CHEMISTRY FOR IIT-JEE

Conducted by:

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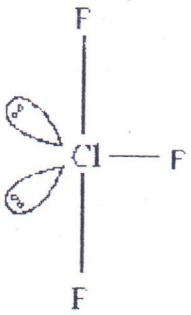
MARKING SCHEME

CHEMISTRY SAMPLE PAPER - II
CLASS - XII

Q.No.	Value Points	Marks
1.	4 – Bromo – 3– methyl pent – 2– ene.	(1)
2.	Dispersed phase : gas Dispersion medium : liquid	(½) (½)
3.	$XeF_6 + 3H_2O \rightarrow XeO_3 + 6HF$	(1)
4.	$H_3C-\underset{\underset{CH_3}{|}}{C}=CH-\underset{\underset{O}{||}}{C}-CH_3$	(1)
5.	XY	(1)
6.	$i = \frac{1}{4}$	(1)
7.	NaCN, Sodium cyanide, used as a depressant.	(1)
8.	 T - shape	(1)
9.	$\Delta T_f = K_f x \frac{w_B}{m_B} x \frac{1000}{w_A}$ $= 1.86 x \frac{12.4}{62} x \frac{1000}{100}$ $= 3.76K$	

since water freezes at O°C, so freezing point of the solution containing ethylene glycol will be-3.76 °C (1)

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$$\Delta T_b = K_b \times \frac{w_B}{M_B} \times \frac{1000}{w_A}$$

$$= 0.512 \times \frac{12.4}{62} \times \frac{1000}{100}$$

$$= 1.024 K$$

since water boils at 100^0C, so a solution containing ethylene glycol will boil at 101.024^0C, so it is advisable to keep this substance in car radiator during summer. (1)

10. (i) The reaction $A \rightarrow P$ is a zero order reaction. (½)

(ii) For the reaction $A \xrightarrow{k} P$

$$\text{rate} = \frac{-d[A]}{dt} = k[A]^0 \quad (½)$$

$$-d[A] = k\,dt$$

integrating both the sides :

$$[A] = kt + C \quad \text{----------(i)}$$

where C = constant of integration

at t = o, $[A] = [A]_o$

Substituting this in equation (i)

$$C = [A]_o$$

Substituting the value of 'C' in eqvation (i)

$$[A] = -kt + [A]_o$$

$$kt = [A]_o - [A]$$

$$t = \frac{[A]_0 - [A]}{k} \quad (1)$$

11. The reaction for reducing action of carbon is : (½)

$$MgO(s) + C(s) \rightarrow Mg(s) + CO(g)$$

$$\Delta_r G = \Delta_f G(CO) - \Delta_f G(MgO)$$

$$= \frac{\text{At } 2273K}{-628} - (-314) \quad (½)$$

$$= -314 kJ/mol \text{ at } 2273K$$

$$\text{At } 1273 K$$

$$\Delta_r G = -439 - (-941)$$

$$= +502 \text{ kJ/mol at } 1273 K \quad (½)$$

So carbon can be used as reducing agent with MgO(s) at 2273K. (½)

12. The two components of starch are: (½)

(a)Amylose (½)

(b)Amylopectin

Amylose is a straight chain polymer of $\alpha - D - (+)$ glucose, while amylopectin is a branched chain polymer o (1)

$\alpha - D -$ glucose.

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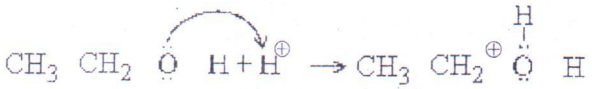
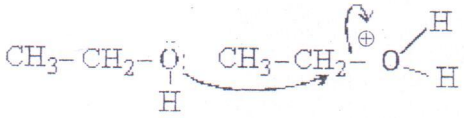
13. (a) On boiling protein of egg gets denatured or coagulated and water of egg get absorbed in it. (1)

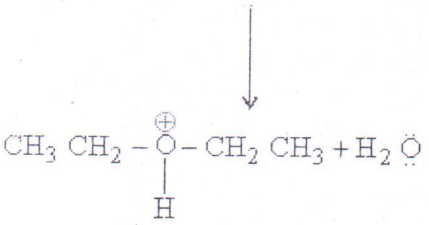
(b) Hydrogen bonding between $-\overset{\overset{O}{\|}}{C}-$ and - NH- groups of peptide bond. (1)

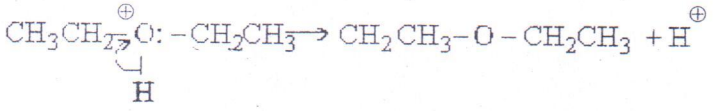
14. $2CH_3CH_2\ddot{O}H \xrightarrow[H_2SO_4]{Conc} CH_3CH_2\ddot{O}CH_2CH_3$

mechanism :

(i)  (½)

(ii)  (½)

 (½)

(iii)  (½)

15. (a) $RNH_2 + CHCl_3 + 3KOH \rightarrow RNC + 3KCl + 3H_2O$ (½)

Carbylamine reaction (½)

(b) $RCONH_2 + Br_2 + 4NaOH \rightarrow RNH_2 + Na_2CO_3 + 2NaBr + 2H_2O$ (½)

Hoffmann bromamide degradation reaction (½)

16. (a) Addition of neutral ferric chloride solution to phenol will give a violet colouration, while no such colouration will be observed in case of benzyl alcohol. (1)

(b) On addition of Lucas reagent (a mixture of concentrated hydrochloric acid and anhydrous zinc chloride) to 2 - methyl - 2- propanol will give a white turbidity immediately while 2 - Butanol will give turbidity after five minutes. (1)

17. In gaseous phase, basic character of amines increases with increase in number of electron releasing alkyl groups, due to + I effect, so trend of basic character is $3^0 > 2^0 > 1^0$ (1)

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but in aqueous phase, solvation of ammonium cation occurs by water molecules, greater the size of ion, lesser will be the solvation, and lesser will be the stability of ion, so on combining + I effect and solvation effect, in aqueous phase trend changes to $2^0 > 3^0 > 1^0$. (1)

OR

(a) During friedal craft's alkylation, aluminium chloride acts as a catalyst, as well as a Lewis acid, it forms salt with - NH_2 group of aniline, so that - NH_2 group acquires a positive charge, and acts as a deactivating group, so aniline does not undergo FCA. (1)

(b) During nitration, in strongly acidic medium aniline is protonated to form anilinium ion, which is a meta directing group, so along with o- & p- isomers, meta isomer is also obtained. (1)

18. (a) At higher altitudes, partial pressure of oxygen is less than that at ground level, so that oxygen concentration becomes less in blood or tissues. Hence people suffer from anoxia. (1)

(b) Due to the fomation of complex K_2 (Hg I_4), number of particles in the solution decreases and hence the freezing point is raised. (1)

19. $$\delta = \frac{Z \times M}{a^3 \times N_A}$$ (½)

$$6.23 = \frac{Z \times 60}{(400)^3 \times 10^{-30} \times 6.023 \times 10^{23}}$$

Z = 4 (1)

The unit cell is face centered cubic (½)

radius 'r' = $\frac{a}{2\sqrt{2}}$

$= \frac{400}{2\sqrt{2}}$

= 141.4 pm. (1)

20. (a) Tetra flouro ethene (½)
addition polymer (½)
(b) Phenol and formaldehyde (½)
Condensation polymer (½)
(c) Isoprene (½)
addition polymer (½)

21. (a) tetraquadichloro chromium (III) chloride. (1)
(b) $[FeF_6]^{4-}$ has 4 unpaired electron as I^- is a weak field ligand (½)
$[Fe(CN)_6]^{4-}$ has zero unpaired electron as CN^- is a strong field ligand. (½)

Q.No.	Value Points	Marks

(c) Ionisation isomerism. (½)

on addition of dilute HCl followed by aqueous $BaCl_2$, $[Co(NH_3)_5]SO_4$ will give a white precipitate while the other coordination compound will not give any white precipitate. (½)

22. (a) As ferric hydroxide, $Fe(OH)_3$ is a positively charged sol, so it gets coagulated by chloride ions, Cl^-, released by NaCl solution. (1)

(b) Cottrell's smoke precipitator, neutraliser the charge on unburnt carbon particles, coming out of chimney and they get precipitated and settle down at the floor of the chamber. (1)

(c) As physical adsorption, involves only weak vander woal's force of interaction, so many layers of adsorbate get attached, while chemisorption involves chemical bond formation between adsorbate and adsorbent, so monolayer is formed. (1)

23. (a) Chlorine water produces nascent oxygen which is responsible for bleaching action and oxidation:

$$Cl_2 + H_2O \rightarrow 2HCl + [O]$$ (1)

(b) Both H_3PO_2 and H_3PO_3 have P- H bonds, so they act as reducing agents, but H_3PO_4, has no P-H bond but has O-H bonds, so it cannot act as a reducing agent. (1)

(c) Ozone gas acts as a strong oxidising agent, so it oxidises iodide ions to Iodine

$$2I^-(aq) + H_2O(l) + O_3(g) \rightarrow 2^{(-)}OH(aq) + I_2(g) + O_2(g)$$

I_2 Vapours evolved have violet colour. (1)

24. For first order reaction

(a) $$k = \frac{2.303}{t} \log \frac{[R]_o}{[R]_t}$$

$$5 \times 10^{-4} = \frac{2.303}{2 \times 60} \log \frac{0.25}{[R]_t}$$

$[R]_t = 0.23$ M (1)

$$t_{1/2} = \frac{0.693}{5 \times 10^{-4}} \text{ sec}$$

$$= 1386 \text{ sec}$$ (1)

(b) (i) $$\text{Rate} = \frac{1}{3}\frac{d[C]}{dt}$$

$$= \frac{1}{3} \times 1.3 \times 10^{-4}$$

$$= 0.43 \times 10^{-4} \text{ mol } L^{-1} \text{ sec}^{-1}$$ (1)

Q.No.	Value Points	Marks

(ii) $= \frac{-d[A]}{dt} = \frac{2}{3} \times \frac{d[C]}{dt}$

$= 0.86 \times 10^{-4} \text{mol } L^{-1} \text{sec}^{-1}$ (½)

25. (a) 1- Bromo butone, being a primary alkyl halide would react faster by S_N^2 pathway, due to less steric hinderance. (1)

(b) In allyl chloride, $CH_2 = CH - CH_2Cl$, the carbocation $CH_2 = \overset{\curvearrowright}{CH} - \overset{\oplus}{C}H_2$ formed is stabilised due to resonance while the carbocation formed form n - propyl chloride i.e. $CH_3CH_2\overset{\oplus}{C}H_2$ is less stable, so allyl chloride is more reactive towards nucleophilic substitution reaction. (1)

(c) KCN, being ionic, $^{\ominus}CN$ ions liberated reacts with halo alkanes forming alkyl cyanides but in $Ag\overset{\ominus}{C}N$, being covalent, does not release $^{\ominus}CN$ ion but lone pair on nitrogen acts as a nucleophile, resulting in formation of iso cyanides. (1)

26. (a) Nitrogen being smaller is size forms $P\pi - P\pi$ multiple bonding with carbon, So $^{\ominus}CN$ ion is known, but phosphorus does not form $P\pi - P\pi$ bond as it is larger in size. (1)

(b) ∵ NO_2 is an odd electron molecule and there fore gets dimerised to stable N_2O_4. (1)

(c) Because ICl has less bond dissociation enthalpy than I_2

OR

'A' = Sulphur (½)

B = H_2S gas (½)

C = SO_2 gas (½)

D = SO_3 gas (½)

$5SO_2(g) + 2MnO_4^- + 2H_2O \rightarrow 5SO_4^{2-} + 4H^+ + 2Mn^{2+}$ (½)

$2SO_2(g) + O_2(g) \xrightarrow{V_2O_5} 2SO_3(g)$ (½)

27. (a) Due to antiblood clotting action, aspirin is used for prevention of heart attacks. (1)

(b) As artificial sweetners provide less calories than natural sweetners. (1)

(c) Detergents have highly branched hydrocarbon chain, which can not be degraded by bacteria, so they get accumulated while soap containing straight hydrocarbon chain can be degraded easily (1)

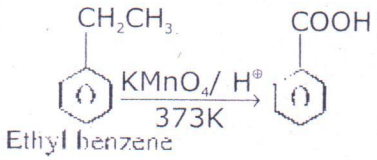
28. (a) As 'A' gives positive iodo form test, so it has $CH_3 - \underset{\underset{O}{\|}}{C} - \text{group}$ (½)

Q.No.	Value Points	Marks

as 'A' gives positive tollen's test, so it must have – CHO group (½)

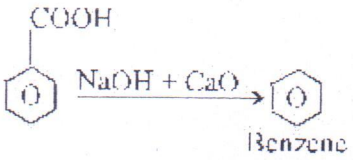
So A is $CH_3-\overset{\overset{O}{\|}}{C}-CH_2\,CH_2\,CHO$ (1)

(b) (i)



Ethyl benzene

(½)



Benzene (½)

(ii) $2CH_3CHO \xrightarrow[NaOH]{dilute} CH_3\,\underset{\underset{OH}{|}}{CH}-CH_2CHO$ (½)

Acetaldehyde

$CH_3\,\underset{\underset{OH}{|}}{C}\,H-CH_2CHO \xrightarrow{NaBH_4} CH_3\,\underset{\underset{OH}{|}}{CH}-CH_2-\underset{\underset{OH}{|}}{CH_2}$ (½)

Butane - 1, 3 -diol

(iii) $CH_3-\overset{\overset{OH}{|}}{\underset{\|}{C}}-CH_3 \xrightarrow{NaBH_4} CH_3CH-\underset{\underset{OH}{|}}{CH_3}$

Acetone (½)

$CH_3-\overset{\overset{OH}{|}}{C}-CH_3 \xrightarrow{Conc.H_2SO_4} CH_3CH=CH_2$ (½)

OR

(a) As 'A' does not give Fehling's or Tollen's test, so it does not have – CHO group but it gives positive iodoform test and DNP test so it has $CH_3-\overset{\overset{O}{\|}}{C}$ group (1)

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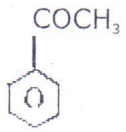
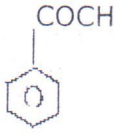
So 'A' is :



Acetophenone (1)

B is carboxylic acid obtained by oxidation of A with H_2CrO_4.

So 'B' is



Benzoic acid (1)

(b) A = $(CH_3)_2CH - \underset{\underset{O}{\|}}{C} - Cl$ (1)

B = $CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-COONa$ (½)

C = CHI_3 (½)

29. (a) $E^{o}_{cell} = E^{o}_{c} - E^{o}_{a} = -0.403 - (-0.763) = 0.360V$

$$\text{As } \log Kc = \left(\frac{nE^{o}_{cell}}{0.059}\right)$$

$$= \left(\frac{2 \times 0.360}{0.059}\right)$$

$$= \left(\frac{0.720}{0.059}\right) = 12.20$$ (1)

K_c = antilog (12.20)

= 1.585×10^{12} (1)

(b) M = Z I t (½)

$$0.369 = \frac{x}{2 \times 96500} \times 0.75 \times 25 \times 60$$ (x = molar mass of copper)

x = 63.3 g/mol. (1)

(c) E^{o}_{cell} for reaction of tarnished silver ware with aluminium pan is

(− 0.71 V) − (− 1.66 V) i.e. + 0.95 V (1)

Tarnished silver ware, therefore, can be cleaned by placing it in an aluminium pan as E^{o}_{cell} is positive. (½)

Q.No.	Value Points OR	Marks
(1(a)	E°_{cell} = (–2.87 V) – (1.50 V) = - 4.37 V	(½)
	ΔG°_{cell} = - 6 x 96500 x - 4.37 V = + 2350.230 kJ/mol	(½)
	Since $\Delta_r G^{\circ}$ is positive, reaction is non spontaneous.	(1)
	Au^{3+}/Au half cell will be a reducing agent Ca^{2+}/Ca half cell will be an oxidising agent	(½)
(b)	$\Lambda^{c}_{m} = K \times \frac{1000}{\text{molarity}}$	(½)
	K = specific conductance $= \frac{4 \times 10^{-5}\ s/cm \times 1000}{.001}$ = 40 $Scm^2\ mol^{-1}$	(½)
	$\alpha = \frac{\Lambda m}{\Lambda^{o}_{m}}$ $\alpha = \frac{40}{390.5}$ $= 0.103$	(½)
	$K_c = \frac{C\alpha^2}{1-\alpha}$ $= \frac{0.001 \times (.103)^2}{1-.103}$ $= 1.19 \times 10^{-5}$	(½)
30.	A = MnO_2	(½)
	B = K_2MnO_4	(½)
	C = $KMnO_4$	(½)
	$2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$	(1)
	$MnO_4^{2-} \xrightarrow[\text{oxidation in alkaline solution}]{\text{electrotyt ic}} MnO_4^-$	(½)
	(b) In acidic medium K_2MnO_4 changes to give purple coloured compound along with black precipitate. $3MnO_4^{2-} \xrightarrow{4H^+} 2MnO_4^- + MnO_2 + 2H_2O$ Green compound → purple compound + Black	(1½)

Q.No.	Value Points	Marks

It is called disproportionation reaction. (½)

OR

(a) Due to strong interatomic interaction between unpaired valence electrons. (1)

(b) Because Cl(IV) has extrastability due to empty f^0 orbital (1)

(c) In $Mn^{2+}d^5$ configuration leads to extrastability of half filled configuration, so Mn^{3+}/ Mn^{2+} (d^4) tends to get converted to stable d^5, configuration of Mn^{2+}, by accepting an electron so Mn^{3+}/Mn^{2+} redox couple has more positive potential than $\underset{(d^5)}{Fe^{3+}}/\underset{(d^4)}{Fe^{2+}}$ couple (1)

(d) Due to more negative enthalpy of hydration of Cu^{2+} (aq) than Cu^{+}(aq) which compensates for second ionisation enthalpy of copper. (1)

(e) In the third transition series after lanthanum there is lanthanoid contraction, due to ineffective shielding by intervening f- orbital electrons and hence second and third transition series elements have similar atomic radii. (1)

A COMPLETE PACKAGE FOR IIT-JEE CHEMISTRY