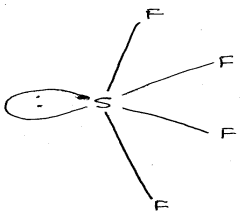
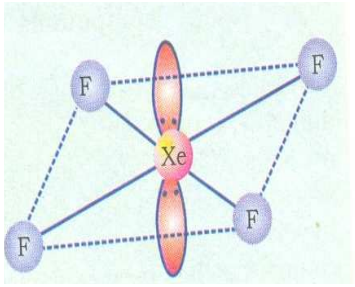
Marking Scheme

Chemistry

Delhi- SET (56/1/1)

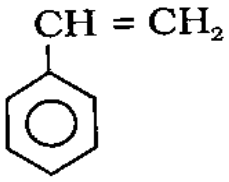
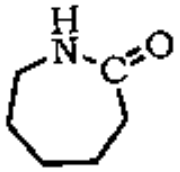
1	6:6 or 6	1
2	The sum of powers of the concentration terms of the reactants in the rate law expression is called the order of that chemical reaction. **Or** rate = $k[A]^p[B]^q$ Order of reaction = p+q	1
3	Due to unbalanced bombardment of the colloidal particles by the molecules of the dispersion medium.	1
4	NO_2^+	1
5	2,5-Dimethylhexane -1,3-diol.	1
6.	$(CH_3)_2CHCOOH < CH_3CH(Br)CH_2COOH < CH_3CH_2CH(Br)COOH$	1
7.	$C_6H_5N_2^+Cl^- + KI \rightarrow C_6H_5I + KCl + N_2$	1
8.	Phenol (or any other correct one)	1
9.	Aryl halides are less ractive towards nucleophilic substitution **because of any of the following reasons with correct explanation:** (i) Resonance effect stabilization (ii) sp^2 hybridization in haloarenes being more electronegative than sp^3 in haloalkanes. (iii) Instability of phenyl cation which is not stabilized by resonance. (iv) possible repulsion between electron rich nucleophile and electron rich arene (atleast two reasons to be given) OR (i) CH_3I, Because iodine is a better leaving group due to its larger size. (ii) CH_3Cl,the presence of bulky group on the carbon atom in $(CH_3)_2CCl$ has an inhibiting effect.	2 1 1
10	(a) 1-Bromobut-2-ene (b) $CH_3CH_2CH_2CH_2Br$	1 1
11	Henry's law states that at a constant temperature, the solubility of a gas in a liquid is directly proportional to the pressure of the gas over the solution. Applications (i) To increase the solubility of CO_2 in soft drinks and soda water, the bottle is sealed under high pressure. (ii) Scuba divers must cope with high concentrations of dissolved Nitrogen with breathing air at high pressure underwater.To avoid this air is diluted with He. (iii) At high altitudes the partial pressure of oxygen is less than that at the ground level. Low blood oxygen causes anoxia. ***(any two)***	1 1

12	$k = \frac{2.303}{t} \log \frac{[A_0]}{[A]}$ $k = \frac{2.303}{40\text{min}} \log \frac{100}{70}$ $k = \frac{2.303}{40} \times 0.155 = 0.00892\text{min}^{-1}$ $t_{1/2} = \frac{0.693}{k}$ $t_{1/2} = \frac{0.693}{0.00892}\text{ min}$ $t_{1/2} = 77.7\text{min}$	½ ½ 1
13	Rate constant 'k' of a reaction is defined as the rate of reaction when the concentration of the reactant(s) is unity. / or Rate constant is the proportionality factor in the rate law. (i) Unit for 'k' for a zero order reaction = mol L^{-1} s^{-1} (ii) Unit for 'k' for a first order reaction = s^{-1}	1 ½ ½
14	(i) Peptide linkage: Peptide linkage is an amide (-CO-NH-) bond formed between –COOH and $–NH_2$ group in protein formation. (ii) Denaturation: When a protein in its native form, is subjected to physical change like change in temperature or chemical change like change in pH,protein loses its biological activity. This is called denaturation of protein.	1 1
15 *	(i) Despite having the aldehyde group, glucose does not give 2,4-DNP test or Schiff's test. (ii) It does not form the hydrogensulphite addition product with $NaHSO_3$. (iii) The pentaacetate of glucose does not react with hydroxylamine indicating the absence of free –CHO group. ***(any two)***	1+1
16	(i)The lone pair of electrons on N atom in NH_3 is directed and not diffused / delocalized as it is in PH_3 due to larger size of P/ or due to availability of d-orbitals in P. (ii) S_2 molecule like O_2, has two unpaired electrons in antibonding π^* orbitals.	1+1

17	SF_4 	1
	XeF_4 	1
18.	Biodegradable detergents are those detergents which are easily degraded by the micro-organisms and hence are pollution free. ex. Soap / Sodium laurylsulphate / any other unbranched chain detergent. *(any one)* Non Biodegradable Detergents are those detergents which cannot be degraded by the bacteria easily and hence create pollution. **[example not essential]**	½ ½ 1
19	The solids with intermediate conductivities between insulators and conductors are termed **<u>semiconductors.</u>** (i) **n- type semiconductor** : It is obtained by doping Si or Ge with a group 15 element like P. Out of 5 valence electrons , only 4 are involved in bond formation and the fifth electron is delocalized and can be easily provided to the conduction band. The conduction is thus mainly caused by the movement of electron. (ii)**p – type semi conductor :** It is obtained by doping Si or Ge with a group 13 element like Gallium which contains only 3 valence electrons. Due to missing of 4^{th} valence electron,electron hole or electron vacancy is created The movement of these positively charged hole is responsible for the conduction.	1 1 1

20	$\Delta T_f = K_f m$ No. of moles of glucose = $\frac{54\ g}{180\ g\ mol^{-1}}$ Molality of Glucose solution = $\frac{54}{180}$ mol x $\frac{1000}{250kg}$ = 1.20mol kg^{-1} $\Delta T_f = K_f m$ = 1.86 K kg mol^{-1} x 1.20 mol kg^{-1} = 2.23 K Temperature at which solution freezes =(273.15 – 2.23K = 270.77K or -2.23^0C Or (273.000 – 2.23)K = 270.7 K	1 1 1
21	Lyophilic sols are solvent attracting sols ex. Gum,gelatine,starch,rubber *(any one)* Lyophobic sols are solvent repelling sols ex. Metal sols,metal sulphides *(any one)* Lyophobic sols are readily coagulated because they are not stable.	½+½ ½+½ ½+½
22	(i) Froth floatation process: This method is based on the difference in the wettability of the mineral particles (sulphide ores)and the gangue particles.The mineral particles become wet by oils while the gangue particles by water and hence gets separated. (ii) Zone refining: This method is based on the principle that the impurities are more soluble in the melt than in the solid state of metal. (iii) Refining by Liquation:The method is based on the lower melting point of the metal than the impurities and tendency of the molten metal to flow on the sloping surface.	1 1 1

23	(i)$3Cl_2+6NaOH \rightarrow 5NaCl+NaClO_3+3H_2O$ (ii)$4H_3PO_3 \rightarrow 3H_3PO_4+PH_3$ (iii)$Xe^+[PtF_6]^-$ OR (i)$Ca_3P_2(s)+ 6H_2O(l) \rightarrow 3Ca(OH)_2(aq) + 2PH_3(g)$ (ii)$Cu^{2+}(aq)+ 4NH_3(aq) \rightarrow [Cu(NH_3)_4]^{2+}(aq)$ (iii)$2F_2(g)+ 2H_2O(l) \rightarrow 4H^+(aq) + 4F^-(aq) + O_2(g)$	1x3=3
24 *	(a) Ligand: The ions or molecules bound to the central atom/ion in the coordination entity are called ligands. ex. of bidentate ligand- ethane-1,2-diamine or oxalate ion (or any other) (b)* In $[Ni(CN)_4]^{2-}$, nickel is Ni^{2+}, $(3d^8)$,with strong Ligand like CN^-, all the electrons are paired up in four d-orbitals resulting into dsp^2 hybridization giving square planar structure and diamagnetic character. In $Ni(CO)_4$:, nickel is in zero valence state , $(3d^8 4s^2)$,with strong Ligand like CO,$4s^2$,electrons are pushed to the d-orbitals resulting into sp^3 hybridization giving tetrahedral shape and diamagnetic in nature. (or this can be explained by drawing orbital configurations too.)	½,½ 1 1
25	(i) PCC, $KMnO_4$,CrO_3 *(any one)* (ii) $LiAlH_4$,$NaBH_4$ *(any one)* (iii)aqueous Br_2 **(or any other suitable reagent)**	1x 3=3

26	(i) It is because in aniline the $-NH_2$ group is attached directly to the benzene ring.It results in the unshared electron pair on nitrogen atom to be in conjugation with the benzene ring and thus making it less available for protonation. *(or any other suitable reason)* (ii) Methyl amine in water gives OH^- ions which react with $FeCl_3$ to give precipitate of ferric hydroxide/ or $CH_3NH_2 + H_2O \longrightarrow CH_3\overset{+}{N}H_3OH^- \longrightarrow CH_3NH_3^+ + OH^-$ $Fe^{3+} + 3OH^- \longrightarrow Fe(OH)_3$ (iii)Aniline does not undergo Friedel-Crafts reaction due to salt formation with aluminium chloride, the Lewis acid.	1X 3=3
27	(i) Buna-S : 1,3- Butadiene and Styrene **$CH_2 = CH - CH = CH_2$ and**  (ii) Neoprene:Chloroprene **$CH_2 = \underset{\displaystyle Cl}{\underset{\displaystyle |}{C}} - CH = CH_2$** (iii) Nylon-6: Caprolactum 	½+½ ½+½ ½+½

28 *

$\Lambda_m = \frac{\kappa}{c}$ 1

$= \frac{7.896 \times 10^{-5}\ S\ cm^{-1} \times 1000\ cm^3 L^{-1}}{0.00241\ mol L^{-1}}$

$= 32.76\ Scm^2\ mol^{-1}$

$\alpha = \frac{\Lambda_m}{\Lambda_m^0}$ 1

$= \frac{32.76\ Scm^2\ mol^{-1}}{390.5\ Scm^2\ mol^{-1}}$

$= 0.084\ Scm^2\ mol^{-1}$ 1

$K = \frac{C\alpha^2}{C(1-\alpha)} = C\alpha^2$ 1

$= 0.00241 \times (0.084)^2$ 1

$= 1.7 \times 10^{-5}$ or 1.865×10^{-5} **(if α is not neglected)**

OR

$Ag^+ + e^- \rightarrow Ag$

108 g is deposited by 96500C electric charge

1.45 g of silver is deposited by $\frac{96500C \times 1.45\ g}{108\ g} = 1295.6\ C$ 1

Quantity of electricity passed = Current x t 1

$t = \frac{1295.6C}{1.5\ amp} = 863.7\ s$ 1

$Cu^{2+} + 2e^- \rightarrow Cu$

2 x 96500 C deposits 63.5 g of Cu

1295.6 C deposits $\frac{63.5g \times 1295.6\ C}{2 \times 96500\ C}$ of Cu 1

$= 0.426$ g of Cu

$Zn^{2+} + 2e^- \rightarrow Zn$

2 x 96500 C deposits 65.4 g of Zn

1295.6 C deposits $\frac{65.4g \times 1295.6\ C}{2 \times 96500\ C}$ of Zn

= 0.44 g of Zn 1

(or any other suitable method)

29 * (i) Because of larger number of unpaired electrons in their atoms they have stronger interatomic interaction and hence stronger bonding between atoms resulting in higher enthalpies of atomisation.

(ii) Because of their ability to adopt multiple oxidation states and to form complexes.

(iii) Because of poorer shielding by 5f electrons than that by 4f , actinoid contraction is greater than the lanthanoid contraction.

(iv) Much larger third inonisation energy of Mn(where the required change is d^5 to d^4) is mainly responsible for this.

(v) Because of the presence of incomplete d-orbital ($3d^1 4s^2$) in its ground state. 1x5=5

OR

$3d^3 4s^2$(Vanadium): Oxidation states +2,+3,+4,+5
Stable oxidation state: +4 as VO^{2+} ,+5 as VO_4^{3-}

$3d^5 4s^2$(Manganese): Oxidation states +2,+3,+4,+5,+6,+7
Stable oxidation states: +2 as Mn^{2+} ,+7 as MnO^-_4

$3d^6 4s^2$(Iron): Oxidation states +2,+3
Stable oxidation state: +2 in acidic medium, +3 in neutral or in alkaline medium. 1x3=3

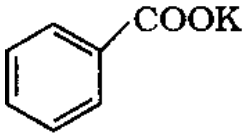
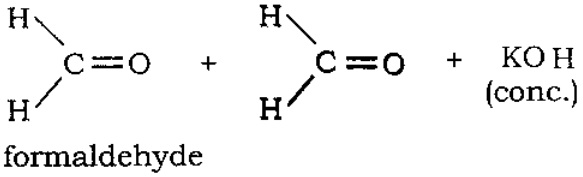
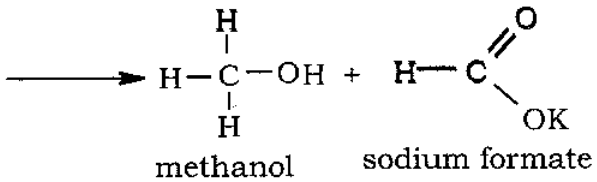
(b) (i)

$$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \longrightarrow 8\ Na_2CrO_4 + 2\ Fe_2O_3 + 8\ CO_2$$

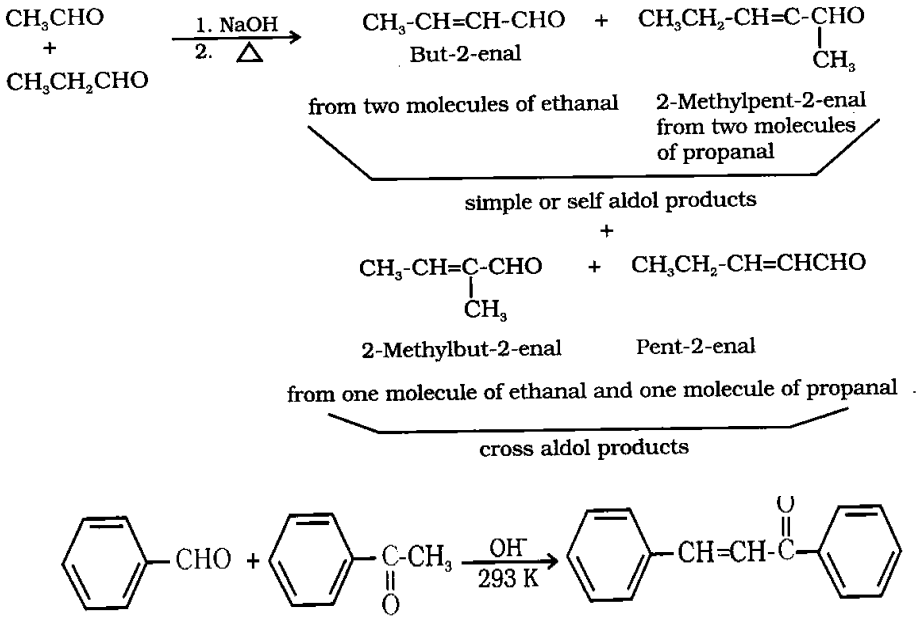
(ii)

$$2MnO_2 + 4KOH + O_2 \longrightarrow 2K_2MnO_4 + 2H_2O$$

1+1

30	(a) (i)  (ii) BH_3, H_2O_2 / OH^-, PCC ***(any two)*** (iii)  **(NOTE:any two correct answers to be evaluated and 1½ marks for each to be awarded)** (b) (i) **<u>Cannizzaro reaction:</u>** Aldehydes which do not have an α-hydrogen atom, uhdergo self oxidation and reduction reaction on treament with concentrated alkali.  formaldehyde  methanol sodium formate ***(or any other suitable reaction)***	1½+1½ 1

(ii) **Cross aldol condensation:** When aldol condensation is carried out between two different aldehydes and /or ketones, it is called Cross aldol condensation



1

(or any other suitable reaction)

(Note: Award full marks for correct chemical equation;award ½ mark if only statement is written)

OR

(i) Because two alkyl groups in ketones reduce the positive charge on carbon atom of the carbonyl group more effectively than in aldehydes. / **or** sterically, the presence of two relatively large substituents in ketones hinders the approach of nucleophile to carbonyl carbon than in aldehydes having only one such substituents.

(ii) Beacuase of the absence of hydrogen bonding in aldehydes and ketones. 1x3=3

(iii) Because of the presence of the sp^2 hybridised orbitals(or π-bond) of carbonyl carbon.

	(b) (i)**<u>Acetaldehyde and benzaldehyde</u>** : Acetaldehyde gives yellow ppt of Iodoform(CHI_3)on addition of NaOH / I_2 whereas benzaldehyde does not give this test. ***(or any other suitable test)*** (ii) **<u>Propanone and propanol</u>** : Propanone gives yellow ppt of Iodoform(CHI_3)on addition of NaOH / I_2 whereas propanol does not give this test. Or / Propanol gives brisk effervesence on adding a piece of Sodium metal whereas Propanone does not give this test. ***(or any other suitable test)***	1+1