CHEMISTRY FOR IIT-JEE

Conducted By :

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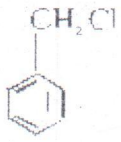
MARKING SCHEME

CHEMISTRY SAMPLE PAPER - III
CLASS - XII

Q. No.	Value Points	Marks
1.	Frenkel defect	1
2.	Zero order reaction	1
3.	2 - Methylcyclopent -3- enecarboxylic acid	1
4.	1 Mole or 6.02×10^{23}	1
5.	One	1
6.	(a) 	½
	(b) 	½
7.	$[Fe(H_2O)_5NO]^{2+}$	1
8.	Except for B_{12}, no other vitamin of group B can be stored in the body and is readily excreted in urine.	1
9.	$P = \frac{ZM}{a^3 N_O}$ g cm^{-3} $a = 1.469 \times 10^{-10}$ m	
	$= 146.9 \times 10^{-10}$ cm	
	$M = \frac{Pa^3 N_O}{Z}$ g	
	$= \frac{19.3 \times (146.9 \times 10^{-10})^3 \times 6.02 \times 10^{23}}{2}$	½
	$= 19.3 \times 3.17 \times 3.01 = 183.5$ g	½
	$r = \frac{\sqrt{3}}{4}$ $a = \frac{\sqrt{3}}{4} \times 1.469 \times 10^{-8}$ cm	½
	$r = 0.634 \times 10^{-8}$ cm	½

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10. (a)	A is a strong electrolyte	½
	B is a weak electrolyte	½
(b)	Molar conductivity of a strong electrolyte increases with dilution as ionic mobility increases.	½
	In a weak electrolyte molar conductivity increases steeply with dilution as degree of dissociation increases.	½
11. (a)	According to the equation $\Delta G = \Delta H - T\Delta S$ for a process to be spentoneous ΔG should be negative. Even though ΔS is negative here, ΔG is negative because reaction is highly exothermic i.e. ΔH is negative.	1
(b)	On increasing temperature desorption occurs in physical adsorption.	½
	Chemical adsorption increases first and then decreases with increase in temprature.	½
12.	Test tube (A) has negative charge.	½
(i)	Test tube (B) positive charge on the colloidal particles.	½
(ii)	In test, tube (A) $I^{\ominus}$ is adsorbed on AgI. [or AgI/ I^- is formed]	½
	In test tube (B) $Ag^{\oplus}$ is adsorbed on AgI. [or AgI / Ag^+ is formed]	½
13. (a)	4	1
(b)	unlike P, N has no vacant d-orbitals in its valence shell.	½
	Bi prefers +3 oxidation state due to inert pair effect.	½
	OR	
(a)	A is NO_2 gas	½
	B is N_2O_4 gas	½
	$MNO_3 + H_2SO_4 \rightarrow MHSO_4 + HNO_3$	
	$Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2$	½
	$2NO \rightleftharpoons N_2O_4$	½
	Brown gas — Colourless gas	
14.	Phenol is a stronger acid, Methyl group due to +I effect concentrates the negative charge on the oxygen, thus destabilizing the intermidiate phenoxide ion in cresol.	1
15. (a)	By reacting it with NaOH and Br_2.	½
(b)	Hoffmann bromamide degradation reaction.	½
(c)	$CH_3 - \underset{\displaystyle Cl}{\underset{|}{CH}} - CH_2 NH_2$	½
	2-Chloropropanamine	½

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16. (a) Chlorine water loses its yellow colour on standing due to the formation of HCl and HClO.

$$Cl_2 + H_2O \rightarrow HCl + HClO$$ 1

(b) $Cl_2 + 2NaoH \rightarrow NaCl + NaClO + H_2O$ 1

(cold & dilute)

17. (a) By reacting with $NaNO_2$ and HCl or HNO_2 at temperature 0-5°C.

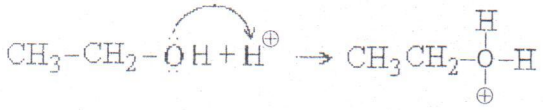
Aniline will form diazonium salt

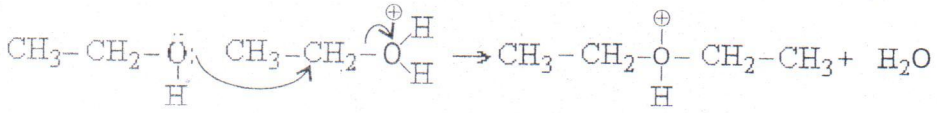
CH_3NH_2 will form methanol and bubbles of N_2 gas will come out of the solution. 1

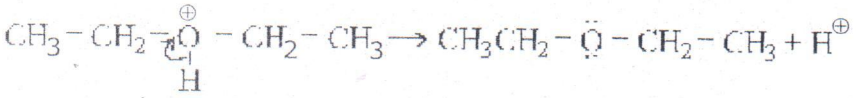
(b) By using Hinsberg's reagent. $C_6H_5SO_2Cl$ 1

$(CH_3)_3N$ will not react.

$(CH_3)_2NH$ will form a product insoluble in alkali.

18. (i)  ½

(ii)  1

(iii)  ½

19. (a) According to Faraday's first law, charge required to deposit 1.50 g

$$\text{Ag} = \frac{96500}{108} \times 1.50 = 1331.70 \text{ Coulombs}$$

$$\text{Time taken} = \frac{1331.70}{1.50} = 887.15 \text{sec}$$ 1

(b) Inert electrodes

$$\text{Anode } 2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$$

$$\text{Cathode } Ag^+(aq) + e^- \rightarrow Ag(s)$$ 1

(c) Ag electrodes

$$\text{Anode} : Ag(s) \rightarrow Ag^+(aq) + e^-$$

$$\text{Cathode} : Ag^+(aq) + e^- \rightarrow Ag(s)$$ 1

20. (a) $\text{Slope} = \frac{k}{2.303}$ ½

(b) As slope = $2 \times 10^{-4} s^{-1}$

$\therefore k = 2.303 \times 2 \times 10^{-4} s^{-1}$

$k = 4.606 \times 10^{-4} s^{-1}$ 1

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(c) For a first order reaction

$$t=\frac{2.303}{k}\log\frac{[R]_0}{[R]}$$ ½

$$\text{At } t_{1/2}, [R]=\frac{[R]_0}{2}$$

$$t_{1/2}=\frac{2.303}{k}\log\frac{[R]_o}{\frac{[R]_o}{2}}$$

$$=\frac{2.303}{k}\log 2$$

$$t_{1/2}=\frac{0.693}{k}$$ 1

21. (a) (i) Mond Process ½

(ii) Van Arkel Method ½

(b) $4\,Au_{(s)}+8CN^-_{(aq)}+2H_2O_{(aq)}+O_{2(g)}\rightarrow 4\left[Au(CN)_2\right]^-_{(aq)}+4\,OH^-_{(aq)}$ ½

$2\left[Au(CN)_2\right]^-_{(aq)}+Zn_{(s)}\rightarrow 2Au_{(s)}+\left[Zn(CN)_4\right]^{2-}_{(aq)}$ ½

In the first reaction Au charges into Au^+ i.e. its oxidation takes place. In the second case

$Au^+\rightarrow Au^o$

i.e. reduction takes place. 1

22. $6XeF_4+12H_2O\rightarrow 4Xe+2XeO_3+24HF+3O_2$ 1

$XeF_6+3H_2O\rightarrow XeO_3+6HF$ 1

Hydrolysis of XeF_4 is a Redox reaction. Here Xe^{4+} is changing into Xe and Xe^{6+}. 1

$Xe^{4+}\rightarrow Xe^o+Xe^{6+}$

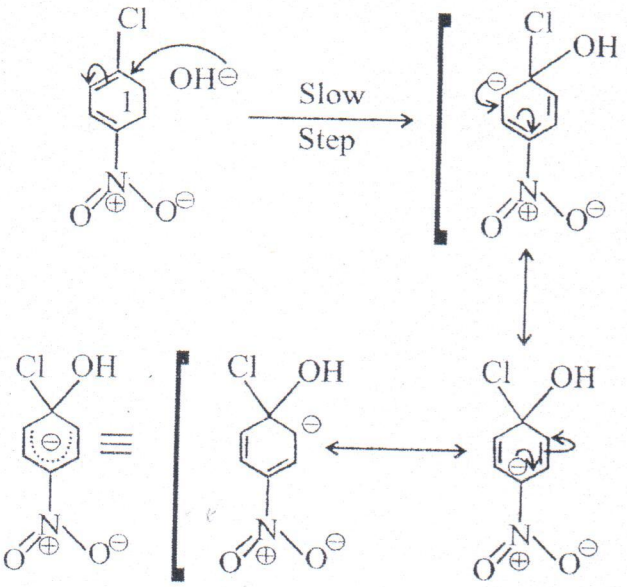
23. (a) In $\left[Ti(H_2O)_6\right]^{3+}$ ion Ti is in 3^+ oxidation state. There is only 1 electron in the d-orbital and its configuration $t_{2g}^{\ 1}\ eg^o$. 1

(b) due to d-d transition, configuration becomes $t_{2g}^{\ o}\ eg^1$. 1

(c) On heating $\left[Ti(H_2O)_6\right]^{3+}$ ion becomes colourless as there is no ligand (H_2O) left in heating. 1

In the absence of ligand, crystal field splitting does not occur.

Q. No.	Value Points	Marks
24. (a)	1-chloro pentane Surface area and hence Van der Waal's forces of attraction decreases on branching.	1
(b)	In this reaction a carbanion intermediate is formed. This is stabilized by Resonance as shown below in p-nitrochloro benzene.	½

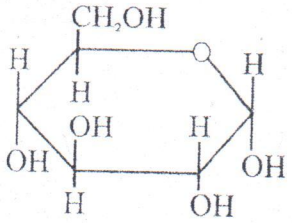


1

The -I effect of nitro group further stabilizes the intermediate.
Hence p- nitrochlorobenzene reacts faster than chloro benzene. ½

25. (a) This indicates that the aldehyde group in glucose is not free. 1

(b)



1

α – D – (+) – Glucopyranose

(c) 'D' gives the configuration i.e. the – OH gp at carbon 5 is on the right hand side.
(+) indicates that the isomer is dextro rotatory.

26. (a) Benzoyl peroxide is initiator.
It forms a free radical. 1

(b) LDPE :- Low Density Polyethylene ½

LDPE is obtained by the polymerisation of ethene under high pressure of 1000 to 2000 Atm at 350K to 570 K temperature in the presence of an initiator. ½

HDPE High Density Polyethylene ½

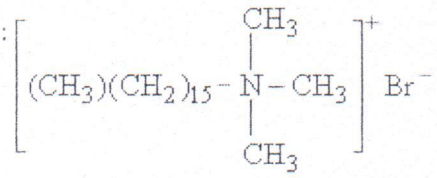
It is obtained when polymerisation is done in the presence of Ziegler Natta Catalyst at 333 K to 343 K under 6 - 7 Atm pressure. ½

27. Anionic detergents : These are sodium salts of sulphonated long chain alcohols or hydrocarbons.

Q. No.	Value Points	Marks

Eg : Sodium Salt of alkyl benzene sulphonates. 1

Cationic detergents : These are quarternary ammonium salts of amines with acetates, chlorides or bromides as anions.

eg :  1

Non-ionic detergents : They do not contain any ion in them.

eg : Ester of stearic acid and polyethylene glycol 1

OR

Antihistamines are drugs that interfere with the natural action of histamines.

eg : (1) Bromopheniramine 1

(2) Terfenadine 1

They interfere with the natural action of histamine by competing with histamine binding sites of receptor where histamine exerts its effect. 1

28. (a) $\frac{\Delta P}{P^o} = i X_B$

$i = \frac{1}{2}$

$X_B = \frac{n_B}{n_A + n_B} = \frac{61/122}{61/122 + \frac{500}{78}}$

$= \frac{0.5}{0.5 + 6.41} = \frac{0.5}{6.91}$ 1

$\frac{\Delta P}{66.6} = \frac{1}{2} \cdot \frac{50}{691}$

$\Delta P = \frac{50 \times 66.6}{691 \times 2} = 2.41$ ½

$P^o - P = 2.41$

P = 66.6 - 2.40

= 64.20 torr ½

(b) In the absence of dimerisation

i = 1

$$\frac{\Delta P}{P^0} = X_B$$

$$\Delta P = \frac{50}{691} \times 66.6 = 4.82$$ 1

$$P = 66.6 - 4.82 = 61.78 \text{ torr}$$

(c) From Raoult's law

$P_1 = x_1 P_1^\circ$

$P_2 = x_2 P_2^\circ$

x_1 = mole fraction of liquid 1

x_2= mole fraction of liquid 2

y_1 = Mole fraction of component -1 in vapour phase.

y_2 = Mole fraction of component - 2 in vapour phase.

$$y_1 = \frac{P_1}{P_{total}} = \frac{P_1}{P_1 + P_2}$$ ½

$$y_2 = \frac{P_2}{P_{total}} = \frac{P_2}{P_1 + P_2}$$ ½

$$y_1 = \frac{x_1 P_1^{\,O}}{x_1 P_1^{\,O} + x_2 P_2^{\,O}} = \frac{x_1 P_1^{\,O}}{x_1 P_1^{\,O} + (1 - x_1) P_2^{\,O}}$$

$$y_2 = \frac{x_2 P_2^{\,O}}{x_1 P_1^{\,O} + x_2 P_2^{\,O}}$$ 1

OR

28. (a) 1 M has higher concentration than 1m. ½

1 m solution = 1 mole in 1000 g solvent

or

1 mole in 1000 cm^3 of solvent if d = 1 g / cm^3 1

But 1 M solution = 1 mole in 1000 cm^3 of solution i.e. solvent is less here,

(b) $\Delta T_f = 0 - (-0.24) = +0.24^\circ C$ ½

$$M_2 = \frac{1000 K_f w_2}{\Delta T_f w_1}$$

$$= \frac{1000 \times 1.86 \times 5}{0.24 \times 100} g\,mol^{-1}$$ ½

$= 38.75 \text{ g mol}^{-1}$ ½

Theoretical mol mass of KCl

$= 39 + 35.5 = 74.5 \text{ g mol}^{-1}$ ½

$$i = \frac{\text{calculated mol mass}}{\text{Theoretical mol mass}} = \frac{74.5}{38.75}$$ ½

$$= 1.92$$

Q. No.	Value Points	Marks

$KCl \rightleftharpoons K^+ + Cl^-$

Initial moles 1 mole 0 0

After dissociation $1 - \alpha$ α α

Total no. of moles after dissociation

$= 1 - \alpha + \alpha + \alpha = 1 + \alpha$

$$i = \frac{1+\alpha}{1}$$

$\alpha = i - 1 = 1.92 - 1 = 0.92$ ½

Percentage dissociation = 92% ½

29. (a) CuF_2 ½

In CuF_2, Cu^{2+} ($3d^9$) has an unpaired electron. ½

(b) (i) Oxidation state of Cr in CrO_4^{2-} is 6+. This is its maximum oxidation state and it can only gain electrons. ½

Oxidation state of Mn in MnO_4^{2-} is 6+. Mn can further loose electron to become 7+ which is its highest oxidation state. ½

(ii) This is due to lanthanoid contraction. 1

(iii) In its highest oxidation state manganese can only accpet electrons and so is acidic in behaviour. 1

Similarly in its lowest oxidation state, it can donate electrons and hence is basic. 1

(iv) Mn (II) has maximum number of unpaired electrons i.e. $3d^5$.

OR

30. (a) Dil H_2SO_4 is an oxidising agent and oxidizes $FeSO_4$ to $Fe_2(SO_4)_3$. 1

Dil HCl is a reducing agent and liberates chlorine on reacting with $KMnO_4$ solution.

Thus, part of the oxygen produced from $KMnO_4$ is used up by HCl.

(b) (i) In these oxoanions the oxygen atoms are directly bonded to the transition metal.

Since oxygen is highly electronegative, the oxoanions bring out the highest oxidation state of the metal. 1

(ii) Ce^{4+} has the tendency to attain +3 oxidation state and so it is used as an oxidizing agent in volumetric analysis. 1

(iii) This is due to the presence of voids of appropriate sizes in their crystal lattices. 1

(iv) Zn^{2+} ion has all its orbitals completely filled where as in Cu^{2+} ion there is one half-filled 3d-orbital. It therefor has a tendency to form coloured salts where as Zn^{2+} has no such tendency. 1

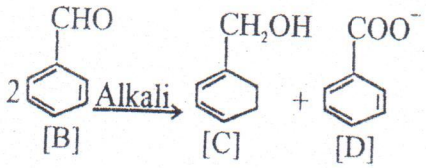
31. (i) A is CH_3CHO or ethanal ½

B is C_6H_5CHO or benzaldehyde. ½

(ii) (2)

$$2CH_3CHO \xrightleftharpoons{NaOH} \underset{[A]}{CH_3-\underset{OH}{\underset{|}{CH}}-CH_2CHO} \xrightarrow{-H_2O} \underset{2-\text{Butenal}}{CH_3-CH=CH-CHO}$$

Q. No.	Value Points	Marks



1

(iii) Toluene

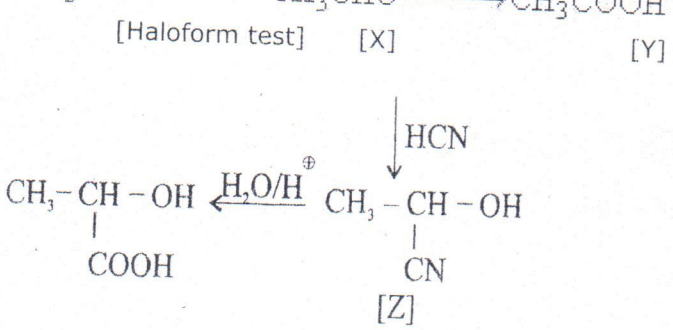
1

OR

(i) X is CH_3CHO Y is CH_3COOH

(ii) 3-Hydroxybutanal. 1

(iii) 1



(3)