Previous IPE

SOLVED PAPERS

MARCH-2019 (AP)

PREVIOUS PAPERS

IPE: MARCH-2019(AP)

Time : 3 Hours **SR.CHEMISTRY** Max.Marks : 60

SECTION-A

I. Answer ALL questions : 10 × 2 = 20

1. What is relative lowering of vapour pressure ?
2. Give two examples for zero order reaction ?
3. Give the composition of a) Brass b) Bronze c) German silver
4. What happens when white phosphorus is heated with conc. NaOH solution in an inert atmosphere of CO_2 ?
5. How is chlorine manufactured by Deacon's Method?
6. What is Misch metal ? Give its composition and use?
7. What is PHBV ? How is it useful to man ?
8. What is PDI (Poly Dispersity Index) ?
9. What are analgesics ? How are they classified ?
10. What are antiseptics ? Give examples.

SECTION-B

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

11. Describing the two main types of semi-conductors and contrast their conduction mechanism.
12. Vapour pressure of water at 293 K is 17.535 mmHg. Calculate the vapour pressure of the solution at 293 K when 25 g of glucose is dissolved in 450 g of water ?
13. Name any four enzyme catalysed reactions.
14. Explain the purification of sulphide ore by Forth Floatation Method.
15. How are XeF_2 and XeF_4 prepared ? Give their structures.
16. Using IUPAC norms, write the systematic names of the following :
    a) $[Co(NH_3)_6]Cl_3$ b) $[Fe(C_2O_4)_3]^{3-}$ c) $[Fe(CN)_6]^{-4}$ d) $[NiCl_4]^{-2}$
17. What are Hormones? Give one example for each
    i) Steroid Hormones ii) Polypeptide Hormones iii) Amino Acid derivatives
18. Which compound in each of the following pairs will react faster in S_N2 reaction with OH^- ?
    i) CH_3Br (or) CH_3I ii) $(CH_3)_3CCl$ (or) CH_3Cl

SECTION-C

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

19. Give the different types of Batteries and explain the construction and working of each type of battery.
20. How is ozone prepared from oxygen ? Explain its reaction with :
    i) C_2H_4 ii) KI iii) Hg iv) PbS
21. Describe the following :
    i) Acetylation ii) Cannizaro reaction
    iii) Cross aldol condensation iv) Decarboxylation

IPE AP MARCH-2019

SOLUTIONS

SECTION-A

1. What is relative lowering of vapour pressure ?

A: Relative Lowering of Vapour Pressure(RLVP): It is the ratio between lowering of vapour pressure ($P^o - P^s$) and vapour pressure of pure solvent (P^o). Thus, $R.L.V.P = \frac{P^o - P^s}{P^o}$

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2. Give two examples for zero Order reactions.

A: Ex 1: $H_2 + Cl_2 \xrightarrow{hv} 2HCl$; rate $= k[H_2]^0 [Cl_2]^0$

Ex 2: $2HI \xrightarrow{gold} H_2 + I_2$; rate $= k[HI]^0$

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3. Give the composition of the following alloys. a) Brass b) German silver c) Bronze

A: (a) **Brass**: 60–80% Cu; 20–40% Zn

(b) **German silver**: 50–60% Cu; 10–30% Ni, 20–30% Zn

(c) **Bronze**: 75–90% Cu; 10–25% Sn

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4. What happens when white phosphorus is heated with conc. NaOH solution in an inert atmosphere of CO_2?

A: When white phosphorus is heated with conc.NaOH solution in an inert atmosphere of CO_2, phosphine gas is liberated.

$$P_4 + 3NaOH + 3H_2O \longrightarrow 3NaH_2PO_2 + PH_3 \uparrow$$

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5. How is chlorine manufactured by Deacon's method?

A: 1) **Deacon's process**: **Hydrogen chloride gas** reacts with atmospheric oxygen in the presence of $CuCl_2$ catalyst at 723K to form **Chlorine**.

2) $4HCl + O_2 \xrightarrow[723K]{CuCl_2} 2Cl_2 + 2H_2O$

6. What is mischmetal? Give its composition and uses.

A: **1) Mischmetal:** It is an alloy of Lanthanide metal.

2) It contains 95% Lanthanide metal and 5% iron and traces of S, C, Ca and Al.

3) It is used in bullets & shells.

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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.

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8. What is PDI (Poly Dispersity Index)?

A: **1) PDI:** It is the ratio between 'weight average molecular mass' ($\bar{M}_w$)and 'number average molecular mass' ($\bar{M}_n$) of a polymer. Thus, PDI= $\frac{\bar{M}_w}{\bar{M}_n}$

2) The value of PDI for polymers lies in between 1 and 1.5.

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9. What are analgesics ? How are they classified ?

A: **1) Analgesics:** These are the drugs used to reduce or abolish pain without causing disturbances to nervous system. These are classified as follows

2) Narcotic analgesics: These are the drugs used to reduce pain by acting on the central nervous system. **Ex:** Morphine, Codeine etc.

3) Non-narcotic drugs : These are the drugs used to reduce pain without acting on central nervous system. **Ex:** Aspirin, Ibuprofen.

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10. What are antiseptics? Give example.

A: **1) Antiseptics :** These are the drugs used 'to kill or prevent the growth of micro organisms'. They are applied in living organisms.

2) Ex: Dettol, Bithional, Tincture of iodine.

SECTION-B

11. Describe the two main types of semiconductors and contrast their conduction mechanism.

A: Types of Semi conductors:

1) **Intrinsic semiconductors:** These are the conductors whose conductivity increases with rise in temperature . **Ex:** Pure solids like Si and Ge.

2) **Extrinsic semiconductors:** These are the conductors whose conductivity increases with the doping of certain impurities. **Ex:** P, As ; B, A*l*.

Extrinsic semiconductors are of two types:

a) **n-type semiconductor:** These are the semi conductors in which majority charge carriers are electrons.

If pure Si is doped with a VA group element like P (or) As, some of the 'Si' atoms are replaced by 'P' (or) 'As'atoms.

VA group element has 5 valence electrons where as 'Si' has 4 valence electrons.

So, 5^{th} electron is free to move through the voids of crystal.

The conductivity of these semi conductors is due to the presence of delocalized,'negatively charged electrons'.

b) **p-type semi conductor:** These are the semi conductors in which majority charge carriers are positive holes.

If pure Si is doped with a IIIA group element like B, A*l* (or) Ga, some of the 'Si' atoms are replaced with IIIA group atoms.

IIIA group element has 3 valence electrons where as 'Si' has 4 valence electrons.

So, an 'electron vacancy' or 'positive hole' is formed.

The conductivity of these semi conductors is due to the migration of 'positive hole' from one atom to other.

12. Vapour pressure of water at 293K is 17.535mm Hg. Calculate the vapour pressure of the solution at 293K when 25g of glucose is dissolved in 450g of water.

A: $P^o = 17.535$ mm

Wt. of glucose = a= 25 g

Molar mass of glucose = M = 180 $g.mol^{-1}$

Wt. of water = b = 450 g

Molar mass of water = W = 18 $g.mol^{-1}$

Applying the relation, $\frac{P^o - P^s}{P^o} = X_{solute}$

$$\frac{P^o - P^s}{P^o} = \frac{a}{M} \times \frac{W}{b} \Rightarrow \frac{17.535 - P^s}{17.535} = \frac{25}{180} \times \frac{18}{450}$$

$$\Rightarrow 1 - \frac{P^s}{17.535} = \frac{1}{180} \Rightarrow \frac{179}{180} = \frac{P^s}{17.535}$$

$P^s = 17.44$ mm Hg

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13. Name any four enzyme catalysed reactions.

A: a. Inversion of cane sugar:

$$\underset{\text{Cane Sugar}}{C_{12}H_{22}O_{11(aq)}} + H_2O_{(l)} \xrightarrow{\text{Invertase}} \underset{\text{Glucose}}{C_6H_{12}O_{6(aq)}} + \underset{\text{fructose}}{C_6H_{12}O_{6(aq)}}$$

b. Conversion of glucose into ethyl alcohol:

$$C_6H_{12}O_{6(aq)} \xrightarrow{\text{Zymase}} 2C_2H_5OH + 2CO_2$$

c. Conversion of Starch into maltose:

$$\underset{\text{Starch}}{2(C_6H_{10}O_5)_{n(aq)}} + nH_2O_{(l)} \xrightarrow{\text{Diastase}} \underset{\text{Maltose}}{nC_{12}H_{22}O_{11(aq)}}$$

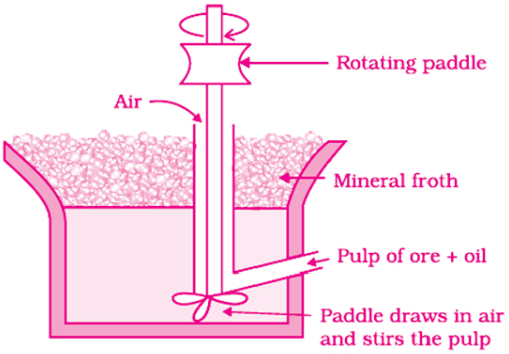
d. Conversion of maltose into glucose:

$$\underset{\text{(Maltose)}}{C_{12}H_{22}O_{11(aq)}} + H_2O_{(l)} \xrightarrow{\text{Maltase}} \underset{\text{(Glucose)}}{2C_6H_{12}O_{6(aq)}}$$

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.



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15. How are XeF_2 and XeF_4 prepared ? Give their structures.

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 .

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

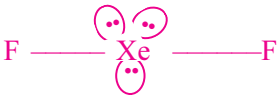
II) Structures:

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

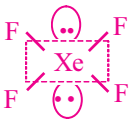
iii) It has two bond pairs and three lone pair.



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.

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16. Using IUPAC norms write the systematic names of the following:

i) $[Co(NH_3)_6]Cl_3$ ii) $[Fe(C_2O_4)_3]^{3-}$ iii) $[Fe(CN)_6]^{-4}$ iv) $[NiCl_4]^{-2}$

A: i. HexaammineCobalt (III)chloride

ii. Trioxalatoferrate(III)ion

iii. Hexacyanoferrate(II) ion

iv. Tetrachloronickelate (II) ion.

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.

a) Steroid hormones. Ex: Estrogens, androgens.

b) Protein hormones. Ex: Insulin, endorphins

c) Amino acid derivatives.

Ex: Thyroxine, epinephrine, norepinephrine

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18. Which compound in each of the following pairs will react faster in S_N2 reaction with –OH? (i) CH_3Br or CH_3I (ii) $(CH_3)_3CCl$ or CH_3Cl

A: i) CH_3I will react faster because bond dissociation energy of C-I Bond is less than that of C- Br bond.

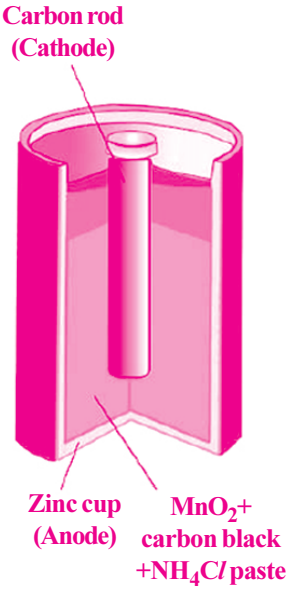
ii) CH_3Cl will react faster because it has less steric hinderance as compared to $(CH_3)_3CCl$.

SECTION-C

19. Give the different types of batteries and explain the construction and working of each type of battery.

A: **(a)Dry cell:** The cell consists of a zinc container which acts as the anode.

The cathode is a carbon rod (graphite) surrounded by powdered manganese dioxide and carbon. The space between the electrodes is filled by a moist paste of ammonium chloride (NH_4Cl) and zinc chloride ($ZnCl_2$).



The electrode reactions are complex, but they can be written in simple way as follows:

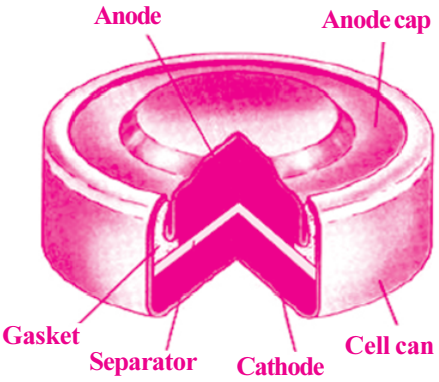
Anode: $Zn_{(s)} \longrightarrow Zn^{+2} + 2e^-$

Cathode: $MnO_2 + NH_4^+ + e^- \rightarrow MnO(OH) + NH_3$

In the reaction at cathode, manganese is reduced from the +4 oxidation state to the +3 oxidation state. Ammonia produced in the reaction forms a complex with Zn+2 to give $[Zn(NH_3)_4]^{+2}$. The cell exhibits a potential of nearly 1.5 V.

(b)Mercury cell:It is suitable for low current devices like hearing aids, watches, etc.,

It consists of zinc-mercury amalgam as anode and a mixture of HgO and carbon as the cathode. The electrolyte is a paste of KOH and ZnO. The electrode reactions for the cell are given below:



Anode:

$Zn(Hg) + 2OH^- \rightarrow ZnO_{(s)} + H_2O + 2e^-$

Cathode:

$HgO + H_2O + 2e^- \rightarrow Hg_{(l)} + 2OH^-$

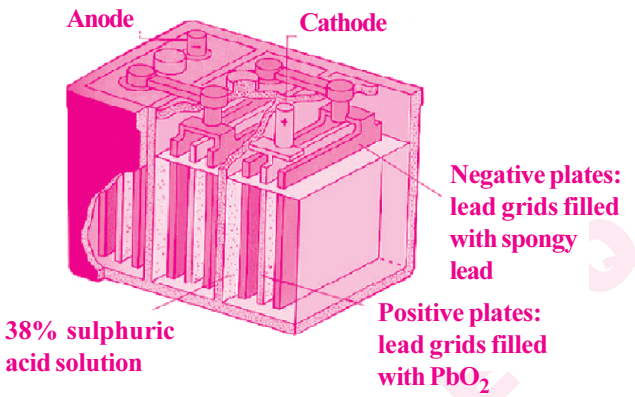
The overall reaction is represented by

$Zn_{(Hg)} + HgO_{(s)} \rightarrow ZnO_{(s)} + Hg_{(l)}$

The cell potential is approximately 1.35 V and it remains constant during its life as the overall reaction does not involve any ion in solution whose concentration can change during its life time.

(c) Lead storage battery: This is commonly used in automobiles and inverters.

It consists of a lead anode and a grid of lead packed with lead dioxide (PbO_2) as cathode. A 38% solution of sulphuric acid is used as electrolyte.



The cell reactions when the battery is in use (discharging) are:

Anode: $Pb_{(s)} + SO^{-2}_{4(aq)} \rightarrow PbSO_{4(s)} + 2e^-$

Cathode:

$$PbO_{2(s)} + SO^{-2}_{4(aq)} + 4H^+_{aq} + 2e^- \rightarrow PbSO_{4(s)} + 2H_2O_{(l)}$$

The overall reaction during discharge is

$$Pb_{(s)} + PbO_{2(s)} + 2H_2SO_{4(aq)} \rightleftharpoons 2PbSO_{4(s)} + 2H_2O_{(l)}$$

These reactions occur during discharge, that is during use of the battery.

On charging the discharged battery the above reaction is reversed and $PbSO_{4(s)}$ on anode and cathode is converted into Pb and PbO_2 respectively.

20. (a) How is Ozone prepared?

(b) How does it react with (i) C_2H_4 (ii) KI (iii) Hg (iv) PbS (v) NO (vi) Ag

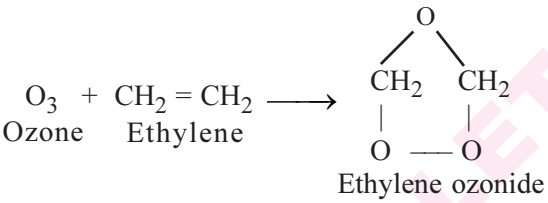
A: (a) Preparation of Ozone:

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

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

(b) Reactions of Ozone:

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



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

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

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

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

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

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

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

v) **Reaction with NO :** Ozone oxidises nitric oxide to **nitrogen dioxide.**

$$NO(g) + O_3(g) \longrightarrow NO_2(g) + O_2(g)$$

vi) **Reaction with Ag :** Ozone oxidises silver to **silver oxide.**

$$2Ag + O_3 \longrightarrow Ag_2O + O_2$$

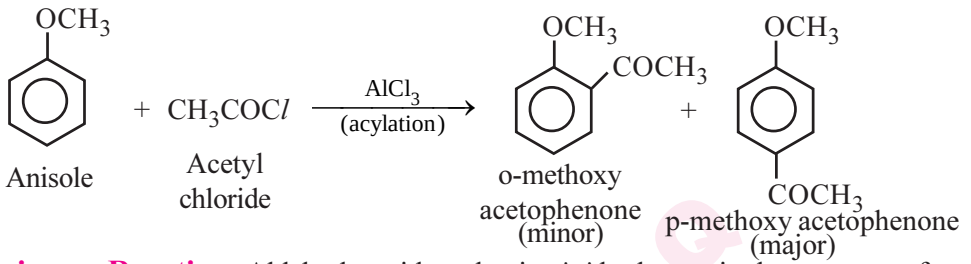
21. Describe the following :

i) Acetylation **ii) Cannizaro reaction**

iii) Cross aldol condensation **iv) Decarboxylation**

A: (i)Friedel Crafts Acylation: Anisole reacts with acetylchloride in the presence of anhydrous $AlCl_3$, to form a mixture of o-methoxy acetophenone and p-methoxyacetophenone.

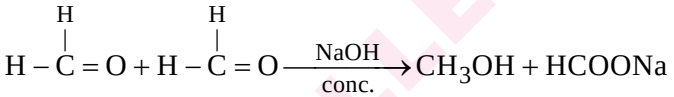
Ex:



Anisole — Acetyl chloride — o-methoxy acetophenone (minor) — p-methoxy acetophenone (major)

(ii)Cannizzaro Reaction: Aldehydes without having 'α' hydrogen in the presence of conc. NaOH undergo self oxidation and reduction to form a mixture of alcohol and salt of acid.

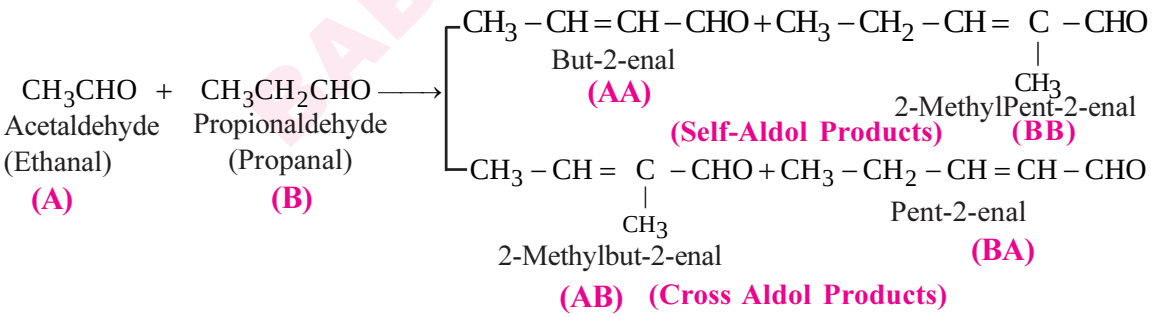
Ex:



Formaldehyde — Methanol Sodium formate

(iii) Cross Aldol Condensation: The 'condensation of two different carbonyl compounds' (one must have an α-hydrogen) in the presence of alkali is called cross aldol condensation.

Condensation of two different halides in the presence of alkali gives four products.



Acetaldehyde (Ethanal) **(A)** — Propionaldehyde (Propanal) **(B)**

But-2-enal **(AA)** — 2-MethylPent-2-enal **(BB)**

(Self-Aldol Products)

2-Methylbut-2-enal — Pent-2-enal **(BA)**

(AB) (Cross Aldol Products)

iv)Decarboxylation : Sodium Ethanoate is heated with **sodalime** to form **Methane.**