Hornbill Classes

Module - 7

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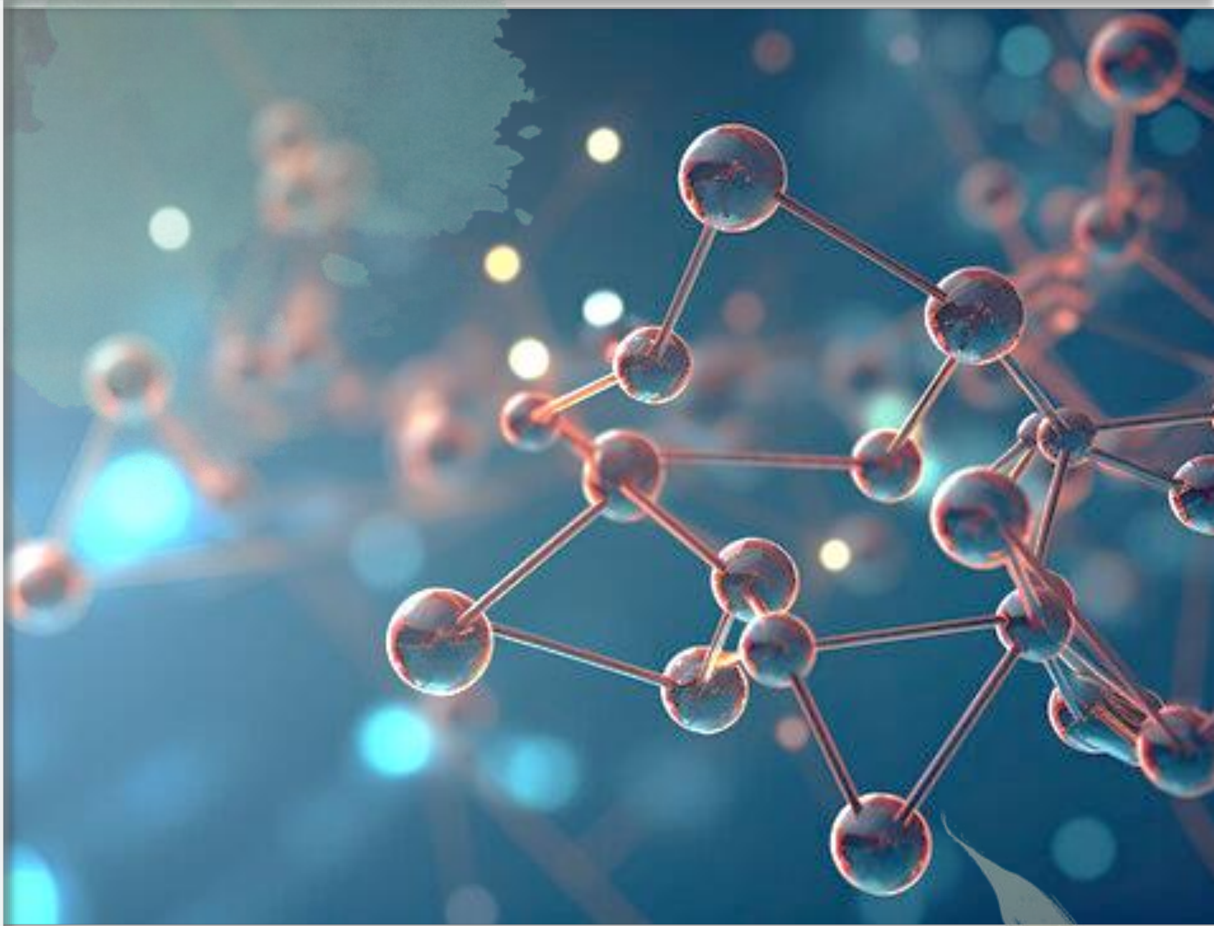

2024

CHHATTISGARH STATE FOREST SERVICE

Congratulations

To all our successful candidates in

MADHYA PRADESH FOREST SERVICE 2020

Assistant Conservator of Forest (ACF)


1 Ashish Vijaywar


2 Ankit Kumar Jain


3 Sachindra Singh Tomar


4 Shubham Soni


6 Rahul Chouhan

5 Out of 6 Selections in MPPSC Forest (ACF) 2020

RANGE FOREST OFFICER (RFO)


1 Gourav Dubey


2 Saurabh Dubey


3 Pawan Sharma


4 Manish Sharma


5 Kuldeep Baghel


6 Sushil Parmar


7 Lantav Jain


9 Shubham Raghuvanshi


10 Manisha Mukati


12 Vedant Goutam


13 Parag Jain


16 Shri Ram Dwivedi


19 Anil Kumar


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21 Anubhav Jain


22 Ravindran Gupta


24 Kuldeep Bohare


25 Shubham Tiwari


26 Yogesh Dhote


27 Piyush Shukla


28 Yogendra Singh Baghel


30 Abhilash Pathak


31 Manav Patidar


33 Omkar Nath Mishra


34 Amit Singh Chandel

CGPSC ACF/RFO EXAMINATION 2024/25

CHEMISTRY

MODULE – 7

Hornbill classes

EDITION : 2024

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SYLLABUS

Unit	Syllabus
1	**CHEMICAL EQUILIBRIUM**: Definition, types of Equilibrium, Factors Affecting Equilibrium, Le-Chatelier's Principle. **LAW OF MASS ACTION**: Introduction, Equilibrium Constant, Equilibrium Constant in Gaseous System, Factors Affecting Equilibrium Constant. **LE-CHATELIER'S PRINCIPLE**: Definition
2	**CHEMICAL KINETICS**: Introduction, Rate of reaction, factors affecting rate of reaction, rate law, average rate of reaction, units of rate constant, order of reaction, half live period of reactions. **DIFFERENT TYPES OF REACTION:** reversible and irreversible reaction, endothermic & exothermic reaction, fast & slow reactions
3	**ACIDS & BASES**: Introduction, properties and uses of acids & bases, different concepts of acids & bases (Arrhenius, Bronsted-Lowry, Lewis), conjugate acids & bases, HSAB concept. **pH SCALE**: pH discovery, pH of acids, bases & water, dissociation constant, some examples.
4	**CHEMICAL COMPOUND**: water: properties and uses, hard & soft water, heavy water. **PREPARATION, PROPERTIES & USES OF**: washing soda, baking soda, bleaching powder, plaster of Paris, gypsum. **PREPARATION OF BUILDING MATERIALS**: lime, cement, glass, steel
5	**METALS & THEIR PROPERTIES**: Introduction, position of metals in periodic table. **NON-METALS**: Introduction, position of non-metals in periodic table. **ORES & ALLOYS**: Types and examples.
6	**METALLURGY**: Introduction, steps involved in the extraction of metals: concentration (gravity separation, magnetic separation, froth flotation), conversion of ores into oxide (calcination, roasting), reduction of ore (different processes). **METALLURGY OF COPPER & IRON**: Introduction & process **CORROSION OF METALS**: Introduction, electrochemical theory of rusting, factors affecting corrosion.

7	HYDROGEN: preparation, isotopes, types, properties and uses. OXYGEN: preparation, properties and uses. NITROGEN: preparation, properties and uses. ALCOHOL: preparation, types, properties and uses. ACETIC ACID: preparation, properties and uses.
8	POLYMER: introduction, types rubber, nylon, polythene, Teflon, PVC, Bakelite, biodegradable polymer, resin soaps & detergents.

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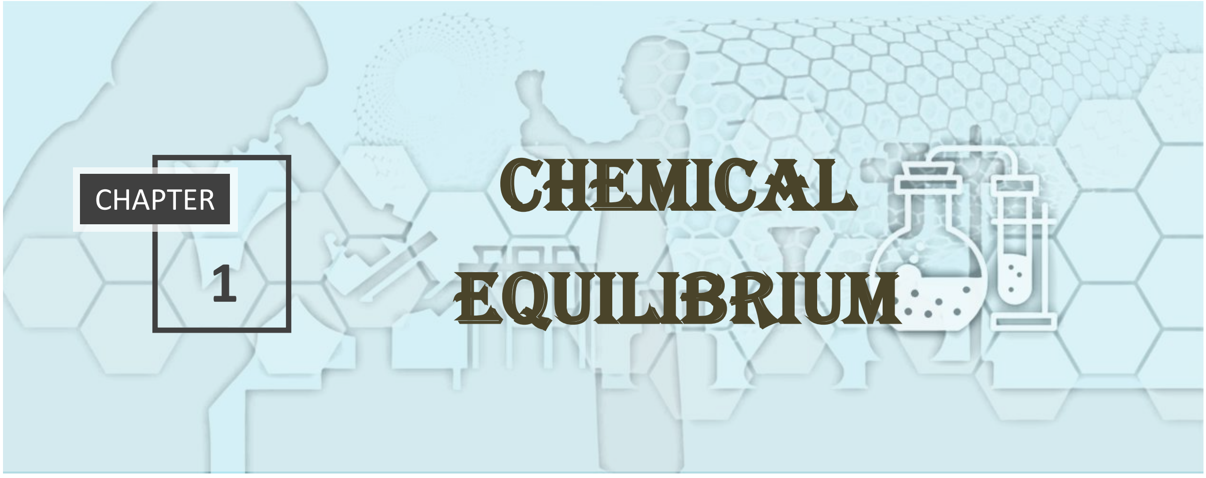


Syllabus: Chemical Equilibrium, Types of Equilibrium, Factors Affecting Equilibrium, Law of Mass Action and Equilibrium Constant, Equilibrium Constant in Gaseous System, Factors Affecting Equilibrium Constant, Le-Chatelier's Principle.

1.1 INTRODUCTION

The state of any reversible process(reaction) in which rate of the forward and the backwards (reverse) reactions are equal is called chemical equilibrium. In this state, the measurable properties of the system like concentration, temperature, colour, density etc. Don't undergo any change with time and remain constant.

a + b ⇋ c+d

Now, a + b = forward reaction

c + d = backward reaction

Then, according to law of mass action:

rate of forward reaction (r_f) α [a] [b]

(r_f) = k_f [a] [b]   (k_f = constant)

and rate of backward reaction (r_b) α [c] [d]

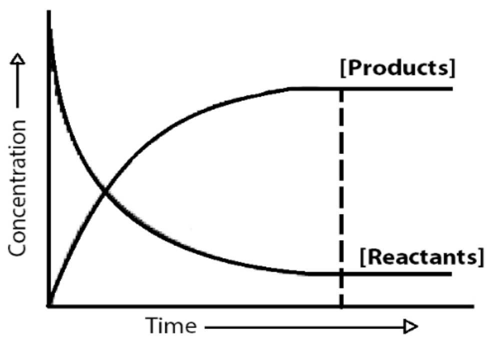
(r_b) = k_b [c] [d]

Now, equilibrium = (r_f) = (r_b)

k_f[a] [b] = k_b [c] [d]

$\frac{K_f}{K_b} = \frac{[C]\,[D]}{[A]\,[B]}$ = k_c

Attainment of Chemical Equilibrium



Here k_c is known as the Equilibrium Constant and has a definite value for every chemical reaction at a particular temperature.

Note: This equilibrium is dynamic in nature as it consists of a forward reaction in which reactants give products and backward rection in which product gives original reactants. Even after equilibrium, the reactants & products are changing into each other and this equilibrium state can be approached from both sides.

Ex: synthesis of ammonia by Haber's process.

$N_2 + 3H_2 \leftrightharpoons 2NH_3$

This reaction also indicates that chemical reaction reaches a state of dynamic equilibrium, in which the rates of forward & backward reactions are equal and there is no net change in composition.

1.2 TYPES OF EQUILIBRIUM

- **Homogenous equilibrium:**

CHAPTER 2

CHEMICAL KINETICS

Syllabus: Rate of reaction, factors affecting rate of reaction, rate law, average rate of reaction, units of rate constant, order of reaction, half live period of reactions, reversible and irreversible reaction, endothermic & exothermic reaction, fast & slow reactions

2.1 INTRODUCTION

- Chemical kinetics = Kinesis (Greek word) = movement
- The **Rate of reaction** can be defined as the change in concentration of a reactant or product per mol in unit time. This means it is the speed at which reactants are converted into products:

  (i) The rate of decrease in concentration of any reactant.

  (ii) The rate of increase in concentration of any product.

  Let's take a general equation at constant volume:

  $$R \rightarrow P$$

  At time t_1 = concentrations of R & P are $[R]_1$&$[P]_1$

  And, at time t_2 = concentrations of R & P are $[R]_2$& $[P]_2$

  Then rate of disappearance of R

  = (Decrease in concentration of R)/ (Time)

  = $-\Delta[R]/\Delta t$ ----------------- (i)

  And rate of appearance of P

  = (Increase in concentration of P)/ (Time)

  = $+\Delta[P]/\Delta t$-----------------(ii)

  Here Δ[R] is taken negative because concentration of reactants is decreasing and Δ[P] is taken positive because concentration of products is increasing with time.

  Example: $N_2 + 3H_2 \rightarrow 2NH_3$

  (i) Rate of formation of ammonia = $+\frac{d[NH3]}{dt}$

  (ii) Rate of disappearance of nitrogen = $-\frac{d[N2]}{dt}$

  (iii) Rate of disappearance of hydrogen = $-\frac{d[H2]}{dt}$

  Now, rate of reaction = $-\frac{d[N2]}{dt} = -\frac{1}{3}\frac{d[H2]}{dt} = +\frac{1}{2}\frac{d[NH3]}{dt}$

  Thus, rate of reaction = $-\frac{d[N2]}{dt} = \frac{1}{2}\frac{d[NH3]}{dt}$

  Or, rate of formation of ammonia = twice the rate of disappearance of nitrogen

  i.e. $\frac{d[NH3]}{dt} = -\frac{2}{3}\frac{d[H2]}{dt}$

$t_{1/2} \alpha \frac{1}{a^{n-1}}$ that means:

for first order reaction = (Half-life α a^0)

for second order reaction = (Half-life α 1/a)

for third order reaction = (Half-life α $1/a^2$)

Exercise no 2.2

1. For the first order reaction, the time required for 99.9% completion of reaction is how many times that required for 50% completion? [Raj ACF 2018]

(a) 50 times

(b) 10 times

(c) 5 times

(d) 2.5 times

Solve- $t = \frac{2.303}{k} \log \frac{a}{a-x}$

$T_{99.9} = \frac{2.303}{k} \log \frac{100}{100-99.9} = = \frac{2.303}{k} \log \frac{100}{1}$

$= \frac{2.303}{k} \log_{10} 1000$---------**(i)**

Now, $T_{50} = \frac{2.303}{k} \log \frac{100}{100-50} = \frac{2.303}{k} \log_{10} 2$------**(ii)**

Now dividing both the equation: $= \frac{3.000}{0.3010} = 10$

2. The $t_{1/2}$ of reaction is doubled as the initial concentration of the reactant is doubled. What is the order of the reaction? [Raj ACF 2018]

(a) 3

(b) 2

(c) 1

(d) 0

Solve: we know that half -life is related to concentration as

$t_{1/2} \alpha \frac{1}{a^{n-1}}$

according to question,

$\frac{t_{1/2}}{2t_{1/2}} = \frac{1/a^{n-1}}{1/2a^{n-1}}$

$½ = 2^{n-1}$

$2^{-1} = 2^{n-1}$

n-1 = -1

n=0, hence the reaction is of the zero order.

3. A first order reaction A → product has a first order rate constant 1.15 x $10^{-3} s^{-1}$ how long it will take 8.0 g of A to reduce to 2.0 g? [Raj ACF 2018]

(a) 802 s

(b) 1205 s

(c) 601 s

(d) 200 s

Solve: $t = \frac{2.303}{k} \log \frac{R_0}{R}$

$= \frac{2.303}{1.15 \times 10^{-3}} \log \frac{8}{2}$

$= 2.00 \times 10^3 \log 4$

$= 2000 \times 0.60206$

t = 1205 s

4. The reaction A → product is zero order while reaction B→ product is first order reaction. for what initial concentration of A, the half-lives of two reactions are equal? [CG pariyojna 2021]

(a) $\log_e 4M$

(b) $\frac{1}{2} \log_e 2M$

(c) $\log_e 2M$

(d) $4 \log_e 2M$

Solve: for a zero-order reaction, concentration at any time

$t_{1/2} = \frac{a}{2k}$-------**(i)**

for a first order reaction,

$t_{1/2} = \frac{\log_e 2}{k}$------**(ii)**

from (i) and (ii)

$\frac{a}{2k} = \frac{\log_e 2}{k}$

Or, $a = \log_e 4$ M

5. In a reaction 3A→ products, the concentration of A decreases from 0.4 mol. L^{-1} to 0.1 mol. L^{-1} in 20 minutes at 300K. the rate of decrease in [A] during this interval (in mol. $L^{-1}.min^{-1}$) at 300K is? [Kerala CE 2022]

(a) 0.005

(b) 0.001

(c) 0.015

(d) 0.15

Solve: we know that for a reaction

Rate = $\frac{1}{3} \times \frac{A_0 - A}{t}$

Rate = $\frac{1}{3} \times \frac{0.4 - 0.1}{20}$

Rate = $\frac{1}{3} \times \frac{3}{200}$

Rate = 0.005 mol. $L^{-1}.min^{-1}$

6. The half life period of a first order reaction at 298K is 20 minutes. The time (in min.) required for 99.9% completion of the reaction at the same temperature, is? [Kerala CE 2022]

(a) 100

(b) 15

(c) 200

(d) 20

Solve: given that**,**

X = 0.999a for $t_{99.9\%}$

And X = 0.5a for $t_{50\%}$

$$\frac{t_{99.9\%}}{t_{50\%}} = \frac{\frac{2.303}{k}\log\frac{a}{a-0.999a}}{\frac{2.303}{k}\log\frac{a}{a-0.5a}}$$

$$\frac{t_{99.9\%}}{20} = \frac{-(-3)}{log2} = \frac{-(-3)}{0.0301}$$

$t_{99.9\%}$ = 10 × 20 = 200 min.

7. For the reaction 2NO + O_2 → 2NO, volume is suddenly reduced to half of its value by increasing the pressure on it. If the reaction is of first order with respect to O_2 and second order with respect to NO, the rate of reaction will

(a) Diminish to one fourth of its initial value

(b) Diminish to one eighth of its initial value

(c) Increase to eight times of its initial value

(d) Increase to four times of its initial value

Solve: given that,

Reaction 2NO + O_2 → 2NO

Rate of reaction = k $[NO]^2$ $[O_2]$ = r_1 (let)

Now after reducing the volume

= k[2NO].[2O_2] = 8.r_1

The reaction rate is increased by 8 times.

8. The time taken for the completion of 90% of a first order reaction is t min. what is the time (in sec) taken for the completion of 99% of the reaction.

(a) 2t

(b) t/30

(c) 120t

(d) 60t

Solve: for the first order reaction:

K = $\frac{2.303}{t}\log\frac{a}{a-x}$

K = $\frac{2.303}{t}\log\frac{100}{100-90}$

K = $\frac{2.303}{t}$ …………(i)

Now, time T =?

a = 100

x = 99

for 99 % completion –

K = $\frac{2.303}{T}\log\frac{100}{100-99}$

Or T = $\frac{2.303}{K}$ log 100

T = $\frac{2.303}{K}$ log × 2 ………. (ii)

Putting the value of k from equation (i) in equation (ii) :

T = $\frac{2.303}{2.303}$ × t × 2

T = 2t

Answer Key
1. (b), 2. (d), 3. (b), 4. (a), 5. (a), 6. (c), 7. (c), 8. (a)

2.8 REVERSIBLE AND IRREVERSIBLE REACTIONS

- **Irreversible reactions:** the reactions which can occur in only one direction is called an irreversible reaction. In this the reaction can change back to the products. But the products cannot change back to the reactants. For example:
  1. **Neutralization Reaction**: A reaction where an acid & a base react together to form a salt & water.
     Acid + Base → Salt + Water
     $HCl + NaOH \rightarrow NaCl + H_2O$
  2. **Precipitation Reaction:** A reaction where two different soluble salts in aqueous solution combine to form a precipitate that is insoluble in solution.
     Ex: $AgNO_3 + KCl \rightarrow AgCl + KNO_3$
     (AgCl: precipitate)
  3. **Combustion Reaction:** A reaction where a substance reacts with O_2 gas, releasing energy in the form of light & heat.
     Ex: $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$ = (water vapour)
  4. **Thermal Decomposition:**
     A reaction where a compound breaks down or decompose when heated and give a variety of products.
     ex: $ZnCO_3(s) \xrightarrow{Heat} ZnO(s) + CO_2 \uparrow$
     Note: The thermal decomposition of $CaCO_3$ is reversible reaction in closed pot and irreversible reaction in open pot as well.
  5. **Redox Reaction:**
     Reactions that involve the transfer of electrons from one species to another. The one loses electrons is said to be oxidized, while the one gains electrons is said to be reduced.
     It consists of 2 reactions:
     (a) **Oxidation:** addition of O_2/removal of H_2
     ex: $2S(s) + O_2(g) \rightarrow 2SO_2(g)$
     (b) **Reduction: -** Removal of o_2/ gain of h_2
     ex: $2FeCl_3(aq) + H_2(g) \rightarrow 2Fecl_2(aq) + 2HCl(aq)$

- **Reversible reaction:** the reaction which occurs in both direction is called reversible reaction. In this the reactants and the products are converted to each other. These reactions are bidirectional and happens in a closed system. These reactions are sometimes very slow and may proceeds till infinity. An equilibrium condition also occurs in this. gibs free energy of these are taken as zero.
  Ex: $N_2(g) + 3H_2(g) \leftrightharpoons 2NH_3(g)$
  Types: (i) homogeneous: whole reaction is in same phase.
  Ex: $N_2(g) + 3H_2(g) \leftrightharpoons 2NH_3(g)$
  (ii) heterogeneous: reaction occurs in different phases.
  ex: $CaCO_3(s) \leftrightharpoons CaO(s) + CO_2(g)$
  Details are given back in equilibrium chapter.
  Note: if the reaction is isothermal then temperature is constant, if the reaction is isobaric then pressure is constant and if the process is isochoric then volume is constant.

CHAPTER 3

ACIDS, BASES & pH SCALE

Syllabus: properties and uses of acids & bases, different concepts of acids & bases (Arrhenius, Bronsted-Lowry, Lewis), conjugate acids & bases, HSAB concept, pH discovery, pH of acids, bases & water, dissociation constant

3.1 INTRODUCTION

The word Acid comes from a Latin word 'Acidus' which means 'sour.' An acid is any hydrogen-containing substance, capable of donating a proton (hydrogen ion) to another substance. A Base is a molecule or ion, able to accept a hydrogen ion from an acid.

Acidic substances are usually identified by their sour taste. They are known to turn blue litmus paper into red and liberate dihydrogen on reacting with some metals.

Bases on the other hand, are characterized by a bitter taste and a slippery texture. A base that can be dissolved in water is referred to as an alkali. That means, All the alkalis are bases but all the bases are not alkalis. Bases are known to turn red litmus paper blue and feel soapy.

3.2 PROPERTIES OF ACIDS

(1) Acids are corrosive in nature.

(2) They are good conductors of electricity.

(3) Their pH is always less than 7.

(4) Examples: Sulfuric acid(H_2SO_4), Hydrochloric acid (HCl), Acetic acid (CH_3COOH).

3.3 PROPERTIES OF BASES

(1) In their aqueous solutions, bases act as good conductors of electricity.

(2) Their pH value is always greater than 7.

(3) Bases release hydroxide ions (OH^-) when dissolved in water.

(4) Example: Sodium Hydroxide (NaOH), milk of magnesia [$Mg(OH)_2$], calcium hydroxide [$Ca(OH)_2$].

3.4 USES OF ACIDS & BASES

(1) **Acids:**

- A diluted solution of acetic acid, called vinegar, has various household application, and it primarily used as food preservative.
- Sulphuric acid (H_2SO_4) is widely used is batteries. The batteries used to start the engines of automobiles commonly contain this acid.
- Citric acid is an integral part of lemon juice and orange. it can also be used as food preservative.
- The industrial production of explosives, dyes, fertilizers, and paints involves the use of nitric acid and sulphuric acid.
- Phosphoric acid is a key ingredient in many soft drinks.

3.6 INTRODUCTION

pH is defined as the negative logarithm of hydrogen (H^+) ion concentration. In other word, hydronium ion concentration expressed on a logarithmic scale known as the pH scale. As all the acids and bases do not react with the same chemical compound at the same rate. Some react very vigorously, some moderately, while some show no reaction. To determine this and the strength of acids and bases, we use a universal indicator and that is called pH.

The pH scale is logarithmic, meaning that an increases or decreases of an integer value changes the concentration by a tenfold, for example a pH of 3 is ten times more acidic than a pH of 4 and likewise a hundred times more acidic than a pH of 5. Similarly, a pH of 11 is ten times more basic than a pH of 10.

3.7 DISCOVERY

In 1909, Sorensen introduced the concept of pH as a way of expressing acidity & basicity. Mathematical Expression of pH:

pH is expressed as:

$pH = -\log_{10}[H^+]$

and $[H^+] = 10^{-pH}$

Similarly, pOH is expressed as:

$pOH = -\log[OH^-]$

Now, at 298K, ionic product of water Kw can be given as:

$Kw = [H^+][OH^-] = 10^{-14}$

Taking the negative log of RHS AND LHS:

$-\log Kw = -\log[H^+.OH^-] = -\log 10^{-14}$

Or $pKw = -\log[H^+] - \log[OH^-] = 14$ $[\log_{10}10 = 1]$

$pKw = pH + pOH = 14$

3.8 pH of ACIDS And BASES

At room temperature solutions having a value of pH ranging from 0 to less than 7 are known as acidic and the pH from more than 7 to 14 are known as basic solutions. Solutions having the pH value of 7 are known as neutral solutions.

Acidic	Neutral	Basic
Less than 7	7	More than 7

- Solution having (0) pH= strong Acids
- Solution having (14) pH = strong Base

CHAPTER 4

CHEMICAL COMPOUNDS

Syllabus: water: properties and uses, hard & soft water, heavy water; Preparation, properties & uses of washing soda, baking soda, bleaching powder, plaster of Paris, gypsum; Preparation of building materials: lime, cement, glass, steel

4.1 WATER

- **Introduction:**

  Water, the most abundant and essential substance on earth is often taken for granted. Yet its properties are truly remarkable and play a vital role in sustaining life. Its chemical formula is H_2O. One molecule of water has two hydrogen atoms covalently bonded to a single oxygen atom. The structure of water molecule is non-linear. 71% of earth is surrounded by water and 65% of human body is composed of water.

- **Physical properties:**

  Water is a colourless & tasteless liquid. The molecules of water have extensive hydrogen bonds resulting in high melting and boiling points. As compared to other liquids, water has a higher specific heat, thermal conductivity, surface tension, dipole moment etc. Water is an excellent solvent and therefore it helps in the transportation of ions and molecules required for metabolism. It has a high latent heat of vaporization which helps in the regulation of body temperature.

- **Chemical Properties:**

  (1) **Amphoteric Nature:**

  Water can act both as acid and base, that's why it is called amphoteric.

  ❖ **Acidic Behaviour:**

  $H_2O(l) + NH_3(aq) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$

  ❖ **Basic Behaviour:**

  $H_2O(l) + H_2S(aq) \rightleftharpoons H_3O^+(aq) + HS^-(aq)$

  (2) **Redox Reaction:**

  Electro positive element reduces water to hydrogen molecule and this is called reduction.

  Example: $2H_2O(l) + 2Na(s) \rightarrow 2NaOH(aq) + H_2(g)$

  During the photosynthesis process, water is oxidized to O_2, hence water can be oxidized and reduced.

  (3) **Hydrolysis Reaction:**

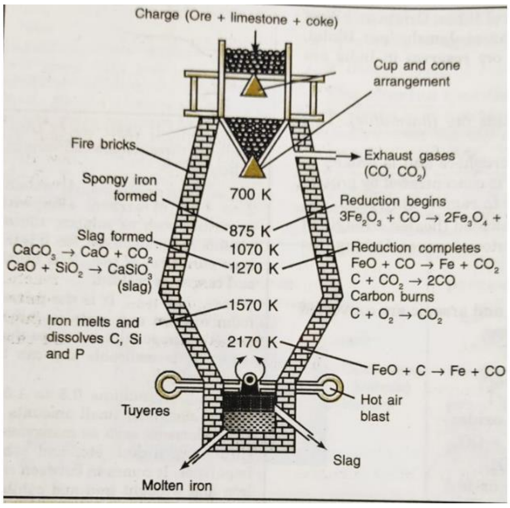
  Water has a very strong hydrating tendency due to its dielectric constant. It dissolves many ionic compounds. Some covalent and iconic compounds can be hydrolysed in water.

  (4) **Solvency of water:**

> The two reasons for high boiling point of water are –
>
> - Formation of H bonds, which requires more energy for breaking the 'extra' bonds.
> - Increase in *van der Waals* forces, as the result of which we need to supply more temperature for water to boil, or change from liquid state to vapour state.

$Fe_3O_4 + CO \rightarrow CO_2 + 3FeO$

$FeO + CO \rightarrow CO_2 + Fe$



ii. Zone of slag formation: (800^0C-1000^0C/bright red heat) When the spongy iron falls in the middle region (zone of heat absorption), limestone (CaCO3) decomposes to give CaO (lime) and CO_2. Lime thus obtained acts as a flux. It combines with silica to form a fusible (meltable) slag.

$CaCO_3 \rightarrow CaO + CO_2$

$CaO + SiO_2 \rightarrow CASiO_3$ (slag)

iii. Zone of combustion: (1500^0C-1900^0C /white heat) This is the zone near the tuyeres. Here the carbon burns to form CO_2 producing tremendous amount of heat.

$C + O_2 \rightarrow CO_2 \uparrow + 97$ kcal

iv. Zone of fusion: (1300^0C-1500^0C) In this zone, the spongy iron melts and dissolves some carbon, phosphorus, and silica. The molten iron collects at the bottom of the furnace while the fusible slag floats on it and protects the iron from oxidation. The layers of molten iron and slag are withdrawn through separate tapping holes from time to time.

Iron so obtained is known as Pig Iron. It is remelted in a vertical furnace (known as cupola) and can be cast or poured into moulds. It is then called cast iron. So cast iron is obtained after remelting pig iron.

Exercise 6.5

1. The oxides of iron ore are reduced in the blast furnace at lower temperature range 500-800K. this reduction is due to [MPPSC SFS Main 2020]
   (a) C
   (b) CO_2
   (c) CO
   (d) Silica
2. Consider the following statements:
   Coke is one of the materials of charge added to blast furnace for production of steel/iron. Its function is to [CG pariyojna 2021]
   (A) Acts as the reducing agent.
   (B) Removes silica associated with iron use.
   (C) Functions as fuel to supply heat.
   (D) Acts as an oxidising agent.
   Correct statements are:
   (a) 1 and 2
   (b) 2 and 4
   (c) 1 and 3
   (d) 3 and 4

(1.) c, (2.) c

CHAPTER 7

PREPARATION AND PROPERTIES OF HYDROGEN, OXYGEN, AND NITROGEN

Syllabus: hydrogen: preparation, isotopes, types, properties and uses; oxygen: preparation, properties and uses; nitrogen: preparation, properties and uses; alcohol: preparation, types, properties and uses; acetic acid: preparation, properties and uses.

7.1 HYDROGEN

Hydrogen is the first and the lightest element in the periodic table. It was discovered by Henry Cavendish in the 18th century. It occurs rarely in free state because it is highly reactive. It is the most abundant element in the universe (70% of the total mass of the universe.), the earth's crust contains 1% of hydrogen by weight. Important sources are water, acids, alkalis, organic matter etc.

Position in periodic table: the position of hydrogen is not definite in the periodic table because it resembles both the alkali metals (group 1st/IA) as well as halogens (17th/VIIA). At the same time, it differs from both in many characteristics.

Isotopes of hydrogen:

Name	**Protium** (ordinary hydrogen)	**Deuterium** (heavy hydrogen)	**Tritium** (radioactive)
Symbol	$_1H^1$	$_1H^2$	$_1H^3$
Neutrons	0	1	2
Protons	1	1	1
Electrons	1	1	1
Stability	Stable	Stable	Unstable (radioactive)
Electronic configuration	$1S^1$	$1S^1$	$1S^1$

Methods of preparation: there are several methods of preparing hydrogen:

1. By action of metals with acid: The metals which are placed above H_2 in electrochemical series, react with dilute acids and liberate hydrogen.

CHAPTER 8

POLYMERS, SOAPS & DETERGENTS

Syllabus: introduction, rubber, nylon, polythene, Teflon, PVC, Bakelite, biodegradable polymer, resin; soaps & detergents.

8.1 INTRODUCTION

The term polymer is used to describe a very large molecule that is made up of many repeating small molecular units. These small units are called monomers and the chemical reaction that combines the monomers together is called polymerization. The term 'polymer' is a Greek term which means- Polus (many) and Meros (part). This term was coined by Berzelius.

Homopolymers and Copolymers: polymers which are formed by only one type of monomer are called homopolymers. Some examples are as follows:

Homopolymer	**Monomer**
Starch	Glucose
Cellulose	Glucose
Polyethylene	Ethylene
Polyvinyl chloride	Vinyl chloride
Teflon	Tetrafluoro ethylene
Nylon-6	Caprolactam

Polymers which are formed by more than one type of monomers are known as copolymers. For ex.

Copolymer	**Monomer**
Saran	Vinyl chloride & vinylidene chloride
SAN	Styrene & acrylonitrile
ABS	Acrylonitrile, butadiene & styrene
Butyl rubber	Isobutylene & isoprene
Buna-S	Styrene & butadiene
Buna-N	Acrylonitrile & butadiene
Nylone-66	Hexamethylenediamine & adipic acid
Terylene	Terephthalic acid ethylene glycol

Aman Patidar

Devesh Trivedi

Arvind Singh Thakur

Sachin Bhondele

Jaikishan Sharma

Gaurav Trivedi

Durgesh Jee Pandey

Sourabhn Kumar Chourasiya

Anita Surwayamshi

Rohit Sharma

Pooja Baghel

Ravikant SIrvaiya

Pushparaj Singh Sikarwar

Shubham Kulhade

Ashish Singh Sikarwar

Anupam Mishra

Amar Singh Bhadoriya

Somesh Sharma

Keshav Meena

Sunil Singh Jadon

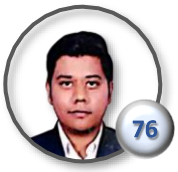
Atul Kumar Patel

Meenakshi Suryawanshi

Neeraj Amb

Rohit Nagar

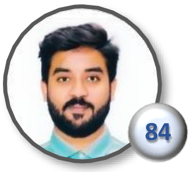
Salil Tamarkar



Deepak Bhadrasen

Kashiram Ahirwar

Jitendra Pandole



Abhijeet Sankla

Dharmendra Maida

Sachin Dodwe

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