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VOLUME - I

UNIT 1

METALLURGY

CHAPTER SNAPSHOT

PTA MODEL QUESTIONS AND ANSWERS

CHOOSE THE CORRECT ANSWER 1 MARK

1. **Sulphide ores of metals are usually concentrated by froath floatation process. Which one of the following sulphide ore offers an exception and is concentrated by chemical leaching.** *[PTA - 4]*

   a) Argentite b) galena
   c) Copper pyrites d) Sphalerite

   [*Ans.* **(a) Argentite**]

2. **Which method of purification represented by the equation?** *[PTA - 5]*

$$\mathbf{Ti(impure) + 2I_2 \xrightarrow{550K} TiI_4}$$
$$\mathbf{\xrightarrow{1800K} Ti(pure) + 2I_2}$$

   a) Cupellation b) Zone refining
   c) Van - Arkel method
   d) Mond's process

   [*Ans.* **(c) Van - Arkel method**]

3. **The process of converting hydrated aluminia into anhydrous alumina is called.** *[PTA - 6]*

   a) Roasting b) Smelting
   c) Auto-reduction d) Calcination

   [*Ans.* **(d) Calcination**]

ANSWER THE QUESTIONS 2 MARKS

1. **What is the role of depressing agent in froath floatation process?** *[PTA - 1]*

Ans. When impurities such as ZnS is present in galena (PbS), sodium cyanide (NaCN) is added to depresses the flotation property of ZnS by forming a layer of zinc complex $Na_2[Zn(CN)_4]$ on the surface of zinc sulphide.

2. **Describe the underlying principle of froth floatation process.** *[PTA - 3]*

Ans. Froth floatation process is based on the principle that the ore particles are wetted by oil and the gangue particles by water. This is used for the concentration of sulphide ores.

ANSWER THE QUESTIONS 3 MARKS

1. **What is the role of graphite rods in the electro metallurgy of aluminium?** *[PTA - 1]*

Ans. *(i)* Graphite rods act as **anode** during electrolytic reduction of alumina.

(ii) At anode, O_2 gas is produced which react with the carbon of anode (rods) to produce CO_2 gas.

(iii) So these graphite rods are consumed slowly and need to be replaced from time to time.

2. **Define roasting.** *[PTA - 4]*

Ans. In roasting, the concentrated ore is oxidised by heating it with excess of oxygen in a suitable furnace below the melting point of the metal.

$$2Pbs + 3O_2 \xrightarrow{\Delta} 2PbO + 2SO_2 \uparrow$$

3. **Explain calcination with an example.** *[PTA - 4]*

Ans. *(i)* Calcination is the process in which the concentrated ore is strongly heated in the absence of air.

(ii) During this process, the water of crystallisation present in the hydrated oxide escapes as moisture.

(iii) Any organic matter (if present) also get expelled leaving behind a porous ore.

(iv) This method can also be carried out with a limited supply of air.

(v) During calcination of carbonate ore, carbon dioxide is expelled

$$PbCO_3 \xrightarrow{\Delta} PbO + CO_2\uparrow$$

ANSWER THE QUESTIONS 5 MARKS

1. **Explain electrolytic refining of silver.** *[PTA - 5]*

Ans. *(i)* Electrolytic refining of silver as an example.

Cathode : Pure silver
Anode : Impure silver rods
Electrolyte : Acidified aqueous solution of silver nitrate.

(ii) When a current is passed through the electrodes the following reactions will take place

(iii) Consequently when an impure molten metal is cooled, crystals of the pure metal are solidified and the impurities remain behind the remaining metal.

19. Give reason : Extraction of copper directly from sulphide ores is less favourable than that from its oxide ores through reduction.

Ans. *(i)* The standard free energy for the formation of $CuFeS_2$ (copper pyrites) is greater than those of CS_2 and H_2S.

(ii) Hence, $CuFeS_2$ cannot be reduced by carbon or hydrogen.

(iii) However, the free energy of copper oxide is less than that of CO_2.

(iv) That is the reason, extraction of copper is easier from its oxide ores through reduction.

SHORT ANSWER 3 MARKS

1. What is gravity separation? (or) Explain hydraulic washing?

Ans. *(i)* In gravity separation method, the ore having high specific gravity is separated from the gangue that has low specific gravity by washing with running water.

(ii) Ore is crushed to a finely powdered form and treated with rapidly flowing current of water.

(iii) During this process the lighter gangue particles are washed away by the running water.

(iv) This method is generally applied to concentrate the native ore such as gold and oxide ores such as haematite (Fe_2O_3), tin stone (SnO_2) etc.

2. Explain alkali leaching in the extraction of aluminum.

Ans. *(i)* In this method, the ore is treated with aqueous alkali to form a soluble complex.

(ii) Bauxite, an important ore of aluminum is heated with a solution of sodium hydroxde or sodium carbonate in the temperature range 470 - 520 K at 35 atm to form soluble sodium meta-aluminate leaving behind the impurities, iron oxide and titanium oxide.

$$Al_2O_{3(s)} + 2NaOH_{(aq)} + 3H_2O_{(l)} \longrightarrow 2Na[Al(OH)_4]_{(aq)}$$

(iii) The hot solution is decanted, cooled, and diluted. This solution is neutralised by passing CO_2 gas, to the form hydrated Al_2O_3 precipitate.

$$2Na[Al(OH)_4]_{(aq)} + 2CO_{2(g)} \longrightarrow Al_2O_3.3H_2O_{(s)} + 2NaHCO_{3(aq)}$$

(iv) The precipitate is filtered off and heated around 1670 K to get pure alumina Al_2O_3.

3. What is cementation?

Ans. *(i)* Gold can be recovered by reacting the deoxygenated leached solution with zinc.

(ii) In this process the gold is reduced to its elemental state (zero oxidation sate) and the process is called **cementation**.

$$Zn_{(s)} + 2[Au(CN)_2]^-_{(aq)} \longrightarrow [Zn(CN)_4]^{-2}_{(aq)} + 2Au_{(s)}$$

4. What is meant by ammonia leaching?

Ans. *(i)* When a crushed ore containing nickel, copper and cobalt is treated with aqueous ammonia under suitable pressure.

(ii) Ammonia selectively leaches these metals by forming their soluble complexes viz. $[Ni(NH_3)_6]^{2+}$, $[Cu(NH_3)_4]^{2+}$, and $[Co(NH_3)_5H_2O]^{3+}$ respectively from the ore leaving behind the gangue, iron(III) oxides/hydroxides and aluminosilicate.

5. How is acid leaching done for the sulphide ores?

Ans. *(i)* Leaching of sulphide ores such as ZnS, PbS etc., can be done by treating them with hot aqueous sulphuric acid.

$$2ZnS_{(s)} + 2H_2SO_{4(aq)} + 2O_2 \longrightarrow 2ZnSO_{4(aq)} + 2S_{(s)} + 4H_2O$$

(ii) In this process the insoluble sulphide is converted into soluble sulphate and elemental sulphur.

PTA MODEL QUESTIONS AND ANSWERS

CHOOSE THE CORRECT ANSWER 1 MARK

1. Elements like silicon and Germanium to be used as a semiconductor is purified by

a) heating under vaccum *[PTA - 1]*
b) Van - Arkel method
c) Zone refining
d) Electrolysis **[*Ans.* (c) Zone refining]**

2. The basicity of hypophosphorus acid is *[PTA - 2]*

a) 1 b) 2 c) 3 d) 4
[*Ans.* (a) 1]

3. Ortho boric acid on dehydration at 373 K produces mainly *[PTA - 3]*

a) metaboric acid
b) boric anhydride
c) Boron metal and Oxygen
d) tetraboric acid. **[*Ans.* (a) metaboric acid]**

4. On hydrolysis BF_3 gives Boric acid and converted to fluroboric acid. The fluoroboric acid contains the species. *[PTA - 6]*

a) H^+, F^- & BF_3 b) H^+ & $[BF_4]^-$
c) $[H BF_3]^+$ & F^- d) H^+, B^{3+} & F^-
[*Ans.* (b) H^+ & $[BF_4]^-$]

ANSWER THE QUESTIONS 2 MARK

1. Nitrogen does not form any penta halides like phosphorus. why? *[PTA - 4]*

Ans. Nitrogen does not form penta halides because it cannot extend its valency upto 5 due to unavailability of d-orbitals.

2. What is water gas equilibrium? *[PTA - 5]*

Ans. The equilibrium involved in the reaction between carbon dioxide and hydrogen, has many industrial applications and is called water gas equilibrium.

$$CO_2 + H_2 \rightleftharpoons \underset{\text{Water gas}}{CO + H_2O}$$

3. Why formic acid act as strong reducing agent? Give one equation to show its reducing property. *[PTA - 6]*

Ans. *(i)* Formic acid (HCOOH) is unique because it contains both an aldehyde group and carboxyl group also.

(ii) Hence it can act as a **reducing agent**. It reduces Fehling's solution Tollen's reagent and decolourises pink coloured $KMnO_4$ solution.

(iii) Whereas in acetic acid, there is no aldehyde group and it cannot act as reducing agent.

(iv) Formic acid reduces ammoniacal silver nitrate solution **(Tollen's reagent)** to metallic silver.

$$HCOOH + Ag_2O \longrightarrow H_2O + CO_2 + 2Ag\downarrow \text{(metallic silver)}$$

(v) Formic acid reduces Fehling's solution. It reduces blue coloured cupric ions to red coloured cuprous ions.

$$HCOO^- + \underset{\text{(blue)}}{2Cu^{2+}} + 5OH^- \longrightarrow CO_3^{2-} + \underset{\text{(red)}}{Cu_2O} + 3H_2O$$

ANSWER THE QUESTIONS 3 MARKS

1. $AlCl_3$ is more stable where as $TlCl_3$ is highly unstable. Why? *[PTA - 2]*

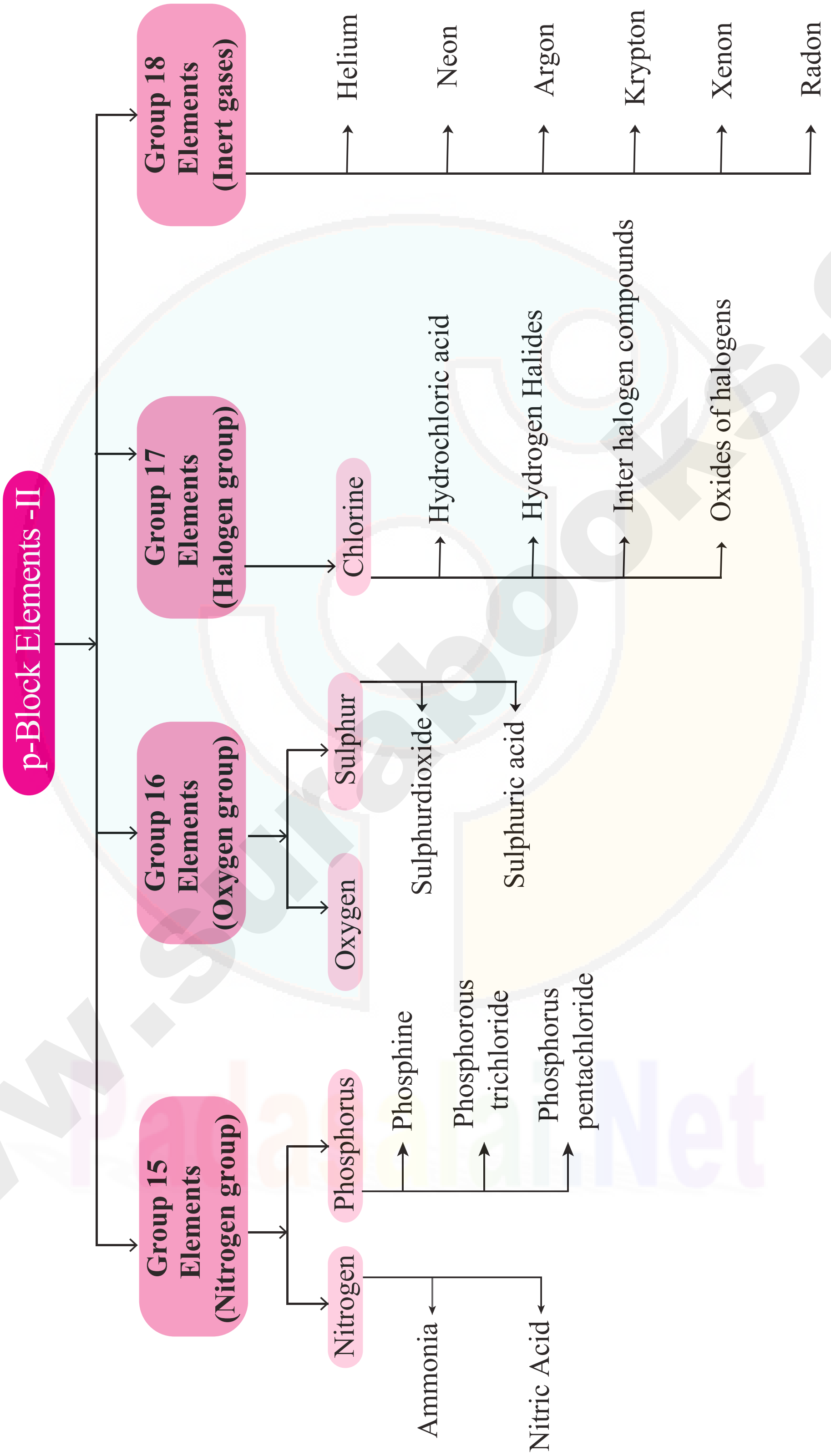
Ans. (i) Aluminium(III)chloride is stable whereas thallium(III)chloride is highly unstable and disproportionates to thallium(I) chloride and chlorine gas.

UNIT 3

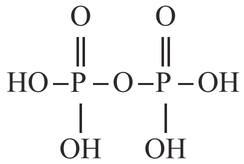
p-BLOCK ELEMENTS - II

CHAPTER SNAPSHOT

CONCEPT MAP


p-Block Elements -II
Group 15 Elements (Nitrogen group)
Nitrogen
Ammonia
Nitric Acid
Phosphorus
Phosphine
Phosphorous trichloride
Phosphorus pentachloride
Group 16 Elements (Oxygen group)
Oxygen
Sulphur
Sulphurdioxide
Sulphuric acid
Group 17 Elements (Halogen group)
Chlorine
Hydrochloric acid
Hydrogen Halides
Inter halogen compounds
Oxides of halogens
Group 18 Elements (Inert gases)
Helium
Neon
Argon
Krypton
Xenon
Radon

(iii) pyro phosphoric acid :



$$HO-\overset{\overset{O}{\|}}{\underset{\underset{OH}{|}}{P}}-O-\overset{\overset{O}{\|}}{\underset{\underset{OH}{|}}{P}}-OH$$

ANSWER THE QUESTIONS 5 MARKS

1. What are the properties of inter halogen compounds? *[PTA - 2; QY_2019]*

Ans. Properties of inter halogen compounds:

(i) The central atom will be the larger one.

(ii) It can be formed only between two halogen and not more than two halogens.

(iii) Fluorine can't act as a central metal atom being the smallest one.

(iv) Due to high electronegativity with small size fluorine helps the central atom to attain high coordination number.

(v) They can undergo the auto ionization.

(vi) They are strong oxidising agents be included.

$$2ICl \rightleftharpoons I^+ + ICl_2^-$$

$$2ICl_3 \rightleftharpoons ICl_2^+ + ICl_4^-$$

2. 0.1 M Solution of HF is weak acid. But 5M solution of HF is strongest acid. Why? *[PTA - 5]*

Ans. 0.1 M solution of HF is weak acid because it is only 10% ionised. But at higher conceatration like 5M, the equilibrium involves the removal of fluoride ions which affects the dissociation of hydrogen.

$$HF + H_2O \rightleftharpoons H_3O^+ + F^-$$

$$HF + F^- \rightleftharpoons HF_2^-$$

3. List any five compounds of xenon and mention the type of hybridization and Structure of the compounds. *[PTA - 6]*

Ans.

Compound	Hybridisation	Shape / Structure
XeF	sp^3d	Linear
XeF_4	sp^3d^2	Square planar
XeF_6	sp^3d^3	Distorted octahedron
$XeOF_2$	sp^3d	T Shaped
$XeOF_4$	sp^3d^2	Square pyramidal
XeO_3	sp^3	Pyramidal

GOVERNMENT EXAM QUESTIONS AND ANSWERS

CHOOSE THE CORRECT ANSWER 1 MARK

1. The shape of $XeOF_4$ is *[Govt.MQP_2019]*

a) T Shaped b) Pyramidal
c) Square planar d) Square pyramidal

[Ans. (d) Square pyramidal]

2. The type of isomerism exhibited by $[Pt(NH_3)_2Cl_2]$? *[Govt.MQP_2019]*

a) coordination isomerism
b) linkage isomerism
c) optical isomerism
d) geometrical isomerism

[Ans. (a) coordination isomerism]

3. The compound used in smoke screen is *[QY_2019]*

a) PH_3 b) NH_3 c) AsH_3 d) BiH_3

[Ans. (a) PH_3]

4. The metal used to prevent rusting of Iron and Steel is *[QY_2019]*

a) Au b) Zn
c) Ag d) All of these

[Ans. (b) Zn]

MUST KNOW DEFINITIONS

Transition metals	:	IUPAC defines transition metal as an element whose atom has an incomplete *d* sub shell or which can give rise to cations with an incomplete '*d*' sub shell.
Lanthanoid contraction	:	The atomic and ionic radii of lanthanoids show gradual decrease with increase in atomic number. This decrease in ionic size is called lanthanoid contraction.
Alloy	:	An alloy is formed by blending a metal with one or more other elements.
Diamagnetic materials	:	Materials with no elementary magnetic dipoles are diamagnetic.
Paramagnetic materials	:	Paramagnetic solids having unpaired electrons possess magnetic dipoles which are isolated from one another.
Ferromagnetic materials	:	Ferromagnetic meterials have domain structure and in each domain the magnetic dipoles are arranged
Reducing agent	:	The substance which is oxdised is a reducing agent
Oxidising agent	:	The substance which is reduced is an oxidising agent.
Non-metal	:	A non-metal is a chemical element that mostly lacks the characteristics of metal
Metal	:	A solid material which is typically hard, shiny, malleable, fusible and ductile, with good electrical and thermal conductivity.
Actinoids	:	The fourteen elements following actinium, i.e. from Thorium (Th) to Lawrenctium (Lr) are called actinoids. It is previously called actinides.
Lanthanoids	:	Lanthanoid series consists of fourteen elements from Cerium ($_{58}$Cr) to Lutetium ($_{71}$Lu) following Lanthanum ($_{57}$La).
Electronic Configuration	:	The electron configuration is the distribution of electrons of an atom or molecule.
Standard electrode potential	:	Standard electrode potential is the value of the standard emf of a cell in which molecular hydrogen under standard pressure (1 atm) and temperature (273 K) is oxidised to solvated protons at the electrode.
Redox reaction	:	Redox reactions involve transfer of electrons from one reactant to another.

ANSWER THE QUESTIONS 5 MARKS

1. What are transition elements? Write two characteristics of the transition elements? *[PTA - 3]*

Ans. The metallic elements that have incompletely filled *d* or *f* sub shell in the neutral or cationic state are called transition elements. This includes lanthanoids and actinoids.

Characteristics :

(i) All the transition elements are metals which are good conductors of heat and electricity.

(ii) Ionization energy of transition element is intermediate between those of *s* and *p* block elements.

GOVERNMENT EXAM QUESTIONS AND ANSWERS

CHOOSE THE CORRECT ANSWER 1 MARK

1. The magnetic moment of Cr^{3+} is *[QY_2019]*

a) 1.73 BM b) 2.73 BM
c) 3.87 BM d) 4.90 BM

[Ans. (c) 3.87 BM]

2. Equivalent weight of $KMnO_4$ in neutral medium is ________. *[HY_2019]*

a) 31.6 b) 52.67
c) 158 d) 52.76

[Ans. (b) 52.67]

ANSWER THE QUESTIONS 3 MARKS

1. What is chromyl chloride test? Give equations. *[Govt.MQP_2019]*

Ans. (i) When potassium dichromate is heated with any chloride salt in the presence of Conc. H_2SO_4, orange red vapours of chromyl chloride (CrO_2Cl_2) is evolved.

(ii) This reaction is used to confirm the presence of chloride ion in inorganic qualitative analysis.

$$K_2Cr_2O_7 + 4NaCl + 6H_2SO_4 \longrightarrow 2KHSO_4 + 4NaHSO_4 + \underset{\text{Chromyl chloride}}{2CrO_2Cl_2}\uparrow + 3H_2O$$

(iii) The chromyl chloride vapours are dissolved in sodium hydroxide solution and then acidified with acetic acid and treated with lead acetate. A yellow precipitate of lead chromate is obtained.

$$CrO_2Cl_2 + 4NaOH \longrightarrow Na_2CrO_4 + 2NaCl + 2H_2O$$

$$Na_2CrO_4 + (CH_3COO)_2Pb \longrightarrow \underset{\substack{\text{Leadchromate}\\\text{(Yellowprecipitate)}}}{PbCrO_4}\downarrow + 2CH_3COONa$$

2. Explain the preparation of potassium permanganate from pyrolusite.

(or)

Explain the preparation of $KMnO_4$. *[Govt.MQP_2019]*

Ans. Potassium permanganate is prepared from pyrolusite (MnO_2) ore. The preparation involves the following steps.

(i) **Conversion of MnO_2 to potassium manganate:** Powdered ore is fused with KOH in the presence of air or oxidising agents like KNO_3 or $KClO_3$. A green coloured potassium manganate is formed.

$$2MnO_2 + 4KOH + O_2 \longrightarrow \underset{\substack{\text{potassium manganate}\\\text{(Green)}}}{2K_2MnO_4} + 2H_2O$$

(ii) **Oxidation of potassium manganate to potassium permanganate:** Potassium manganate thus obtained can be oxidised in two ways, either by chemical oxidation or electrolytic oxidation.

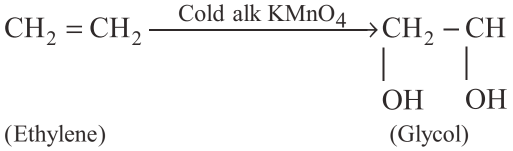
3. Do transition elements form complex co-ordinate compounds? (or)

Why do d-block elements readily form coordination compounds? *[QY_2019]*

Ans. (i) Transition elements have a tendency to form coordination compounds with a species that has an ability to donate an electron pair to form a co-ordinate covalent bond.

25. What is Bayer's reagent? Give its use.

Ans. Cold dilute alkaline $KMnO_4$ is known as Bayer's reagent. It is used to oxidise alkenes into diols.



$$CH_2 = CH_2 \xrightarrow{\text{Cold alk } KMnO_4} \underset{OH}{CH_2} - \underset{OH}{CH}$$

(Ethylene) (Glycol)

SHORT ANSWER 3 MARKS

1. What is meant by lanthanoid contraction?

Ans. The steady decrease in the atomic/ionic radius from La^{3+} to Lu^{3+} is called lanthanoid contraction.

2. Write chemical equations for the reactions involved in the manufacture of potassium permanganate from pyrolusite ore.

Ans. *(i)* $2MnO_2 + 4KOH + O_2 \xrightarrow{\Delta} 2K_2MnO_4 + 2H_2O$

(ii) $MnO_4^{2-} \xrightarrow{\text{Electrolysis}} MnO_4^- + e^-$

Purple

3. Discuss the general characteristic of the 3d series of the transition elements with special reference to their

(i) Atomic size

(ii) Enthalpies of atomisation

Ans. *(i)* **Atomic size :** The atomic size in 3d transition series decrease from Sc to Mn and then Fe, CO, Ni have almost same atomic size while copper has bigger size. It is because number of unpaired electrons in *d*– orbitals increase in the beginning till Mn. Therefore effective nuclear charge increases hence atomic size decreases then pairing of electrons in *d*– orbitals takes place, so the atomic size remains the same and finally it increases due to repulsion between paired electrons in *d*– orbitals which leads to decrease in effective nuclear charge.

(ii) They have high enthalpy of atomisation due to strong metallic bonds and additional covalent bonding due to the presence of unpaired electrons in *d*– orbitals.

4. What are the general properties of f-block elements? (Lanthanides and Actinides)

(i) Electronic configuration

(ii) Oxidation state

(iii) Radii of tripositive ions.

Ans.

Properties	Lanthanides	Actinides
Electronic configuration	$[_{54}Xe]\ 4f^{1-14}\ 5d^1 6s^2$	$[Rn]\ 5f^{0,1-14}\ 6d^{0,1-2}\ 7s^2$
Oxidation state	Common : +3 Uncommon : +2, +4	Common : +4 Uncommon : +2, +3, +5, +6
Radii	M^{3+} gradually decrease in size on moving from La to Lu. **Lanthanide contraction**	M^{3+} and M^{4+} ions decrease in size on moving from Ac to Lr. **Actinide contraction**

5. Complete the following equations.

(i) $Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow$

Ans. *(i)* $Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow Cr^{3+} + 7H_2O$

(ii) $MnO_4^- + 4H^+ + 3e^- \longrightarrow$

Ans. *(ii)* $MnO_4^- + 4H^+ + 3e^- \longrightarrow MnO_2 + 2H_2O$

6. Explain why oxidation states of transition elements increases first from Sc to Mn and then decrease?

Ans. *(i)* The use of 3*d* electron for formation of bond increases from Sc to Mn, causing the increase in oxidation state upto +7.

(ii) The reason for Mn having highest oxidation state of +7 is due to the presence of 7 unpaired electrons in its atom.

(iii) As the number of unpaired electrons decrease from Fe to Cu. So there is the decrease in oxidation state.

7. Account for the following:

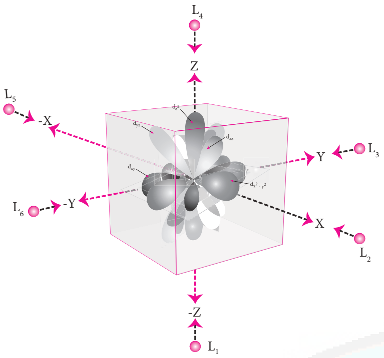
The d^1 configuration is very unstable in ions.

Ans. Ions of transition metals with d^1 configuration tend to lose one electron to acquire d^0 configuration that is quite stable. Therefore, such ions (with d^1) undergo either oxidation or disproportionation, hence unstable.

UNIT 5

CO-ORDINATION CHEMISTRY

CHAPTER SNAPSHOT



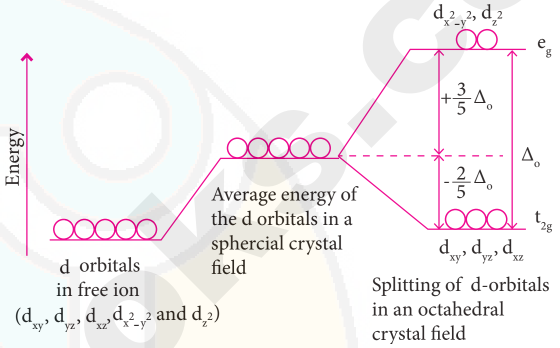
Octahedral ligand field

As shown in the figure, the orbitals lying along the axes dx^2-y^2 and dz^2 orbitals will experience strong repulsion and raise in energy to a greater extent than the orbitals with lobes directed between the axes (d_{xy}, d_{yz} and d_{zx}). Thus the degenerate d orbitals now split into two sets and the process is called crystal field splitting.

Step 3 : Up to this point the complex formation would not be favoured. However, when the ligands approach further, there will be an attraction between the negatively charged electron and the positively charged metal ion, that results in a net decrease in energy. This decrease in energy is the driving force for the complex formation.

Crystal field splitting in octahedral complexes:

During crystal field splitting in octahedral field, in order to maintain the average energy of the orbitals (barycentre) constant, the energy of the orbitals $d_{x^2-y^2}$ and d_{z^2} (represented as e_g orbitals) will increase by $3/5\Delta_o$ while that of the other three orbitals d_{xy}, d_{yz} and d_{zx} (represented as t_{2g} orbitals) decrease by $2/5\Delta_o$. Here, Δ_o represents the crystal field splitting energy in the octahedral field.



Splitting of d-orbitals in an octahedral crystal field

ADDITIONAL QUESTIONS AND ANSWERS

CHOOSE THE CORRECT ANSWER 1 MARK

1. **Identify the ambidentate ligand among the following.**
   a) NH_3 b) $C_2O_4^{2-}$
   c) NO_2^- d) SCN^-
   [*Ans.* (d) SCN^-]

2. **An aqueous solution of $(PdCl)_2$ $4NH_3$ when treated with excess of $AgNO_3$ precipitated 2 moles of AgCl. Predict the secondary valency of the compound.**
   a) 2 b) 3 c) 4 d) 6
   [*Ans.* (c) 4]

3. **The total number of electrons donated by ligands to platinum ion in $[Pt(en)_2Cl_2]$ is**
   a) 8 b) 10
   c) 12 d) 14 [*Ans.* (c) 12]

4. **Primary and secondary valencies of Cu in $[Cu(NH_3)_4]SO_4$ is**
   a) 4,4 b) 2,4
   c) 4,1 d) 4,2 [*Ans.* (b) 2,4]

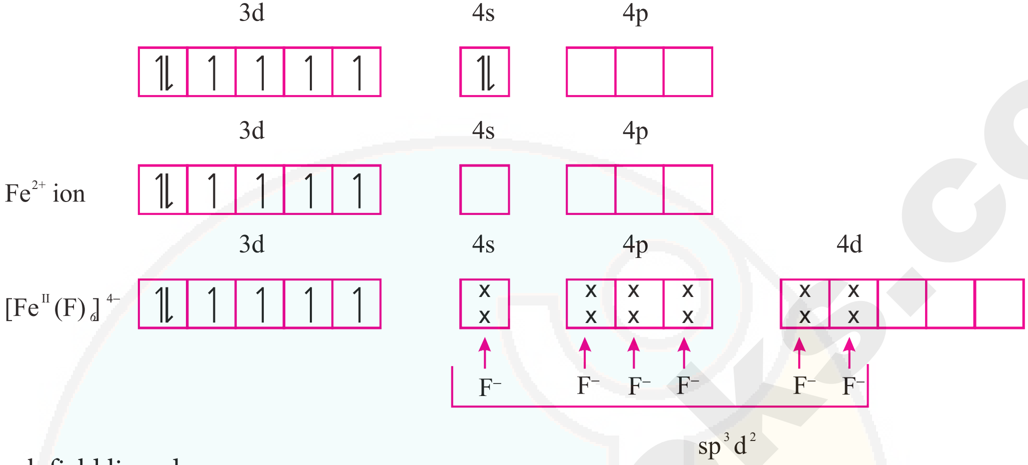
5. **Structural formula of tetra aquadichlorideo Chromium (III) chloride.**
   a) $[Cr(H_2O)_4Cl_2]Cl_2$
   b) $[Cr(H_2O)_4Cl_3]$
   c) $[(H_2O)_4Cl_2Cr]Cl_2$
   d) $[Cl_2(H_2O)_4Cr]Cl_3$
   [*Ans.* (a) $[Cr(H_2O)_4Cl_2]Cl_2$]

6. **Which of the following octahedral complexes do not show geometrical isomerism?**
   a) $[Co(NH_3)_3Cl_3]$
   b) $[PtCl_2(NH_3)_4]$
   c) $[Pt(NH_3)_2Cl_2]$
   d) $[Co(en)_3]^{3+}$ [*Ans.* (d) $[Co(en)_3]^{3+}$]

LONG ANSWER 5 MARKS

1. Mention the type of hybridisation and magnetic property of the following complexes using VB theory a) $[FeF_6]^{4-}$ b) $[Fe(CN)_6]^{4-}$

Ans. **a) $[FeF_6]^{4-}$:** Fe atom - outer electronic configuration $3d^6 4s^2$



F⁻ is weak field ligand

In $[FeF_6]^{4-}$ the hybridisation take place is sp^3d^2

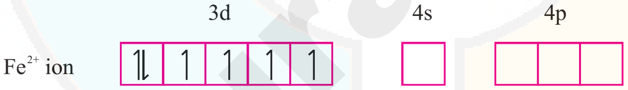
The number of unpaired electrons = 4.

$$\therefore \mu_s = \sqrt{4(4+2)} = \sqrt{24} = 4.90 \text{ BM}$$

The molecule is **paramagnetic** due to the presence of unpaired electrons.

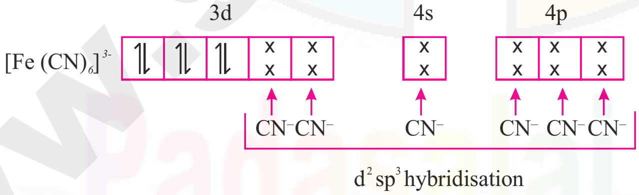
The geometry of the molecule is **octahedral**.

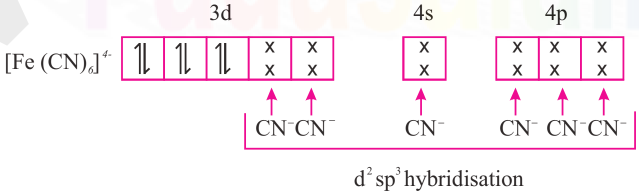
b) $[Fe(CN)_6]^{4-}$



In $[Fe(CN)_6]^{4-}$ complex, the **CN⁻ ligand is a powerful ligand**, it forces the unpaired electrons in the 3d level to pair up inside.

Hence the species has **no unpaired electron** after hybridisation. So the molecule is **diamagnetic**.





The geometry of the molecule is **octahedral**

UNIT 6

Solid State

CHAPTER SNAPSHOT

(ii) It is also given that the atoms of y are present at the body centre.

∴ No. of atoms of y in one unit cell = 1

Hence the formula of the compound is xy.

23. Sodium metal crystallizes in bcc structure with the edge length of the unit cell 4.3×10^{-8} cm. calculate the radius of sodium atom. *[QY_2019]*

Ans. In a body centered cubic lattic atom touch along the body diagonal of the cube. Thus

$$4r = \sqrt{3}a$$

$$r = \frac{\sqrt{3}}{4}a$$

$$= \left(\frac{\sqrt{3}}{4}\right)(4.3 \times 10^{-8})$$

$$= 1.86 \times 10^{-8}\ \text{cm} = 1.86\text{Å}$$

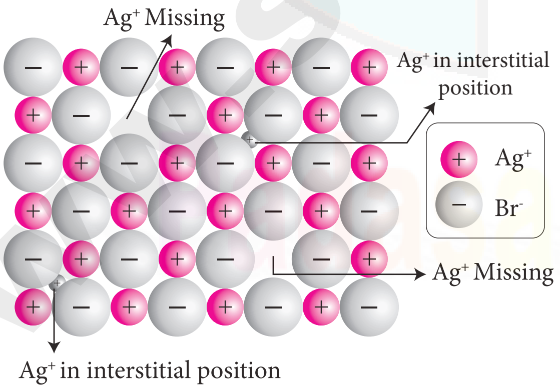
24. Write a note on Frenkel defect. *[PTA - 4]*

Ans. *(i)* Frenkel defect arises due to the dislocation of ions from its crystal lattice.

(ii) The ion which is missing from the lattice point occupies an interstitial position.

(iii) This defect is shown by ionic solids in which cation and anion differ in size. Unlike Schottky defect, this defect does not affect the density of the crystal.

(iv) For example AgBr, in this case, small Ag^+ ion leaves its normal site and occupies an interstitial position as shown in the figure.



Frenkel Defect

EVALUATE YOURSELF

1. An element has a face centered cubic unit cell with a length of 352.4 pm along an edge. The density of the element is 8.9 gcm^{-3}. How many atoms are present in 100 g of an element?

Ans. **Given :**

Density = 8.9 gcm^{-3}

Number of Atom in unit cell of fcc = 4

1 pico meter, pm = 10^{-10} cm

∴ Edge length = 352.4 pm = 352.4×10^{-10} cm

Avogadro's number = 6.023×10^{23} mol^{-1}

Mass of element = 100g

$$\rho = \frac{Z \times M}{N_A \times a^3}$$

$$8.9\ g\ cm^{-3} = \frac{4 \times M}{(6.02 \times 10^{23}\ mol^{-1}) \times (352.4 \times 10^{-10}\ cm)^3}$$

$$M = 58.6\ g/mole.$$

$$\text{Moles of element} = \frac{\text{Mass of element}}{\text{Molar mass of element}}$$

$$= \frac{100g}{58.6\ g/mol}$$

$$= 1.7\ \text{moles.}$$

As, 1 mole contains 6.023×10^{23} number of atoms.

So, 1.7 mole contains, = $1.7 \times (6.023 \times 10^{23})$

= 10.23×10^{23} number of atoms.

∴ The number of atoms present in 100 g of element is 10.23×10^{23}.

UNIT TEST

Time : 40 min Marks : 25

I. CHOOSE THE CORRECT ANSWER (5 × 1 = 5)

1. The ratio of close packed atoms to tetrahedral hole in cubic packing is

a) 1:1 b) 1:2 c) 2:1 d) 1:4

2. The yellow colour in NaCl crystal is due to

a) excitation of electrons in F centers
b) reflection of light from Cl^- ion on the surface
c) refraction of light from Na^+ ion
d) all of the above

3. Potassium has a bcc structure with nearest neighbor distance $4.52\ A^0$. Its atomic weight is 39. its density will be

a) $915\ kg\ m^{-3}$ b) $2142\ kg\ m^{-3}$
c) $452\ kg\ m^{-3}$ d) $390\ kg\ m^{-3}$

4. The vacant space in bcc lattice unit cell is

a) 48% b) 23% c) 32% d) 26%

5. **Assertion :** Monoclinic sulphur is an example of monoclinic crystal system

Reason : For a monoclinic system, $a \neq b \neq c$ and $\alpha = \gamma = 90°, \beta \neq 90°$

a) Both assertion and reason are true and reason is the correct explanation of assertion.
b) Both assertion and reason are true but reason is not the correct explanation of assertion.
c) Assertion is true but reason is false.
d) Both assertion and reason are false.

II. SHORT ANSWER (2 × 2 = 4)

1. Classify the following solids

a. P_4 b. Brass
c. Diamond d. NaCl
e. Iodine

2. Explain Schottky defect.

III. ANSWER IN PARAGRAPH (2 × 3 = 6)

1. Distinguish between hexagonal close packing and cubic close packing.

2. Why ionic crystals are hard and brittle?

IV. LONG ANSWER (2 × 5 = 10)

1. KF crystallizes in fcc structure like sodium chloride. calculate the distance between K^+ and F^- in KF. (Given : density of KF is $2.48\ g\ cm^{-3}$)

2. Explain the following :
Similarities and differences between metallic and ionic crystals.

☆ ☆ ☆

Answer Key

I.
1. b) 1:2
2. a) excitation of electrons in F centers
3. a) $915\ kg\ m^{-3}$
4. c) 32%
5. a) Both assertion and reason are true and reason is the correct explanation of assertion.

II.
1. ***Refer Sura's Guide Book Back, Q.No. 4.***
2. ***Refer Sura's Guide Book Back, Q.No. 9.***

III.
1. ***Refer Sura's Guide Book Back, Q.No. 6.***
2. ***Refer Sura's Guide Book Back, Q.No. 13.***

IV.
1. ***Refer Sura's Guide Book Back, Q.No. 21.***
2. ***Refer Sura's Guide Additional 5 Marks, Q.No. 7.***

☆ ☆ ☆

UNIT 7

CHEMICAL KINETICS

CHAPTER SNAPSHOT

b) $k=\left(\frac{2.303}{t}\right)\log\left(\frac{2P_0}{P_0-P}\right)$

c) $k=\left(\frac{2.303}{t}\right)\log\left(\frac{3P_0-P}{2P_0}\right)$

d) $k=\left(\frac{2.303}{t}\right)\log\left(\frac{2P_0}{3P_0-2P_0}\right)$

[*Ans.* (a) $k=\left(\frac{2.303}{t}\right)\log\left(\frac{2P_0}{3P_0-P}\right)$]

22. If 75% of a first order reaction was completed in 60 minutes , 50% of the same reaction under the same conditions would be completed in

a) 20 minutes
b) 30 minutes
c) 35 minutes
d) 75 minutes

[*Ans.* (b) 30 minutes]

23. The half life period of a radioactive element is 140 days. After 560 days, 1 g of element will be reduced to *[Govt.MQP_2019]*

a) $\left(\frac{1}{2}\right)g$
b) $\left(\frac{1}{4}\right)g$
c) $\left(\frac{1}{8}\right)g$
d) $\left(\frac{1}{16}\right)g$

[*Ans.* (d) $\left(\frac{1}{16}\right)g$]

24. The correct difference between first and second order reactions is that *(NEET)*

a) A first order reaction can be catalysed; a second order reaction cannot be catalysed.
b) The half life of a first order reaction does not depend on $[A_0]$; the half life of a second order reaction does depend on $[A_0]$.
c) The rate of a first order reaction does not depend on reactant concentrations; the rate of a second order reaction does depend on reactant concentrations.
d) The rate of a first order reaction does depend on reactant concentrations; the rate of a second order reaction does not depend on reactant concentrations.

[*Ans.* (b) The half life of a first order reaction does not depend on $[A_0]$; the half life of a second order reaction does depend on $[A_0]$]

25. After 2 hours, a radioactive substance becomes $\left(\frac{1}{16}\right)^{th}$ of original amount. Then the half life (in min) is

a) 60 minutes
b) 120 minutes
c) 30 minutes
d) 15 minutes

[*Ans.* (c) 30 minutes]

Q & A ANSWER THE FOLLOWING QUESTIONS

1. Define average rate and instantaneous rate.

Ans. **Average rate of chemical reaction :**

It may be defined as the change in concentration of a reaction or product of a chemical in a given interval of time.

Average rate of reaction =

$$\frac{\text{Change in concentration of reactants or products}}{\text{Time interval}}$$

Instantaneous rate of reaction :

It may be defined as the rate of a reaction of a particular instant. Instantaneous reaction rate $\frac{d[l_2]}{dt}$ where, $d(l_2)$ = small change in concentration.

d+ = small change in time

2. Define Rate law and Rate constant.

Ans. **Rate law :**

(i) It is the expression which relates the rates of reaction with concentration of the reactants.

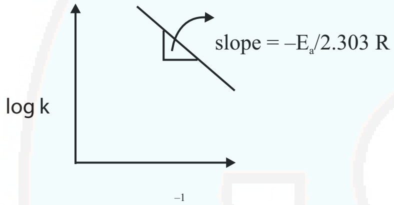
(ii) In rate law, the rate of the reaction is expressed as function of the concentration of reactant and products present in the reaction $A + B \rightarrow C$, For a reaction rate law = K[A][B]

Rate constant : When the concentration of reactants is unity, then the rate of reaction is known as rate constant. It is also called specific reaction rate.

HOTS

1. Explain how will you find activation energy of a reaction by graphical method. (or) Draw the graph between log k vs $\frac{1}{T}$. What is the relationship between its slope and acitivation energy.

Ans. *(i)* A plot of log k against $\frac{1}{T}$ values gives a straight line with slope value equal to $-E_a/2.303R$ and intercept value equals to log A.



(ii) The plot gives a negative slope straight line also.

(iii) From the slope of straight line E_a can be calculated.

2. How will you determine the rate constant for the decomposition of nitrogen pentaoxide in CCl_4.

Decomposition of nitrogen pentoxide in CCl_4.

Ans. $N_2O_5 \xrightarrow{k_1} 2NO_2 + \frac{1}{2}O_2$

(i) At time t = 0, the volume of oxygen liberated is zero.

(ii) Let V_t and V_∞ be the measured volumes of oxygen liberated after the reactant has reacted in 't' time and at completion (t =∞).

(iii) Initial concentration of N_2O_5 is proportional to total volume of oxygen liberated (i.e.,) (V_∞).

(iv) $(V_\infty - V_t)$ is proportional to undecomposed N_2O_5 at time 't'.

(v) $$\therefore k_1 = \frac{2.303}{t}\log\frac{V_\infty}{(V_\infty - V_t)}\ \text{sec}^{-1}$$

NUMERICAL PROBLEMS

1. For the reaction R - P, the concentration of a reactant changes from 0.03 M to 0.02 M in 25 minutes. Calculate the average rate of reaction using units of time both in minutes and second.

Ans. Average rate = $-\frac{\Delta(R)}{\Delta t} = -\frac{[R]_2 - [R]_1}{t_2 - t_1}$

$= -\frac{0.02\,M - 0.03\,M}{25\,min} = \frac{-0.01\,M}{25\,min}$

$= 4 \times 10^{-4}$ M min^{-1} and

$= -\frac{-0.01m}{25 \times 60} = 6.66 \times 10^{-6}$ Ms^{-1}

2. The conversion of molecules *x* to *y* follows second order kinetics. It concentration of *x* is increased to three times how will it affect the rate of formation of *y* ?

For the reaction $x \longrightarrow y$ as it follows second order kinetics wherefore the rate of formation of y?

Ans. Rate = $k[x]^2 = ka^2$

$[x] = a$ mol^{-1}

If the concentration of *x* is incross three time, then

$(x) = 3a$ mol L^{-1}

Rate = $R(3a)^2 = 9\,ka^2$

Hence, the rate of formation will increase by 9 times.

3. A first order reaction laws on rate constant 1.15×10^{-3} s^{-1}. How long will 5 g of this reactant take to reduce to 3g?

Ans. $[R]_0 = 5g$, $[R] = 3g$

$K = 1.15 \times 10^{-3}$ s^{-1}.

As the reaction is of first order

$$K = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$$

$$t = \frac{2.303}{1.15 \times 10^{-3}\,s^{-1}}\log\frac{5g}{3g}$$

VOLUME - II

UNIT 8

IONIC EQUILIBRIUM

CHAPTER SNAPSHOT

MUST KNOW DEFINITIONS

Lowry – Bronsted Theory : According to Lowry – Bronsted concept, an acid is defined as a substance that has a tendency to donate a proton to another substance and base is a substance that has a tendency to accept a proton form other substance. In other words, an acid is a proton donor and a base is a proton acceptor.

Lewis concept : According to Lewis concept, an acid is a species that accepts an electron pair while base is a species that donates an electron pair.

Ionisation of water : The ionic product of water at 25°C is

$$K_w = [H_3O]^+ [OH^-]$$
$$K_w = (1 \times 10^{-7}) (1 \times 10^{-7})$$
$$= 1 \times 10^{-14}$$

pH scale : pH of a solution is defined as the negative logarithm of base 10 of the molar concentration of the hydronium ions present in the solution.

$$pH = -\log_{10} [H_3O^+]$$
$$pOH = -\log_{10} [OH^-]$$
$$pH + pOH = 14$$

Degree of dissociation : Degree of dissociation (α) is the fraction of the total number of moles of a substance that dissociates at equilibrium.

$$\alpha = \frac{\text{Number of moles dissociated}}{\text{total number of moles}}$$

Ostwald's dilution law : $k_a = \frac{\alpha^2 C}{1-\alpha}$ is known as Ostwald's dilution law.

$$\alpha = \sqrt{\frac{k_a}{C}}$$

Common ion effect : The dissociation of a weak acid (CH_3COOH) is suppressed in the presence of a salt (CH_3COONa) containing an ion common to the weak electrolyte. It is called the common ion effect.

Buffer : Buffer is a solution which consists of a mixture of a weak acid and its conjugate base (or) a weak base and its conjugate acid.

Buffer action : This buffer solution resists drastic changes in its pH upon addition of a small quantities of acids (or) bases, and this ability is called buffer action.

Acidic buffer solution : A solution containing a weak acid and its salt.
Example : solution containing acetic acid and sodium acetate

Basic buffer solution : A solution containing a weak base and its salt.
Example : Solution containing NH_4OH and NH_4Cl

$$[Pb^{2+}][Cl^-]^2 = (0.06)(0.08)$$
$$= 3.84 \times 10^{-4}$$

Since ionic product $[Pb^{2+}][Cl^-]^2 > K_{sp}$, $PbCl_2$ is precipitated.

27. K_{sp} of $Al(OH)_3$ is 1×10^{-15} M. At what pH does 1.0×10^{-3}M Al^{3+} precipitate on the addition of buffer of NH_4Cl and NH_4OH solution?

Ans. $Al(OH)_3 \rightleftharpoons Al^{3+}_{(aq)} + 3OH^-_{(aq)}$

$$K_{sp} = [Al^{3+}][OH^-]^3$$

$Al(OH)_3$ precipitates when

$$[Al^{3+}][OH^-]^3 > K_{sp}$$
$$[1 \times 10^{-3}][OH^-]^3 > 1 \times 10^{-15}$$
$$[OH]^3 > 1 \times 10^{-12}$$
$$[OH^-] > 1 \times 10^{-4}\,M$$
$$[OH^-] = 1 \times 10^{-4}\,M$$
$$POH = -\log_{10}[OH^-]$$
$$= -\log[1 \times 10^{-4}] = 4$$
$$PH = 14 - 4 = 10$$

Thus, $Al(OH)_3$ precipitates at a pH of 10.

EVALUATE YOURSELF

1. Classify the following as acid (or) base using Arrhenius concept

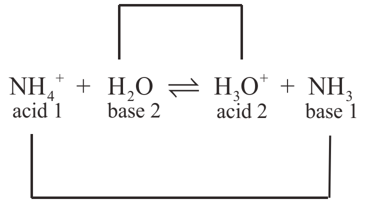
i) HNO_3 ii) $Ba(OH)_2$
iii) H_3PO_4 iv) CH_3COOH

Ans. **acid :**
i) HNO_3 iii) H_3PO_4
iv) CH_3COOH
Base : ii) $Ba(OH)_2$

2. Write a balanced equation for the dissociation of the following in water and identify the conjugate acid –base pairs.

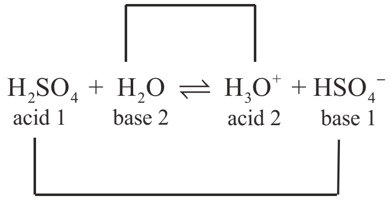
i) NH_4^+ ii) H_2SO_4 iii) CH_3COOH.

Ans. *(i)*



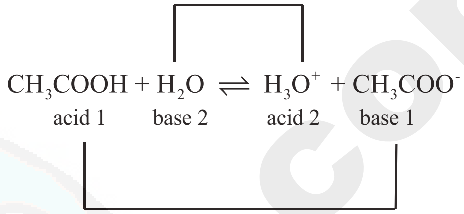
$$\underset{\text{acid 1}}{NH_4^+} + \underset{\text{base 2}}{H_2O} \rightleftharpoons \underset{\text{acid 2}}{H_3O^+} + \underset{\text{base 1}}{NH_3}$$

(ii)



$$\underset{\text{acid 1}}{H_2SO_4} + \underset{\text{base 2}}{H_2O} \rightleftharpoons \underset{\text{acid 2}}{H_3O^+} + \underset{\text{base 1}}{HSO_4^-}$$

(iii)

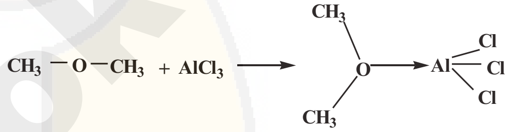


$$\underset{\text{acid 1}}{CH_3COOH} + \underset{\text{base 2}}{H_2O} \rightleftharpoons \underset{\text{acid 2}}{H_3O^+} + \underset{\text{base 1}}{CH_3COO^-}$$

3. Identify the Lewis acid and the Lewis base in the following reactions.

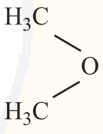
i. $CaO + CO_2 \longrightarrow CaCO_3$

ii.



Ans. *(i)* CaO - Lewis base ; CO_2 - Lewis acid

(ii)



- Lewis base

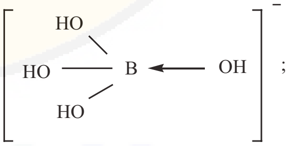
$AlCl_3$ - Lewis acid

4. H_3BO_3 accepts hydroxide ion from water as shown below

$H_3BO_3(aq) + H_2O(l)$ $B(OH)_4^- + H^+$

Predict the nature of H_3BO_3 using Lewis concept.

Ans.



; electron pair acceptor - Lewis acid

5. At a particular temperature, the K_w of a neutral solution was equal to 4×10^{-14}. Calculate the concentration of $[H_3O^+]$ and $[OH^-]$.

Ans. **Given solution is neutral**

$$\therefore [H_3O^+] = [OH^-]$$
$$\text{Let } [H_3O^+] = x \text{ ; then } [OH^+] = x$$
$$K_w = [H_3O^+][OH^-]$$
$$4 \times 10^{-14} = x \, . \, x$$
$$x^2 = 4 \times 10^{-14}$$
$$x = \sqrt{4 \times 10^{-14}} = 2 \times 10^{-7}$$

It means that there is no hydrolysis. In such cases $[H^+] = [OH^-]$ pH is maintained and, therefore, the solution is neutral.

7. Derive an expression for the hydrolysis constant for the hydrolysis of salt of weak acid and weak base.

Ans. Let us consider the hydrolysis of ammonium acetate.

$$CH_3COONH_{4(aq)} \longrightarrow CH_3COO^-_{(aq)} + NH^+_{4(aq)}$$

In this case, both the cation (NH_4^+) and anion (CH_3COO 3^-) have the tendency to react with water

$$CH_3COO^- + H_2O \rightleftharpoons CH_3COOH + OH^-$$

$$NH_4^+ + H_2O \rightleftharpoons NH_4OH + H^+$$

The nature of the solution depends on the strength of acid (or) base i.e, if $K_a > K_b$; then the solution is acidic and pH < 7, if $K_a < K_b$; then the solution is basic and pH > 7, if $K_a = K_b$; then the solution is neutral.

The relation between the dissociation constant (K_a, K_b) and the hydrolysis constant is given by the following expression.

$$K_a . K_b . K_h = K_w$$

pH of the solution

pH of the solution can be calculated using the following expression,

$$pH = 7 + \frac{1}{2}pK_a - \frac{1}{2}pK_b$$

8. Derive the hydrolysis constant for the hydrolysis of salt of strong base and weak acid. Deduce its pH.

Ans. Let us find a relation between the equilibrium constant for the hydrolysis reaction (hydrolysis constant) and the dissociation constant of the acid.

$$K_h = \frac{[CH_3COOH][OH^-]}{[CH_3COO^-][H_2O]}$$

$$K_h = \frac{[CH_3COOH][OH^-]}{[CH_3COO^-]} \qquad ......(1)$$

$$CH_3COOH_{(aq)} \rightleftharpoons CH_3COO^-_{(aq)} + H^+_{(aq)}$$

$$K_a = \frac{[CH_3COO^-][H^+]}{[CH_3COOH]} \qquad ......(2)$$

(1) × (2)

$\Rightarrow K_b . K_a = [H^+][OH^-]$

we know that $[H^+][OH^-] = K_w$

$K_h . K_a = K_w$

K_h value in terms of degree of hydrolysis (h) and the concentration of salt (C) for the equilibrium can be obtained as in the case of Ostwald's dilution law. $K_h = h^2C$. and i.e $[OH^-] = \sqrt{K_h.C}$

pH of salt solution in terms of K_a and the concentration of the electrolyte.

$$pH + pOH = 14$$

$$pH = 14 - pOH = 14 - \{-\log [OH^-]\}$$

$$= 14 + \log [OH^-]$$

$$\therefore pH = 14 + \log(K_hC)^{\frac{1}{2}}$$

$$pH = 14 + \log\left(\frac{K_wC}{K_a}\right)^{\frac{1}{2}}$$

$$pH = 14 + \left(\frac{1}{2}\log K_w + \frac{1}{2}\log C - \frac{1}{2}\log K_a\right)$$

$$[\because K_w = 10^{-14}]$$

$$pH = 14 - 7 + \frac{1}{2}\log C + \frac{1}{2}pK_a$$

$$\frac{1}{2}\log K_w = \frac{1}{2} \times \log 10^{-14} = \frac{-14}{2}(1) = -7$$

$$pH = 7 + \frac{1}{2}pK_a + \frac{1}{2}\log C \qquad [-\log K_a = pK_a]$$

PROBLEMS FOR PRACTICE

1. The hydrogen ion concentration of a fruit juice is 3.3×10^{-2} M. What is the pH of the juice ? Is it acidic or basic ?

Ans. The definition of pH is

We are given $[H^+] = 3.3 \times 10^{-2}$

Substituting into the definition of pH, we get

$$pH = -\log(3.3 \times 10^{-2})$$

$$= -(-1.48) = 1.48$$

Since the pH is less than 7.00, the solution is acidic.

UNIT 9

ELECTRO CHEMISTRY

CHAPTER SNAPSHOT

EVALUATION

CHOOSE THE CORRECT ANSWER

1. **The number of electrons that have a total charge of 9650 coulombs is** *[PTA - 2]*

a) 6.22×10^{23} b) 6.022×10^{24}
c) 6.022×10^{22} d) 6.022×10^{-34}

[*Ans.* (c) 6.022×10^{22}]

2. **Consider the following half cell reactions:**

$Mn^{2+} + 2e^- \longrightarrow Mn$ $E° = -1.18V$

$Mn^{2+} \longrightarrow Mn^{3+} + e^-$ $E° = -1.51V$

The E° for the reaction $3Mn^{2+} \longrightarrow Mn + 2Mn^{3+}$, and the possibility of the forward reaction are respectively.

a) 2.69V and spontaneous
b) −2.69 and non spontaneous
c) 0.33V and Spontaneous
d) 4.18V and non spontaneous

[*Ans.* (b) −2.69 and non spontaneous]

3. **The button cell used in watches function as follows**

$Zn(s) + Ag_2O(s) + H_2O(l) \rightleftharpoons 2Ag(s) + Zn^{2+}(aq) + 2OH^-(aq)$

the half cell potentials are

$Ag_2O(s) + H_2O(l) + 2e^- \longrightarrow 2Ag(s) + 2OH^-(aq)$

$E° = 0.34V$. The cell potential will be

a) 0.84V b) 1.34V c) 1.10V d) 0.42V

[*Ans.* (c) 1.10V]

4. **The molar conductivity of a 0.5 mol dm^{-3} solution of $AgNO_3$ with electrolytic conductivity of 5.76×10^{-3} S cm^{-1} at 298 K is**

a) 2.88 S cm^2 mol^{-1} b) 11.52 S $cm^2 mol^{-1}$
c) 0.086 S $cm^2 mol^{-1}$ d) 28.8 S cm^2 mol^{-1}

[*Ans.* (b) 11.52 S cm^2mol^{-1}]

5.

Electrolyte	KCl	KNO_3	HCl	NaOAC	NaCl
Λ_ (S cm^2 mol^{-1})	149.9	145.0	426.2	91.0	126.5

Calculate $\Lambda°_{HoAC}$ using appropriate molar conductances of the electrolytes listed above at infinite dilution in water at 25°C.

a) 517.2 b) 552.7 c) 390.7 d) 217.5

[*Ans.* (c) 390.7]

6. **Faradays constant is defined as** *[PTA - 4]*

a) charge carried by 1 electron
b) charge carried by one mole of electrons
c) charge required to deposit one mole of substance
d) charge carried by 6.22×10^{10} electrons.

[*Ans.* (b) charge carried by one mole of electrons]

7. **How many faradays of electricity are required for the following reaction to occur**

$MnO_4^- \longrightarrow Mn^{2+}$

a) 5F b) 3F c) 1F d) 7F

[*Ans.* (a) 5F]

8. **A current strength of 3.86 A was passed through molten Calcium oxide for 41minutes and 40 seconds. The mass of Calcium in grams deposited at the cathode is (atomic mass of Ca is 40 g / mol and 1F = 96500C).**

a) 4 b) 2 c) 8 d) 6

[*Ans.* (b) 2]

9. **During electrolysis of molten sodium chloride, the time required to produce 0.1mol of chlorine gas using a current of 3A is** *[Govt.MQP_2019]*

a) 55 minutes b) 107.2 minutes
c) 220 minutes d) 330 minutes

[*Ans.* (b) 107.2 minutes]

6. **The electrochemical cell reaction of the Daniel cell is**

$$Zn_{(s)} + Cu^{2+}_{(aq)} \longrightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$$

What is the change in the cell voltage on increasing the ion concentration in the anode compartment by a factor 10?

Ans. $Zn_{(s)} + Cu^{2+}_{(aq)} \longrightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$

$$E_{cell} = E^\circ - \frac{0.0591}{n}\log\frac{[Zn^{2+}]}{[Cu^{2+}]}$$

If the concentration of Zn^{2+} is increased, the second term on the RHS becomes more negative. This lowers the value of E_{cell}, so E_{cell} value will decrease if the ion concentration in the anode compartment is increased.

7. **A solution of a salt of metal was electrolysed for 15 minutes with a current of 0.15 amperes. The mass of the metal deposited at the cathode is 0.783 g. Calculate the equivalent mass of the metal.**

Ans.

$$\begin{aligned}
I &= 0.15 \text{ amperes}\\
\text{time } t &= 15 \times 60 \text{ s} = 900 \text{ s}\\
\text{mass } m &= 0.783 \text{ g}\\
m &= ZIt\\
z &= \frac{m}{It}\\
m &= \frac{\text{Eq. mass}}{F} \times I \times t;\ \text{Eq. mass} = \frac{m \times F}{I \times t}\\
&= \frac{0.783 \times 96500}{0.15 \times 150 \times 60} = \frac{75559.5}{1350}\\
m &= 55.97 \text{ g. equiv}^{-1}.
\end{aligned}$$

PTA MODEL QUESTIONS AND ANSWERS

CHOOSE THE CORRECT ANSWER 1 MARK

1. **Assertion : A small piece of Zinc dissolved in dilute nitric acid but hydrogen gas is not evolved** *[PTA - 3]*

Reason : HNO_3 is an oxidising agent and this oxidizes hydrogen

a) Both assertion and reason are true and reason is the correct explanation of assertion

b) Both assertion and reason are true but reason is not the correct explanation of assertion

c) Assertion is true but reason is false

d) Both assertion and reason are false

[*Ans.* (a) Both assertion and reason are true and reason is the correct explanation of assertion]

1. **Which of the following statement is not correct with respect to electrolytic conductance?** *[PTA - 3]*

a) Conductivity increases with the decrease in Viscosity

b) Conductivity increases with increase in temperature

c) Molar conductance of a solution decreses with increase in dilution

d) Conductance decrease with increase in temperature

[*Ans.* (c) Molar conductance of a solution decreses with increase in dilution]

2. **Which of the following is Secondary Cell?** *[PTA - 5]*

a) Laclanche cell

b) Lithium ion battery

c) Mercury button cell

d) both (a) and (c) **[*Ans.* (d) both (a) and (c)]**

3. **The general representation of a fuel cell is** *[PTA - 6]*

a) Fuel / Electrode / Electrolyte / Electrode / Oxidant

b) Oxidant / Electrode / Electrolyte / Electrode / Fuel

c) Fuel / Electrode / Electrolyte / Electrode / Reductant

d) Oxidant / Electrode / Electrolyte / Electrode / Reductant

[*Ans.* (a) Fuel / Electrode / Electrolyte / Electrode / Oxidant]

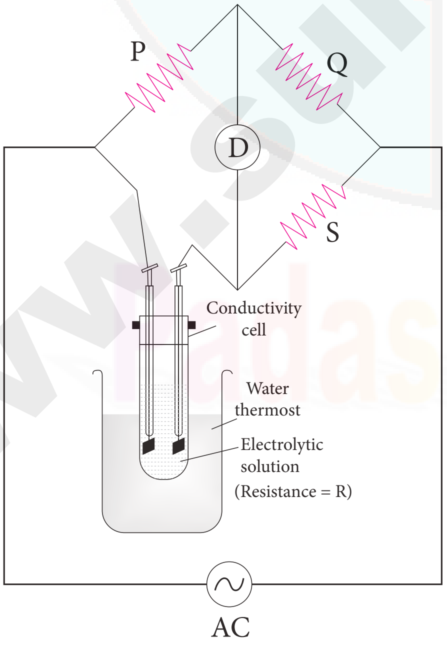
LONG ANSWER 5 MARKS

1. How will you determine the conductivity of an electrolytic solution using a wheatstone bridge?

Ans. *(i)* The conductivity of an electrolytic solution is determined by using a wheatstone bridge arrangement in which one resistance is replaced by a conductivity cell filled with the electrolytic solution of unknown conductivity.

(ii) In the measurement of specific resistance of a metallic wire, a DC power supply is used. Here, if we apply DC current through the conductivity cell, it will lead to the electrolysis of the solution taken in the cell. So, AC current is used for this measurement to prevent electrolysis.

(iii) A wheatstone bridge is constituted using known resistances P, Q, a variable resistance S and conductivity cell (Let the resistance of the electrolytic solution taken in it be R) as shown in the figure. An AC source (550 Hz to 5 KHz) is connected between the junctions A and C. Connect a suitable detector (Such as the telephone ear piece detector) between the junctions 'B' and 'D'.



Schematic diagram of a conductivity cell in a wheatstone bridge circuit

(iv) The variable resistance 'S' is adjusted until the bridge is balanced and in this conditions there is no current flow through the detector.

Under balanced condition,

$$\frac{P}{Q} = \frac{R}{S}$$

$$\therefore R = \frac{P}{Q} \times S$$

(v) The resistance of the electrolytic solution (R) is calculated from the known resistance values P, Q and the measured 'S' value under balanced condition using the above expression.

2. How will you calculate solubility product of AgCl which is a sparingly soluble salt?

Ans. Substances like AgCl, $PbSO_4$ etc., are sparingly soluble in water. The solubility product of such substances can be determined using conductivity measurements.

Let us consider AgCl as an example

$AgCl_{(s)} \rightleftharpoons Ag^+ + Cl^-$

$K_{sp} = [Ag^+][Cl^-]$

Let the concentration of $[Ag^+]$ be 'C' mol L^{-1}.

As per the stoichiometry, if $[Ag^+] = C$, then $[Cl^-]$ also equal to 'C' mol L^{-1}.

$K_{sp} = C.C$

$\Rightarrow K \; = C^2$

We know that the concentration (in mol dm^{-3}) is related to the molar and sepcific conductance by the following expressions

$$\Lambda_0 = \frac{\kappa \times 10^{-3}}{C(\text{in mol } L^{-1})}$$

(or)

$$C = \frac{\kappa \times 10^{-3}}{\Lambda}$$

Substitute the concentration value in the relation

$K_{sp} = C^2$

$$K_{sp} = \left(\frac{\kappa \times 10^{-3}}{\Lambda}\right)^2$$

UNIT 10

SURFACE CHEMISTRY

CHAPTER SNAPSHOT

UNIT TEST

Time : 40 min Marks : 25

I. CHOOSE THE CORRECT ANSWER (5 × 1 = 5)

1. **Assertion : Coagulation power of Al^{3+} is more than Na^{+}.**

   Reason : Greater the valency of the flocculating ion added, greater is its power to cause precipitation

   a) if both assertion and reason are true and reason is the correct explanation of assertion.
   b) if both assertion and reason are true but reason is not the correct explanation of assertion.
   c) assertion is true but reason is false
   d) both assertion and reason are false.

2. **Adsorption of a gas on solid metal surface is spontaneous and exothermic, then**

   a) ΔH increases b) ΔS increases
   c) ΔG increases d) ΔS decreases

3. **Fog is colloidal solution of**

   a) solid in gas b) gas in gas
   c) liquid in gas d) gas in liquid

4. **The phenomenon of Tyndall's effect is not observed in**

   a) emulsion b) colloidal solution
   c) true solution d) none

5. **Which type of colloid is a sol ?**

   a) Solid in liquid b) Liquid in solid
   c) Soild in solid d) Gas in solid

II. VERY SHORT ANSWER (2 × 2 = 4)

1. Give two important characteristics of physisorption.
2. What are the methods by which colloids are prepared?

III. SHORT ANSWER (2 × 3 = 6)

1. Write a note on electro-osmosis.
2. Explain the advantages of using nano catalyst.

IV. LONG ANSWER (2 × 5 = 10)

1. Differentiate physisorption and chemisorption.
2. Describe adsorption theory of catalysis.

Answer Key

I. 1. a) Both assertion and reason are true and reason is the correct explanation of assertion.
2. d) ΔS decreases
3. c) liquid in gas
4. c) true solution
5. a) Solid in liquid

II. 1. *Refer Sura's Guide Book back Q.No. 1.*
2. *Refer Sura's Guide Additional 2 marks Q.No. 9.*

III. 1. *Refer Sura's Guide Book back Q.No. 21.*
2. *Refer Sura's Guide Additional 3 marks Q.No. 5.*

IV. 1. *Refer Sura's Guide Book back Q.No. 2.*
2. *Refer Sura's Guide Book back Q.No. 25.*

☆ ☆ ☆

UNIT 11

HYDROXY COMPOUNDS AND ETHERS

CHAPTER SNAPSHOT

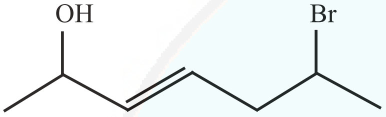
EVALUATE YOURSELF

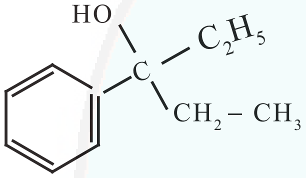
1. **Classify the following alcohols as 1°, 2°, and 3° and give their IUPAC Names.**

a) $CH_3-CH_2-CH(OH)\,CH_2-\overset{\overset{Br}{|}}{C}(CH_3)_2$

b) $(C_2H_5)_3COH$

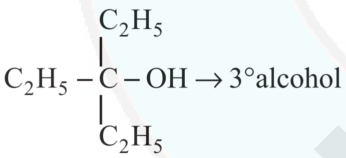
c) $CH_2=C(Cl)-CH\,(OH)\,CH_3$

d) 

e) 

Ans. *(a)* 2° alcohol
5 - bromo - 5 - methyl hexan - 3 ol

(b) $(C_2H_5)_3-C-OH$

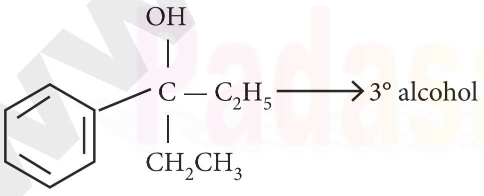


$$C_2H_5-\underset{\underset{C_2H_5}{|}}{\overset{\overset{C_2H_5}{|}}{C}}-OH \rightarrow 3°\text{alcohol}$$

3 - ethyl pentan - 3 - ol

(c) 2° alcohol
3 - chloro but - 3 ene - 2 - ol

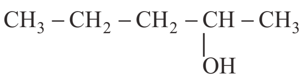
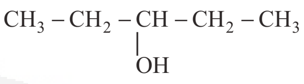
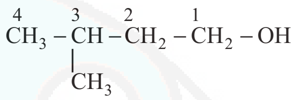
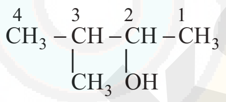
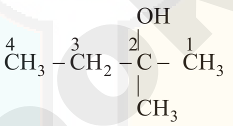
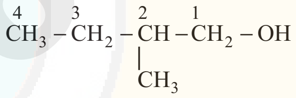
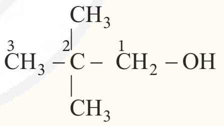
(d) 2° alcohol
6 - bromo Hept - 3 - ene - 2 - ol

(e) 

3 - phenyl - 3 - pentanol

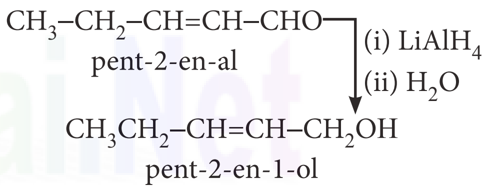
2. **Write all the possible isomers of an alcohol having the molecular formula $C_5H_{12}O$ and give their IUPAC names.**

Ans.

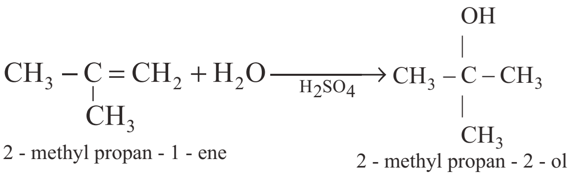
S.NO	Structure	IUPAC NAMES
1.	$CH_3–CH_2–CH_2–CH_2–CH_2–OH$	pentan 1 ol
2.	 $CH_3-CH_2-CH_2-\underset{\underset{OH}{\vert}}{CH}-CH_3$	pentan 2 ol
3.	 $CH_3-CH_2-\underset{\underset{OH}{\vert}}{CH}-CH_2-CH_3$	pentan 3 ol
4.	 $\overset{4}{CH_3}-\overset{3}{\underset{\underset{CH_3}{\vert}}{CH}}-\overset{2}{CH_2}-\overset{1}{CH_2}-OH$	3 methyl butan 1 ol
5.	 $\overset{4}{CH_3}-\overset{3}{\underset{\underset{CH_3}{\vert}}{CH}}-\overset{2}{\underset{\underset{OH}{\vert}}{CH}}-\overset{1}{CH_3}$	3 methyl butan 2 ol
6.	 $\overset{4}{CH_3}-\overset{3}{CH_2}-\overset{\overset{OH}{\vert}\,2}{\underset{\underset{CH_3}{\vert}}{C}}-\overset{1}{CH_3}$	2 methyl butan 2 ol
7.	 $\overset{4}{CH_3}-\overset{3}{CH_2}-\overset{2}{\underset{\underset{CH_3}{\vert}}{CH}}-\overset{1}{CH_2}-OH$	2 methyl butan 1 ol
8.	 $\overset{3}{CH_3}-\overset{\overset{CH_3}{\vert}\,2}{\underset{\underset{CH_3}{\vert}}{C}}-\overset{1}{CH_2}-OH$	2,2 dimethyl propan 1 ol

3. **Suggest a suitable carbonyl compound for the preparation of pent-2-en-1-ol using $LiAlH_4$.**

Ans. The suitable carbonyl compound for the preparation Pent-2-en-1-ol using $LiAlH_4$.



4. **2-methylpropan-1-ene $\xrightarrow{H_2SO_4/H_2O}$?**

Ans. 

$$CH_3-\underset{\underset{CH_3}{|}}{C}=CH_2+H_2O\xrightarrow[H_2SO_4]{}CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3$$

2 - methyl propan - 1 - ene   2 - methyl propan - 2 - ol

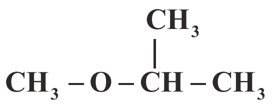
It follows Markownikoff's addition.

82. **The functional isomer of $CH_3CH_2CH_2OH$ is ___________.**

(a) $CH_3–O–CH_2–CH_3$ (b) CH_3CH_2CHO
(c) $CH_3–CO–CH_3$ (d) CH_3CHO

[*Ans.* (a) **$CH_3–O–CH_2–CH_3$**]

83. **$CH_3 - CH_2 - O - CH_2CH_3$ and**



$CH_3 - O - \overset{\overset{\displaystyle CH_3}{|}}{CH} - CH_3$

are examples of _________ isomerism.

(a) functional (b) chain
(c) position (d) metamerism

[*Ans.* (d) **metamerism**]

84. **Lower halogenated ethers can be converted into higher ethers by using ______ reagent.**

(a) Grignard (b) Tollen's
(c) Fehling's (d) none of the above

[*Ans.* (a) **Grignard**]

85. **_______ cannot be prepared by using Grignard reagent.**

(a) $CH_3 - OC_2H_5$ (b) $CH_3 - OCH_3$
(c) $C_2H_5 - O - C_2H_5$
(d) $CH_3 - OCH_2CH_2CH_3$

[*Ans.* (b) **$CH_3 - OCH_3$**]

86. **Ether oxygen is capable of forming ______ bonds with electron deficient species.**

(a) covalent (b) ionic
(c) coordinate covalent (d) hydrogen

[*Ans.* (c) **coordinate covalent**]

87. **On heating, peroxides are ___________.**

(a) stable (b) unstable
(c) decomposes violently
(d) both (b) and (c)

[*Ans.* (d) **both (b) and (c)**]

88. **Anisole on bromination yields _______**

(a) m-bromo anisole (b) o-bromo anisole
(c) o- & p-bromo anisole
(d) benzoic acid

[*Ans.* (c) **o- & p-bromo anisole**]

ASSERTION & REASON :

Direction : In each of the following questions a statement of assertion (A) is given and a corresponding statement of reason (R) is given just below it. Mark the correct statement as.

a) (A) and (R) are true and (R) is the correct explanation of (A)
b) Both (A) and (R) are true but (R) does not explain (A)
c) (A) is true but (R) is false
d) Both (A) and (R) are false

1. **Assertion (A) :** Pentan-2-ol and pentan-3-ol are both secondary alcohols

Reason (R) : Both give blue colouration with Victor Meyer's test

[*Ans.* (b) **Both (A) and (R) are true but (R) does not explain (A)**]

2. **Assertion (A) :** Phenol is more acidic than aliphatic alcohols

Reason (R) : The increased acidity is due to the stability of the phenoxide ion due to resonance.

[*Ans.* (a) **(A) and (R) are true and (R) is the correct explanation of (A)**]

3. **Assertion (A) :** Alcohols have higher boiling points than ethers of comparable molecular mass.

Reason (R) : Alcohols and ethers are functional isomers.

[*Ans.* (b) **Both (A) and (R) are true but (R) does not explain (A)**]

4. **Assertion (A) :** Reduction of crotonaldehyde is preferably carried in the presence of $LiAlH_4$.

Reason (R) : $LiAlH_4$ does not reduce carbon-cabon double bond in the carbonyl compound

[*Ans.* (a) **(A) and (R) are true and (R) is the correct explanation of (A)**]

UNIT 12

CARBONYL COMPOUND

CHAPTER SNAPSHOT

6. Why acid anhydride are preferred to acyl chloride for carrying out acylation reactions ?

Ans. Acetic anhydride is preferred for acylation due to

(i) Its ease of availability and cheap compared to acetyl chloride.

(ii) when acylation is carried out with acetyl chloride, the by product is HCl which is a strong acid and has the potential for unwanted reactions whereas with acetic anhydride, the by product is only acetic acid.

(iii) Acetyl chloride is more reactive and hence more liable to undergo side reaction. Therefore acetic anhydride is preferred for acylation.

PTA MODEL QUESTIONS AND ANSWERS

CHOOSE THE CORRECT ANSWER 1 MARK

1. The general order of reactivity of carbonyl compounds towards nucleophilic addition reaction is *[PTA - 1]*

a) HCHO > RCHO > C_6H_5CHO > R_2CO > $(C_6H_5)_2$

b) HCHO > CH_3CHO > C_6H_5CHO > CH_3COCH_3 > $C_6H_5COCH_3$

c) $C_6H_5COC_6H_5$ > CH_3COCH_3 > C_6H_5CHO > CH_3CHO > HCHO

d) HCHO > CH_3COCH_3 > $C_6H_5COC_6H_5$ > CH_3CHO > C_6H_5CHO

[*Ans.* (b) HCHO > CH_3CHO > C_6H_5CHO > CH_3COCH_3 > $C_6H_5COCH_3$]

2. Which one of the following pairs is not correctly matched? *[PTA - 3]*

Reducing agent	Name of the reaction
a) Zn / Hg / ConHCl	Clemension reduction
b) $LiAlH_4$	Wolf - Kishner's reduction
c) Pd / $BaSO_4$	Rosenmund's reduction
d) $SnCl_2$/ConHCl	Stephen's reduction

[*Ans.* (b) $LiAlH_4$ - Wolf - Kishner's reduction]

ANSWER THE QUESTIONS 2 MARKS

1. Write two tests of carboxylic acid. *[PTA - 2]*

Ans. *(i)* Aqueous solution of carboxylic acids turn blue litmus into red colour.

(ii) Carboxylic acids give brisk effervescence with sodium bicarbonate due to the evolution of CO_2.

2. Name the ester which had the following flavour? *[PTA - 6]*

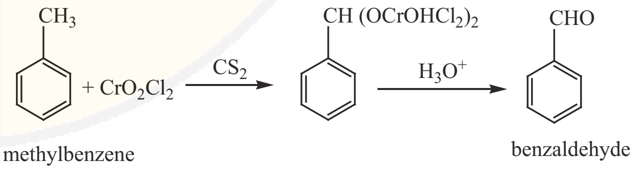
(1) Banana
(2) Orange
(3) Pineapple
(4) Apricot

Ans. (1) Banana - Amyl acetate
(2) Orange - Octyl acetate
(3) Pineapple - Ethyl butyrate
(4) Apricot - Amyl butyrate

ANSWER THE QUESTIONS 3 MARKS

1. Write a note on Etard reaction? *[PTA - 4]*

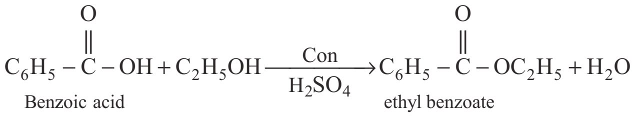
Ans. When chromylchloride is used as an oxidising agent, toluene gives benzaldehyde. This reaction is called Etard reaction. Acetic anhydride and CrO_3 can also be used for this reaction.



ANSWER THE QUESTIONS 5 MARKS

1. What happens when ethanoic acid reacts with ethonal in the presence of con H_2SO_4. Give its complete mechanism. *[PTA - 6]*

Ans. When carboxylic acids are heated with alcohols in the presence of conc. H_2SO_4 or dry HCl gas, esters are formed. The reaction is reversible and is called **esterification**.



$$C_6H_5-\overset{\overset{\displaystyle O}{\|}}{C}-OH+C_2H_5OH\xrightarrow[H_2SO_4]{Con}C_6H_5-\overset{\overset{\displaystyle O}{\|}}{C}-OC_2H_5+H_2O$$

PROBLEMS FOR PRACTICE

1. An organic compound A (C_7H_6O) reduces Tollen's reagent. On treating with an alkali compound A forms B and C. B on treating with sodalime forms benzene and C (C_7H_8O) is an antiseptic. Identify compounds A, B and C. Explain the reactions.

Ans. **Solution :**

(i) From the molecular formula compound (A) is identified as Benzaldehyde C_6H_5CHO and it reduces Tollen's reagent.

$$\underset{\text{Tollen's reagent}}{C_6H_5CHO + Ag_2O} \longrightarrow \underset{\text{Silver mirror}}{2Ag} + C_6H_5COOH$$

(ii) Benzaldehyde on treatment with alkali undergoes Cannizzaro reaction to give benzoic acid (B) and benzyl alcohol (C).

$$\underset{(A)}{C_6H_5CHO + C_6H_5CHO} \xrightarrow{NaOH} \underset{(B)}{C_6H_5COOH} + \underset{(C)}{C_6H_5CH_2OH}$$

(iii) Benzoic acid on treatment with sodalime gives benzene.

$$\underset{(B)}{C_6H_5COOH} \xrightarrow[CaO]{NaOH} \underset{\text{Benzene}}{C_6H_6} + CO_2$$

(iv) Benzyl alcohol acts as an antiseptic.

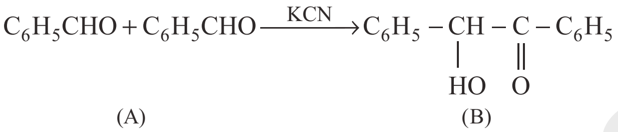
Compound	Compound Name	Formula
A	Benzaldehyde	C_6H_5CHO
B	Benzoic acid	C_6H_5COOH
C	Benzyl alcohol	$C_6H_5CH_2OH$

2. An organic compound A (C_7H_6O) forms a bisulphite. A when treated with alcoholic KCN forms B ($C_{14}H_{12}O_2$) and A on refluxing with sodium acetate and acetic anhydride forms an acid C ($C_9H_8O_2$). Identify A, B and C. Explain the conversion of A to B and C.

Ans. **Solution :**

(i) An organic compound (A) with formula C_7H_6O form bisulphite means it must be benzaldehyde C_6H_5CHO.

(ii) Benzaldehyde on treatment with KCN form benzoin.



$$\underset{(A)}{C_6H_5CHO + C_6H_5CHO} \xrightarrow{KCN} \underset{(B)}{C_6H_5 - \underset{HO}{\underset{|}{CH}} - \underset{O}{\underset{\|}{C}} - C_6H_5}$$

(iii) Benzaldehyde on treatment with sodium acetate and acetic anhydride form an acid, cinnamic acid it is (C).

$$\underset{(A)}{C_6H_5CHO + (CH_3CO)_2\,O} \xrightarrow{CH_3COONa} \underset{(C)}{C_6H_5CH = CH - COOH} + CH_3COOH$$

Compound	Compound Name	Formula
A	Benzaldehyde	C_6H_5CHO
B	Benzoin	C_6H_5–CH–OHCO–C_6H_5
C	Cinnamic acid	C_6H_5CH=CHCOOH

3. An aromatic aldehyde (A) of molecular formula C_7H_6O which has the smell of bitter almonds on treatment with $(CH_3CO)_2O$ and CH_3COONa to give compound (B) which is an aromatic unsaturated acid. (A) also reacts with (A) in the presence of alc. KCN to give dimer (C). Identify (A), (B) and (C). Explain the reactions.

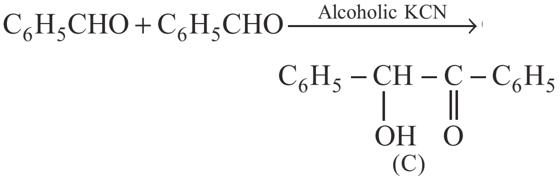
Ans. **Solution :**

(i) An organic compound which has the smell of bitter almonds is **benzaldehyde** C_6H_5CHO and it is (A).

(ii) Benzaldehyde reacts with acetic anhydride in the presence of sodium acetate gives **Cinnamic acid**.

$$\underset{(A)}{C_6H_5CHO + (CH_3CO)_2\,O} \xrightarrow{CH_3COONa} \underset{(B)}{C_6H_5CH = CHCOOH} + CH_3COOH$$

(iii) Benzaldehyde on treatment with alcoholic KCN gives **Benzoin** a dimer and it is (C).



$$C_6H_5CHO + C_6H_5CHO \xrightarrow{\text{Alcoholic KCN}} \underset{(C)}{C_6H_5 - \underset{OH}{\underset{|}{CH}} - \underset{O}{\underset{\|}{C}} - C_6H_5}$$

EVALUATION

Choose The Correct Answer

1. **Which of the following reagent can be used to convert nitrobenzene to aniline**

   a) Sn / HCl b) ZnHg / NaOH

   c) $LiAlH_4$ d) All of these

   [*Ans.* ★ **(a) and (c)**]

2. **The method by which aniline cannot be prepared is**

   a) degradation of benzamide with Br_2 / NaOH

   b) potassium salt of phthalimide treated with chlorobenzene followed by hydrolysis with aqueous NaOH solution.

   c) Hydrolysis of phenylcyanide with acidic solution

   d) reduction of nitrobenzene by Sn / HCl .

   [*Ans.* **(b) potassium salt of phthalimide treated with chlorobenzene followed by hydrolysis with aqueous NaOH solution**]

3. **Which one of the following will not undergo Hofmann bromamide reaction**

   a) $CH_3CONHCH_3$ b) $CH_3CH_2CONH_2$

   c) CH_3CONH_2 d) $C_6H_5CONH_2$

   [*Ans.* **(a) $CH_3CONHCH_3$**]

4. **Assertion : Acetamide on reaction with KOH and bromine gives acetic acid**

   Reason : Bromine catalyses hydrolysis of acetamide.

   a) if both assertion and reason are true and reason is the correct explanation of assertion.

   b) if both assertion and reason are true but reason is not the correct explanation of assertion.

   c) assertion is true but reason is false

   d) both assertion and reason are false.

   [*Ans.* **(d) both assertion and reason are false**]

5. $$CH_3CH_2Br \xrightarrow[\Delta]{\text{aq NaOH}} A \xrightarrow[\Delta]{KMnO_4/H^+}$$
   $$B \xrightarrow[\Delta]{NH_3} C \xrightarrow{Br_2/NaOH} D$$

   'D' is

   a) bromomethane

   b) α - bromo sodium acetate

   c) methanamine

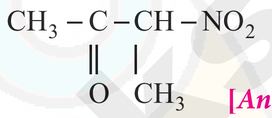
   d) acetamide [*Ans.* **(c) methanamine**]

6. **Which one of the following nitro compounds does not react with nitrous acid**

   a) $CH_3-CH_2-CH_2-NO_2$

   b) $(CH_3)_2\,CH-CH_2NO_2$

   c) $(CH_3)_3\,C\,NO_2$

   d) 
   $CH_3-\underset{\underset{O}{\|}}{C}-\underset{\underset{CH_3}{|}}{CH}-NO_2$

   [*Ans.* **(c) $(CH_3)_3\,C\,NO_2$**]

7. **Aniline + benzoylchloride $\xrightarrow{NaOH}$ $C_6H_5-NH-COC_6H_5$ this reaction is known as**

   a) Friedel – crafts reaction

   b) HVZ reaction

   c) Schotten – Baumann reaction

   d) None of these

   [*Ans.* **(c) Schotten – Baumann reaction**]

8. **The product formed by the reaction an aldehyde with a primary amine** (NEET) *[HY_2019]*

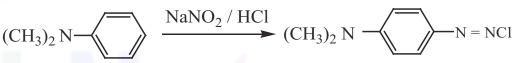
   a) carboxylic acid b) aromatic acid

   c) schiff 's base d) ketone

   [*Ans.* **(c) schiff 's base**]

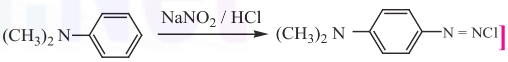
9. **Which of the following reaction is not correct.**

   a) $CH_3CH_2NH_2 \xrightarrow{HNO_2} CH_3CH_2OH + N_2$

   b) 

   c) $CH_3CONH_2 \xrightarrow{Br_2/NaOH} CH_3NH_2$

   d) none of these

   [*Ans.* **(b)** ]

10. **When aniline reacts with acetic anhydride the product formed is**

    a) o – aminoacetophenone

    b) m-aminoacetophenone

    c) p – aminoacetophenone

    d) acetanilide [*Ans.* **(d) acetanilide**]

17. What are different types of RNA which are found in cell?

Ans. RNA molecules are classified according to their structure and function into three major types,

(i) Ribosomal RNA (rRNA)
(ii) Messenger RNA (mRNA)
(iii) Transfer RNA (tRNA)

18. Write a note on formation of α-helix. *[PTA - 6]*

Ans. The amino acids in the polypeptide chain forms highly regular shapes (sub-structures) through the hydrogen bond between the carbonyl oxygen (–C=O) and the neighbouring amine hydrogen (–NH)of the main chain. α-Helix and β-strands or sheets are two most common sub structures formed by proteins.

α-Helix :

(i) In the α-helix sub-structure, the amino acids are arranged in a right handed helical (spiral) structure and are stabilised by the hydrogen bond between the carbonyl oxygen one amino acid (nth residue) with amino hydrogen of the fifth residue (n + 4th residue).

(ii) The side chains of the residues protrude outside of the helix.

(iii) Each turn of an α-helix contains about 3.6 residues and is about 5.4 A long.

(iv) The amino acid proline produces a kink in the helical structure and often called as a helix breaker due to its rigid cyclic structure.

19. What are the functions of lipids in living organism? *[PTA - 2]*

Ans. **Biological importance of lipids :**

(i) Lipids are the integral component of cell membrane. They are necessary of structural integrity of the cell.

(ii) The main function of triglycerides in animals is as an energy reserve. They yield more energy than carbohydrates and proteins.

(iii) They act as protective coating in aquatic organisms.

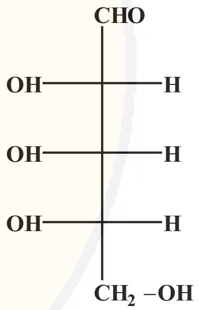
(iv) Lipids of connective tissue give protection to internal organs.

(v) Lipids help in the absorption and transport of fat soluble vitamins.

(vi) They are essential for activation of enzymes such as lipases.

(vii) Lipids act as emulsifier in fat metabolism.

20. Is the following sugar, D – sugar or L – sugar?



Ans. L-Sugar.

PTA MODEL QUESTIONS AND ANSWERS

CHOOSE THE CORRECT ANSWER 1 MARK

1. Which of the following statement is incorrect? *[PTA - 2]*

a) Nucleoside + Phosphate → Nucleotide
b) Nucleoside + Base → Nucleotide
c) Sugar + Base → Nucleoside
d) nNucleotide → Polynucleotide

[*Ans.* (b) Nucleoside + Base → Nucleotide]

2. Assertion : Thymine pairs with Adenine wheareas Cytosine pairs with Guanine in DNA molecule.

Reason : The hydrogen bonding between bases of two strands is highly specific. *[PTA - 5]*

a) Both assertion and reason are true and reason is the correct explanation of assertion
b) Both assertion and reason are true but reason is not the correct explanation of assertion
c) Assertion is true but reason is false
d) Both assertion and reason are false

[*Ans.* (a) Both assertion and reason are true and reason is the correct

UNIT
15

CHEMISTRY IN EVERYDAY LIFE

CHAPTER SNAPSHOT

GOVERNMENT EXAM QUESTIONS AND ANSWERS

ANSWER THE QUESTIONS 2 MARKS

1. Write the preparation of Teflon and Give its use. *[HY_2019]*

Ans. The monomer is tetrafluroethylene. When the monomer is heated with oxygen (or) ammonium persulphate under high pressure, Teflon is obtained.

$$n\,CF_2{=}CF_2 \xrightarrow{\Delta} \left(CF_2 - CF_2 \right)_n$$

It is used for for coating articles and preparing non-stick utensils.

2. Give an example and use of antihistamine. *[HY_2019]*

Ans. **Antihistamine:** Examples - Cetirizine, levocetirizine, desloratadine, brompheniramine, Terfenadine.

Uses : To provide relief from the allergic effects.

ANSWER THE QUESTIONS 3 MARKS

1. Write a short note on Antioxidants. *[Govt.MQP_2019]*

Ans. *(i)* Antioxidants are substances which retard the oxidative deteriorations of food.

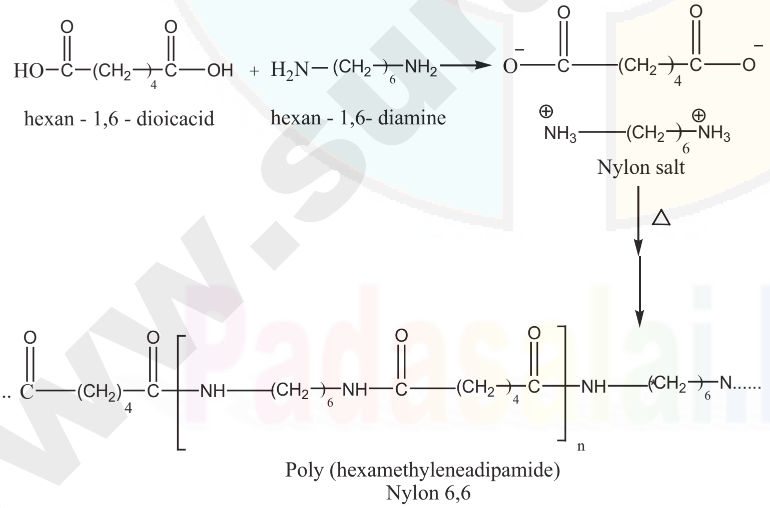
(ii) Food containing fats and oils is easily oxidised and turn rancid.

(iii) To prevent the oxidation of the fats and oils, chemical BHT(butylhydroxy toluene), BHA(Butylated hydroxy anisole) are added as food additives.

(iv) They are generally called antioxidants. These materials readily undergo oxidation by reacting with free radicals generated by the oxidation of oils, thereby stop the chain reaction of oxidation of food.

2. How is Nylon – 6,6 prepared? Give it use. *[Govt.MQP_2019]*

Ans. Nylon – 6,6 can be prepared by mixing equimolar adipic acid and hexamethylene – diamine to form a nylon salt which on heating eliminate a water molecule to form amide bonds.



It is used in textiles, manufacture of cards etc…

NEET BASED QUESTIONS

NEET BASED QUESTIONS

1. **Rutherford's alpha-particle scattering experiment eventually led to the conclusion that**
(A) Mass and energy are related
(B) Electron occupy space around the nucleus
(C) Neutrons are buried deep in the nucleus
(D) The point of impact with matter can be precisely determined

2. **The number of α- and β-particles emitted in the nuclear reaction**

$$ {}_{90}Th^{228} \longrightarrow {}_{83}Bi^{212} $$

(A) Four alpha and one beta
(B) Three alpha and seven beta
(C) Eight alpha and one beta
(D) One alpha and four beta

3. **Principal quantum number determines**
(A) Size of the electron wave and energy of electron
(B) Orbital angular momentum
(C) Shape of the electron cloud
(D) Configuration of orbitals in space

4. **Correct electronic configuration of Cr is**
(A) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^{10}\ 3d^5\ 4s^1$
(B) $1s^2\ 2s^2\ 2p^6\ 3s^2,\ 3d^8\ 4s^0$
(C) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$
(D) $1s^2\ 2p^2\ 2p^6\ 3p^0\ 3d^5\ 4s^1$

5. **The bond order of individual carbon-carbon bond in benzene is–**
(A) 1 (B) 2
(C) Between 1 and 2 (D) 1 and 2, alternatively

6. **Hybridisation of sulphur in SO_2 is**
(A) *sp* (B) sp^3 (C) sp^2 (D) dsp^2

7. **Hybridisation states of carbon in diamond, graphite and acetylene respectively, are**
(A) sp^2, sp, sp^3 (B) sp, sp^2, sp^3
(C) sp^3, sp^2, sp (D) sp, sp^3, sp

8. **$NaHCO_3$ decompose as**

$2NaHCO_{3(s)} \rightleftharpoons Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(g)}$

The equilibrium pressure is 1.04 atm the K_p for the reaction is–
(A) 0.2704 (B) 2.704
(C) 27.04 (D) 270.4

9. **For the reaction**

$$ H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)} $$

K_c = 66.9 at 350°C and 50.0 at 448°C. The reaction has–
(A) ΔH +ve (B) ΔH = –ve
(C) ΔH = zero (D) None of these

EXPLANATORY ANSWERS

1. (D)	**2.** (A)	**3.** (A)	**4.** (C)	**5.** (C)	**6.** (C)	**7.** (C)	**8.** (A)	**9.** (B)	**10.** (B)
11. (B)	**12.** (C)	**13.** (B)	**14.** (C)	**15.** (A)	**16.** (C)	**17.** (B)	**18.** (A)	**19.** (A)	**20.** (A)
21. (A)	**22.** (D)	**23.** (A)	**24.** (A)	**25.** (D)	**26.** (B)	**27.** (A)	**28.** (D)	**29.** (B)	**30.** (A)
31. (D)	**32.** (C)	**33.** (C)	**34.** (B)	**35.** (C)	**36.** (A)	**37.** (B)	**38.** (A)	**39.** (D)	**40.** (B)
41. (C)	**42.** (C)	**43.** (C)	**44.** (C)	**45.** (B)	**46.** (A)	**47.** (D)	**48.** (D)	**49.** (C)	**50.** (C)
51. (C)	**52.** (D)	**53.** (C)	**54.** (A)	**55.** (C)	**56.** (B)	**57.** (D)	**58.** (D)	**59.** (D)	**60.** (C)
61. (C)	**62.** (A)	**63.** (D)	**64.** (B)	**65.** (D)	**66.** (D)	**67.** (B)	**68.** (D)	**69.** (D)	**70.** (C)
71. (A)	**72.** (C)	**73.** (B)	**74.** (D)	**75.** (B)	**76.** (D)	**77.** (B)	**78.** (D)	**79.** (C)	**80.** (A)
81. (A)	**82.** (C)	**83.** (C)	**84.** (D)	**85.** (D)	**86.** (A)	**87.** (A)	**88.** (C)	**89.** (C)	**90.** (C)
91. (D)	**92.** (A)	**93.** (C)	**94.** (C)	**95.** (D)	**96.** (C)	**97.** (C)	**98.** (B)	**99.** (B)	**100.** (D)

EXPLANATORY NOTES

EXPLANATORY NOTES

8. $$Kp = p_{CO_2(g)} \cdot p_{H_2O(g)}$$

$$p_{CO_2(g)} + p_{H_2O(g)} = 1.04$$

$$p_{CO_2(g)} = p_{H_2O(g)}$$

$$p_{CO_2(g)} = \frac{1.04}{2} = 0.52$$

$Kp = 0.52 \times 0.52 = 0.2704.$

9. The reaction is exothermic because, with the increase in temperature Kc decreases
$\Delta H = -ve.$

10. $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$
has the expression for Kc

$$Kc = \frac{[SO_3]^2}{[SO_2]^2[O_2]}$$

$$[SO_3] = [SO_2]$$

$$Kc = \frac{1}{[O_2]}$$

$$[O_2] = \frac{1}{K_c} = \frac{1}{100} = 0.01 \text{ mole/litre}$$

Moles of O_2 in 10 litre
$= 0.01 \times 10 = 0.1$

11. $$Kp = \frac{P^2_{CO}}{P_{CO_2}} = \frac{4 \times 4}{2} = 8$$

12. $$K = \frac{[H_2]^2[S_2]}{[H_2S]^2} = \frac{0.1 \times 0.1 \times 0.4}{0.5 \times 0.5}$$

$= 0.016$ mole/litre.

13. The molecularity can never be zero.

14. $$t_{0.5} = \frac{0.693}{K_2}$$

$$t_{0.75} = \frac{2 \times 0.693}{K_1}$$

Hence **$t_{0.75} : t_{0.5} = 2 : 1.$**

16. $$[H^+] \propto \frac{1}{\sqrt{C}}$$

$$pH \propto \frac{1}{[H^+]} \propto \sqrt{C}$$

where C = conc. of the salt. Hence, minimum the concentration, minimum is the pH.

12th STD. Govt. Model Question Paper - 2019-20

CHEMISTRY (With Answers)

Time Allowed : 15 minutes 3.00 hrs Maximum Marks : 70

Instructions: 1. Check the question paper for fairness of printing. It there is any lack of fairness, inform the Hall Supervisor immediately.
2. Use Blue or Black ink to write and underline and pencil to draw diagrams:

Note: Draw a diagrams and write equations wherever necessary.

PART - I

Note : (i) Answer **all** the questions: ($15 \times 1 = 15$)
(ii) Choose the most suitable answer from the given four alternatives and write the option code and the corresponding answer.

1. Which one of the following ore is best concentrated by froath - floatation method?
a) Magnetite b) Haematite
c) Galena d) Cassiterite

2. Which compound is used as flux in metallurgy?
a) Boric acid b) Borax
c) Diborane d) BF_3

3. The shape of $XeOF_4$ is
a) T Shaped b) Pyramidal
c) Square planar d) Square pyramidal

4. How many moles of acidified KMn04 required to oxidise one mole of oxalic acid?
a) 5 c) 1.5 b) 0.6 d) 0.4

5. The type of isomerism exhibited by $[Pt(NH_3)_2Cl_2]$?
a) coordination isomerism
b) linkage isomerism
c) optical isomerism
d) geometrical isomerism

6. The fraction of the total volume occupied by the atoms in a fcc is
a) $\frac{\pi}{6}$ b) $\frac{\pi}{3\sqrt{2}}$ c) $\frac{\pi}{4}$ d) $\frac{\sqrt{3}\pi}{8}$

7. The half life period of a radioactive element is 140 days. After 280 days 1g of element will be reduced to which amount of the following?
a) $\frac{1}{4}$ b) $\frac{1}{16}$ c) $\frac{1}{8}$ d) $\frac{1}{2}$

8. Which is not a Lewis base?
a) BF_3 b) PF_3 c) CO d) F^-

9. During electrolysis of molten copper chloride, the time required to produce 0.2mole of chlorine gas using a current of 2A is
a) 32.66 min b) 321 .66 min
c) 378 min d) 260 min

10. Smoke is a colloidal solution of
a) Solid in gas b) Gas in gas
c) liquid in gas d) Gas in liquid

11. Iso propyl benzene on oxidation in presence of air and dilute acid gives
a) C_6H_5COOH b) $C_6H_5COCH_3$
c) $C_6H_5COC_6H_5$ d) C_6H_5OH

12. But - 2 ene on ozonolyis followed by subsequent cleavage with Zn and water gives
a) ethanal b) Propanal
c) Propanone d) Methanal

13. Aniline + benzoyl chloride $\xrightarrow{NaOH}$ $C_6H_5NH\text{-}OC\text{-}C_6H_5$. This reaction is known as
a) Friedal - craft's reaction
b) HVZ reaction
c) Schotten - Baumann reaction
d) Cannizaro reaction

12th STD.

HALF YEARLY Examination

2019 - 2020

TIME ALLOWED : 3.00 HRS

CHEMISTRY

MAXIMUM MARKS : 70

Instructions:
1. Check the question paper for fairness of printing. It there is any lack of fairness, inform the Hall Supervisor immediately.
2. Use Blue or Black ink to write and underline and pencil to draw diagrams:

Note: Draw a diagrams and write equations wherever necessary.

PART - I

Note : (i) Answer **all** the questions: (15 × 1 = 15)
(ii) Choose the most suitable answer from the given four alternatives and write the option code and the corresponding answer.

1. Bauxite has the composition
a) Al_2O_3 b) $Al_2O_3.nH_2O$
c) $Fe_2O_3.2H_2O$ d) None of these

2. All the elements of group 17 and 18 are :
a) metalloids b) metals
c) non-metals d) both (a) and (b)

3. Which is true regarding nitrogen?
a) least electronegative element
b) has low ionisation enthalpy than oxygen
c) d- orbitals available
d) ability to form $p\pi - p\pi$ bonds with itself

4. Common isotope of iodine is :
a) I^{19} b) I^{35} c) I^{79} d) I^{127}

5. Equivalent weight of $KMnO_4$ in neutral medium is ________.
a) 31.6 b) 52.67 c) 158 d) 52.76

6. Which type of isomerism is exhibited by $[Pt(NH_3)_2 Cl_2]^?$
a) Coordination isomerism
b) Linkage isomerism c) Optical isomerism
d) Geometrical isomerism

7. In Naphthalene, constituent molecules are held together by :
a) Electrostatic attraction
b) London forces
c) Hydrogen bond
d) Strong dipole - dipole interaction

8. **Assertion : rate of reaction doubles when the concentration of the reactant is doubles if it is a first order reaction.**
Reason : rate constant also doubles
a) Both assertion and reason are true and reason is the correct explanation of assertion.
b) Both assertion and reason are true but reason is not the correct explanation of assertion.
c) Assertion is true but reason is false.
d) Both assertion and reason are false.

9. Match the following :

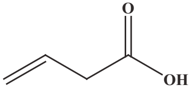
(1)	Lewis acids	i)	Gives H^+ in water
(2)	Lowry – Bronsted Theory	ii)	$K_a = \alpha_2 C$
(3)	Arrhenius Concept	iii)	Carbonium ion
(4)	Ostwald's dilution law	iv)	Has a tendency to donate proton

a) (1)-(iii), (2)-(iv), (3)-(i), (4)-(ii)
b) (1)-(iv), (2)-(iii), (3)-(ii), (4)-(i)
c) (1)-(ii), (2)-(iv), (3)-(i), (4)-(iii)
d) (1)-(i), (2)-(iv), (3)-(iii), (4)-(ii)

10. Collodion is a 4% solution of which one of the following compounds in alcohol – ether mixture?
a) Nitroglycerine b) Cellulose acetate
c) Glycoldinitrate d) Nitrocellulose

11. The oxidising agent used in swern oxidation is :
a) fenton's reagent b) dimethyl sulfoxide
c) alkaline $KMnO_4$ d) periodic acid

12. The IUPAC name of



a) but – 3- enoic acid
b) but – 1- ene-4-oic acid
c) but – 2- ene-1-oic acid
d) but -3-ene-1-oic acid