Previous IPE

SOLVED PAPERS

MARCH -2026(TG)

PREVIOUS PAPERS

IPE: MARCH-2026 (TG)

SR. CHEMISTRY

Time : 3 Hours Max.Marks : 60

SECTION-A

I. Answer all questions: 10 × 2 = 20

1. State Henry's law.
2. What is a primary battery? Give one example.
3. What is the role of cryolite in the metallurgy of aluminium?
4. Nitrogen molecule is highly stable. Why?
5. Why Zn^{2+} is diamagnetic whereas Mn^{2+} is paramagnetic?
6. What is Ziegler–Natta catalyst?
7. What is PHBV? How is it useful to man?
8. What are antacids? Give example.
9. What are artificial sweetening agents? Give one example.
10. Write equation for Carbylamine reaction of any one aliphatic amine.

SECTION-B

II. Answer any six of the following Questions. 6 × 4 = 24

11. Classify each of the following as either a p-type or an n-type semiconductor.
    (a) Ge doped with In (b) Si doped with B
12. A solution of sucrose in water is labelled as 20% w/w.
    What would be the mole fraction of each component in the solution?
13. What is catalysis? How is catalysis classified? Give one example for each type of catalysis.
14. Explain the purification of sulphide ore by froth flotation method.
15. Explain the structures of (a) XeF_2 and (b) XeF_4
16. Explain Werner's theory of coordination compounds with suitable examples.
17. What are hormones? Give one example for each of the following:
    (a) Steroid hormones (b) Polypeptide hormones (c) Amino acid derivatives
18. (a) What are ambident nucleophiles?
    (b) What are enantiomers?

SECTION-C

III. Answer any two of the following Questions. 2 × 8 = 16

19. (a) State and explain Kohlrausch's law of independent migration of ions.
    (b) What is the "molecularity" of a reaction? How is it different from the 'order' of a reaction? Name one bimolecular and one trimolecular gaseous reaction.
20. How is ozone prepared from oxygen? Explain its reaction with
    (a) C_2H_4 (b) KI (c) Hg (d) PbS
21. Describe the following:
    (a) Acetylation (b) Cannizzaro reaction
    (c) Cross aldol condensation (d) Decarboxylation

IPE TG MARCH - 2026

SOLUTIONS

SECTION-A

1. State Henry's law.

A: 1) **Henry's law:** The **partial pressure** of the gas in vapour phase is directly proportional to the mole fraction(X) of the gas in the solution.

2) Thus, $p \propto X \Rightarrow p = K_H X$

---

2. What is a primary batteries? Give one example.

A: 1) **Primary cell:** It is the electrochemical cell which cannot be reused and is irreversible .

It acts as a source of electrical energy.

Ex: Leclanche cell, Dry cell.

---

3. What is the role of cryolite in the metallurgy of aluminium?

A: **Role of cryolite :**

1) Cryolite increases the 'conductivity of alumina' .

2) It decreases the melting point of molt.

---

4. Nitrogen molecule is highly stable. Why?

A: 1) The two N atoms in N_2 are bonded to each other by 'very strong Triple covalent bonds'. Hence, the bond dissociation enthalpy of N_2 is very high.

2) So, N_2 is less reactive and highly stable, at room temperature.

---

5. Why Zn^{2+} is diamagnetic whereas Mn^{2+} is paramagnetic?

A: 1) Electronic configuration of Zn^{2+} is [Ar] $4s^0 3d^{10}$.

It has paired d electrons. So it is diamagnetic.

2) Electronic configuration of Mn^{2+} is [Ar]$4s^0 3d^5$

It has five unpaired electrons. So it is paramagnetic.

---

6. What is Ziegler-Natta catalyst?

A: 1) **Ziegler-Natta catalyst:** Triethylaluminium and titanium tetrachloride($(C_2H_5)_3Al$+$TiCl_4$).

2) It is used in the preparation of high density polythene.

7. What is PHBV? How is it useful to man?

A: **1) PHBV:** Poly β-hydroxy butyrate –co–β–hydroxy valerate .

2) This biogdegradable polymer is useful to man in the following ways

(i) manufacture of capsules (ii) packing of orthopaedic devices.

---

8. What are antacids? Give example.

A: **1) Antacids:** These are the drugs used 'to remove the excess acid' in the stomach and maintain the normal P^H level .

2) Ex: Omeprazole, Lansoprazole.

---

9. What are artificial sweetening agents? Give example.

A: **1) Artificial Sweetening Agent:** These are low calorie sweetners used as sugar substitutes.

2) Ex: Saccharin, aspartame, Sucrolose etc.

---

10. Write equations for carbylamine reaction of any one aliphatic amine. [TS 19,24][IPE'14]

A: When a primary amine is heated with alcoholic caustic potash and chloroform, an offensive smelling compound called carbylamine (Ethylisocyanide) is formed. The reaction is used as a test for chloroform (or) for a primary amine.

$$\underset{\text{Ethanamine}}{C_2H_5NH_2} + CHCl_3 + 3KOH \xrightarrow[\Delta]{\text{alc.}} \underset{\text{Ethyl carbylamine}}{C_2H_5NC} + 3\,KCl + 3H_2O$$

SECTION-B

11. Classify each of the following as either a p-type or n-type semiconductor

1) Ge doped with In 2) Si doped with B

A: 1) Since Ge (group 14 element) is doped with In (group 13 element), an electron deficient hole is created and thus makes it a p-type semiconductor.

2) Since Si (group 14 element) is doped with B (group 13 element), an electron deficient hole is created and thus makes it a p-type semiconductor.

---

12. A solution of sucrose in water is labeled as 20% w/w. What would be the mole fraction of each component in the solution ?

A: 20% w/w sucrose solution means
20g of sucrose present in 100g of solution.
Mass of sucrose = 20g
Molar mass of sucrose = 342 g mol^{-1}.
Mass of solution = 100g
Mass of solvents = 100–20 = 80g
Molar mass of water 18 g mol^{-1}.

No. of moles of sucrose, $n_A = \frac{20}{342} = 0.0585$

No. of moles of water, $n_B = \frac{80}{18} = 4.4445$

Mole fraction of sucrose, $\chi_A = \frac{n_A}{n_A + n_B} = \frac{0.0585}{0.0585 + 4.4445} = \frac{0.0585}{4.503} = 0.013$

Mole fraction of water, $\chi_B = 1 - \chi_A = 1 - 0.013 = 0.987$

---

13. What is catalysis? How is catalysis classified? Give two examples for each type of catalysis.

A: 1) **Catalysis:** It is the process of speeding up of reaction by adding catalyst. It is classified into two types.

2) **Homogeneous catalysis:** It is the catalytic process in which the reactants and the catalyst are in the same phase.

Ex 1: $2SO_2(g) + O_2(g) \xrightarrow{NO(g)} 2SO_3(g)$

Ex 2: $CH_3COOCH_3\ (l) + H_2O\ (l) \xrightarrow{H^+} CH_3COOH(aq) + CH_3OH(aq)$

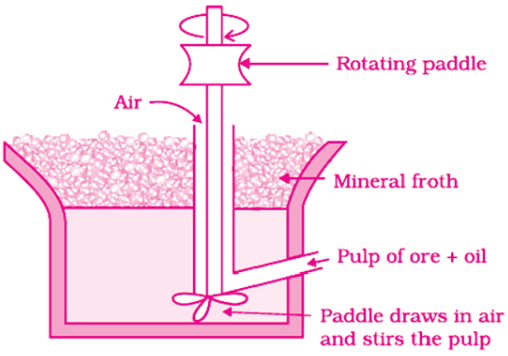
3) **Heterogeneous catalysis:** It is the catalytic process in which the reactants and the catalyst are in different phases.

Ex 1: $2SO_{2(g)} + O_{2(g)} \xrightarrow{Pt(s)} 2SO_{3(g)}$

Ex 2: $N_{2(g)} + 3H_{2(g)} \xrightarrow{Fe} 2NH_{3(g)}$

14. Explain the purification of sulphide ore by froth floatation method.

A: Froth Floatation method:



1) This method is used for **removing gangue from sulphide ores.**
2) First a **suspension of the powdered ore** is made with water.
3) To this suspension, froth collectors(pine oil) and stabilizers(cresols) are added.
4) Then **'ore is wetted by oil'** and **'gangue is wetted by water'**.
5) A rotating paddle is used to agitate the suspension and air is blown into it.
6) The mixture agitated and air is blown into it.
7) As a result, froth is formed which carries the mineral particles.
8) The froth is light and is skimmed off.
9) The sulphide ore particles are then obtained from the froth.

15. (I) How are XeF_2, XeF_4, XeF_6 prepared?

(II) Give the structures of XeF_2, XeF_4, XeF_6.

(III) Explain the reaction of the above with water

A: I) Preparation :

1) Preparation of XeF_2:

A mixture of Xenon and Fluorine is heated in the molar ratio of 2:1 to form XeF_2.

$$Xe_{(g)} + F_{2(g)} \xrightarrow{673K,\ 1\ bar} XeF_{2(s)}$$

2) Preparation of XeF_4 :

A mixture of Xenon and Fluorine is heated in the molar ratio of 1:5 to form XeF_4 .

$$Xe_{(g)} + 2F_{2(g)} \xrightarrow{873K,\ 7\ bar} XeF_{4(s)}$$

3) Preparation of XeF_6 :

Xenon and fluorine (1:20 ratio) reacts at 573K, 60-70 bar gives XeF_6.

$$Xe_{(g)} + 3F_{2(g)} \xrightarrow{573K,\ 60-70\ bar} XeF_{6(s)}$$

II) Structures:

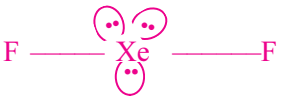
1) Structure of XeF_2:

i) In XeF_2, the central atom Xe undergoes sp^3d hybridisation and forms five sp^3d hybrid orbitals.

ii) It forms two σ bonds with two fluorine atoms

iii) It has two bond pairs and three lone pair.

iv) As per VSEPR theory, the shape of XeF_2 is linear.



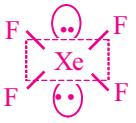
2) Structure of XeF_4:

i) In XeF_4, the central atom Xe undergoes sp^3d^2 hybridisation and forms six sp^3d^2 hybrid orbitals.

ii) It forms four σ bonds with four fluorine atoms.

iii) It has four bond pair and two lone pairs.

iv) As per VSEPR theory, the shape of XeF_4 is square planar.



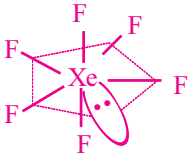
3) Structure of XeF_6:

i) In XeF_6, the central atom Xe undergoes sp^3d^3 hybridisation and forms seven sp^3d^3 hybrid orbitals.

ii) It forms six σ bonds with six fluorine atoms

iii) It has six bond pairs and one lone pair.

iv) As per VSEPR theory, the shape of XeF_6 is distorted octahedral



III) Reactions with water:

1) $2XeF_{2(s)} + 2H_2O_{(l)} \longrightarrow 2Xe_{(g)} + 4HF_{(aq)} + O_{2(g)}$

2) $6XeF_4 + 12H_2O \longrightarrow 4Xe + 2XeO_3 + 24HF + 3O_2$

3) $XeF_6 + 3H_2O \longrightarrow XeO_3 + 6HF$

16 . Explain Werner's theory of coordination compounds with suitable examples.

A: **1) Werner's theory:** This theory explains the structures of 'coordination compounds'. In co-ordination compounds the central metal atom shows two types of valencies,

a) Primary valency b) Secondary valency.

2) Primary Valency:

i) It is equal to the oxidation number of the central atom.

ii) It is satisfied only by the negative ions.

iii) It is ionisable.

iv) It is non-directional and it is represented by dotted lines.

3) Secondary Valency:

i) It is equal to the co-ordination number of the central atom.

ii) It is satisfied by negative ions, neutral molecues and rarely by positive ions.

iii) It is non-ionisable.

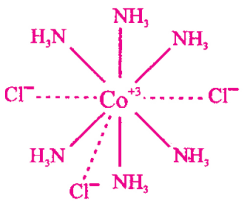
iv) It is directional and it is represented by solid lines. It exhibits isomerism.

4) Example: Hexaammine cobalt (III) chloride-$[Co(NH_3)_6]Cl_3$:

i) Here, primary valency of Co is 3.
It is satisfied by 3 Cl^- ions.

ii) Secondary valency of Co is 6.
It is satisfied by 6 NH_3 molecules.

iii) Shape of complex is Octahedral.



$[Co(NH_3)_6]Cl_3$

---

17. What are hormones? Give an example for each of the following:

a) Steroid hormones b) Polypeptide hormones c) Amino acid derivatives

A: **1) Hormones :** These are the molecules which act as intracellular messengers. They transfer biological information from one group of cells to distant tissues (or) target organs. These are produced by Endocrine glands. They are directly released into blood.

2) On the basis of their chemical nature, hormones are classified into three types.

i) Steroid hormones. Ex: Estrogens, androgens.

ii) Protein hormones. Ex: Insulin, endorphins

iii) Amino acid derivatives.

Ex: Thyroxine, epinephrine, norepinephrine

18. a) What are ambident nucleophiles? b) What are Enantiomers?

A: a) Ambident nucleophiles:

1) These are the nucleophiles with two donor atoms.

2) Ex: Cyanide ion, Nitrite ion

b) Enantiomers:

1) These are a 'pair of stereo isomers' which are mirror images to each other. These are 'non-super imposable' compounds.

2) Ex: d-Lactic acid & *l*-Lactic acid

SECTION-C

19. a) State and explain Kohlrausch's law of independent migration of ions.

b) What is the "molecularity" of a reaction? How is it different from the 'order' of a reaction? Name one bimolecular and one trimolecular gaseous reaction.

A: a) 1) Kohlrausch law: The limiting molar conductivity (Λ_m^0) of an electrolyte is equal to the sum of the limiting molar conductivities of cations (λ_+^0) and anions (λ_-^0) of the electrolyte, at infinite dilution.

2) Formula: $\Lambda_m^0 = \lambda_+^0 + \lambda_-^0$

3) Ex: For the electrolyte NaCl, we have $\Lambda^o_{(NaCl)} = \lambda^0_{Na^+} + \lambda^0_{Cl^-}$

4) Applications: Kohlrausch's law is used to calculate the following

i) Limiting molar conductivities (Λ^0) of weak electrolytes.

ii) Degree of dissociation (α) of weak electrolytes $\alpha = \frac{\Lambda_m}{\Lambda_m^o}$

iii) Dissociation constant (K) of weak electrolytes $K = \frac{C\alpha^2}{1-\alpha}$

b) What is molecularity of a reaction ? How is it different from the order of a reaction? Name one bimolecular and one trimolecular gaseous reaction.

1) Molecularity: The 'number of atoms, ions or molecules' participating in the 'rate determining step' of a chemical reaction is called molecularity of that reaction.

2) Order of a reaction: The 'sum of powers of concentration terms' of the reactants in the 'rate equation' is called order of reaction.

3) Differences between Molecularity and Order :

Molecularity	Order
i) It is determined **theoretically**.	i) It is determined **experimentally**.
ii) It can have **integral values** only.	ii) It can have **fractional values** also.
iii) It can be unimolecular,bimolecular....	iii) It can be zero order, first order....
iv) It is applicable only to **elementary reactions**.	iv) It is applicable to **elementary and complex reactions.**

4) Bimolecular reaction: Dissociation of hydrogen iodide into H_2 and I_2 .

$2HI \rightarrow H_2 + I_2$

5) Trimolecular reaction: Formation of NO_2 from NO and O_2

$2NO + O_2 \rightarrow 2NO_2$

20. How is ozone prepared from oxygen? Explain its reaction with

(a) C_2H_4 (b) KI (c) Hg (d) PbS

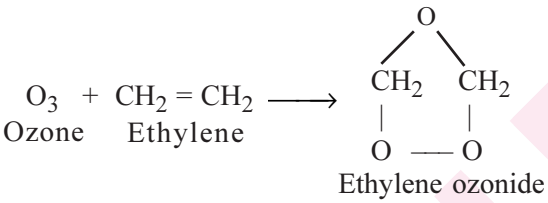
A: I. Preparation of Ozone:

Ozone is prepared when a slow dry stream of pure, cold oxygen is subjected to a **silent electrical discharge** in ozonizer.

$3O_2 \rightarrow 2O_3$; $\Delta H = +142 \text{ kJ mol}^{-1}$.

II. Reactions of Ozone:

a) Ozone reacts with Ethylene to give **Ethylene ozonide.**



b) **Ozone** oxidises moist Potassium Iodide to **Iodine.**

$$O_3 + 2KI + H_2O \longrightarrow 2KOH + I_2 + O_2$$

c) **Ozone** oxidises Mercury to **Mercurous oxide.**

(This reaction is called as **'Tailing of Mercury'**.)

$$O_3 + 2Hg \longrightarrow Hg_2O + O_2$$

d) **Ozone** oxidises black leadsulphide to **white leadsulphate.**

$$4O_3 + PbS \longrightarrow PbSO_4 + 4O_2$$

21. Describe the following:

a) Acetylation **b) Cannizzaro reaction**

c) Cross aldol condensation **d) Decarboxylation**

A: a) Acetylation: Alcohols when treated with an acyl chloride (or) acid anhydride in the presence of pyridine give esters. In this reaction H of the –OH group of alcohol is replaced by acyl (CH_3–CO–) group. So, this reaction is called acylation.

Ex: $CH_3-\overset{\overset{O}{\|}}{C}-\boxed{Cl+H}O-C_2H_5 \xrightarrow{\text{Pyridine}} CH_3-\overset{\overset{O}{\|}}{C}-OC_2H_5 + HCl$

(acetyl chloride) (ethyl acetate)

b) Cannizzaro reaction: Aldehydes having no 'α' hydrogen undergo Cannizzaro's reaction. Such aldehydes in the presence of concentrated alkaline solution undergo self oxydation-reduction to give a mixture of alcohol and a salt of carboxylic acid. **[TS 15,19,23,24,25][AP 16,18,19,22]**

Ex: 1) When 2 molecules of formaldehyde undergo self oxydation in presence of conc.NaOH to form methanol and Sodium formate.

$$H-\overset{\overset{H}{|}}{C}=O + H-\overset{\overset{H}{|}}{C}=O \xrightarrow{\text{Conc. NaOH}} CH_3OH + H-\overset{\overset{O}{\|}}{C}-ONa$$

2) Benzaldehyde gives benzyl alcohol and sodium benzoate.

c) Cross aldol condensation: The condensation of two different carbonyl compounds (one of which must have one α-hydrogen) in the presence of alkali is called cross aldol condensation.

CH_3CHO + CH_3CH_2CHO → (Self-Aldol Products)

Acetaldehyde (Ethanal) + Propionaldehyde (Propanal) →

- $CH_3-CH=CH-CHO$ — But-2-enal
- $CH_3-CH_2-CH=\overset{\overset{CH_3}{|}}{C}-CHO$ — 2-MethylPent-2-enal
- $CH_3-CH=\overset{\overset{CH_3}{|}}{C}-CHO$ — 2-Methylbut-2-enal
- $CH_3-CH_2-CH=CH-CHO$ — Pent-2-enal

(Cross Aldol Products)

d) Decarboxylation: Heating of anhydrous potassium salt of carboxylic acid with sodalime (CaO + NaOH) forms Alkane with the liberation of CO_2. The formed alkane contains one carbon less than that of parent acid. This reaction is known as Decarboxylation. **[TS 15,17,19,20,23,24,25]**

Ex: $RCOONa + NaOH + CaO \xrightarrow{\Delta} R-H + Na_2CO_3 + CaO$ **[AP 15,16,19]**

$CH_3COONa + NaOH + CaO \xrightarrow{\Delta} CH_4 + Na_2CO_3 + CaO$