC RXN

- Decrease in temperature favours FORWARD RXN

* when the equilibrium Constant is less than ONE (< 1) the equilibrium is REACHED (far from completion)

* When the equilibrium Constant is greater than One (> 1) the reaction is Reached Completion.

* In chemical system that is in equilibrium is affected by the particular factors and if there is changing in one of the factor, the equilibrium will shift so as to annul the effect of the change is the principle of LECHATALIER

* The branch of thermo chemistry is called THERMODYNAMICS.

* A conversion of chemical energy to other forms of energy by generating heat is called THERMOCHEMISTRY

* ~~The~~ In an isolated system, the total energy is Constant is FIRST LAW OF THERMODYNAMIC.

* When a system A is increased to system B, the heat evolved or absorbed is independent of the path taken is the HESS LAW OF CONSTANT SUMMATION

* $\Delta H^{\circ} = Q_1 + Q_2$ is Hess Law.

* When reaction occurs in nature, there is an increase in the total Entropy. is the SECOND LAW OF THERMODYNAMICS

* The measure of the degree of randomness of molecules, ions is called ENTROPY

FACTORS THAT ALTER ENTROPY

1. Temperature:
   - The higher the temperature the higher the entropy and vise-versa.

2. Volume:
   - The larger the volume, the higher the entropy

* when
  ΔH is possitive (+)
  $T\Delta S$ is possitive (+)

* The metal discharge which carries negative charged is called CATHODE

* The non-metal discharge which carries possitive charged is ANODE

* Oxidation reaction takes place in ANODE

* Reduction reaction takes Place in CATHODE

FACTORS AFFECTING IONIC DISCHARGE

1. Concentration
2. Nature of the electrode
3. position of ion in the electrochemical series.

DIFFERENT CONCENTRATED SOLUTION.

- Diluted
- Concentration
- Unsaturated
- Supper-Saturated

Low Concentrated of solute is DILUTE

High Concentration of solution is CONCENTRATION

The equal Concentration of Solute & solvent is Called UNSATURATED

Excess solute in the solution is Called SUPER-SATURATED

CLASSIFICATION OF SOLUTION

1. Gas Solution
2. Liquid Solid Solution
3. Solid Solution.

Air is GAS SOLUTION

Alcohol in H_2O is an example of LIQUID SOLID SOLUTION.

Bronze, Alloy of Copper, Cu and Sn, ~~Cu~~ are SOLID SOLUTION

COLLIGATIVE PROPERTIES OF SOLUTIONS

1. Vapour pressure
2. Boiling point elevation
3. freezing point depression
4. Osmotic pressure

for a solution that has only one(1) solute(A) is

$$P_A = X_A P_A^{\circ}$$

* For a solution that has two(2) solutes A & B is

$$P_B = X_B P_B^{\circ}, \quad P_T = P_A + P_B$$

$$= \boxed{X_A P_A + X_B P_B^{\circ}}$$ known as

RAUTH'S LAW OF DILUTE SOLUTION

* Boiling point of elevation is given as

$$\boxed{T_b = mK_b}$$

* Freezing point depression is given as

$$\boxed{T_f = mK_f}$$

* Osmotic pressure is given as

$$\boxed{\pi = \frac{nRT}{V}}$$

* The movement of particle from lower concentration to a high concentration is called OSMOTIC PRESSURE

* $$\boxed{K_{-1} = \frac{\alpha^2 C^2}{(1-\alpha)C} = \frac{\alpha^2 C}{1-\alpha}}$$ is

Ostward's Law of dilution.

* $$\boxed{K_a = \frac{[H^+][A^+]}{[HA]}}$$ is

DISSOCIATION CONSTANT OF ACID.

* $$\boxed{K_{sp} = \frac{[A^+]^x + [B^-]^y}{A_x B_y}}$$ is

SOLUBILITY PRODUCT

* The quantitative relationship between vapour pressure lowering and concentration in an ideal solution is stated in

RAOULT'S LAW

* The pressure of the vapour phase above the liquid at this point is

EQUILIBRIUM VAPOUR PRESSURE

The pressure formed by the vapour of a liquid or solid over the surface of a liquid is called

VAPOUR PRESSURE

The temperature at which the vapour pressure of the is equal to standard pressure is called

BOILING POINT

The amount by which the boiling point is raised is known as BOILING POINT ELEVATION

The molarity of boiling point constant of water is

0.5121°C/m

The amount by which freezing point is lowered is called

FREEZING POINT DEPRESSION

The minimum pressure required to be applied to a solution to prevent the inward flow of its pure solvent across a semi permeable membrane is

OSMOTIC PRESSURE