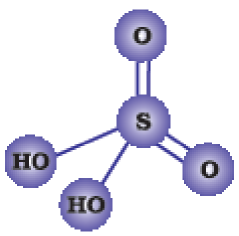
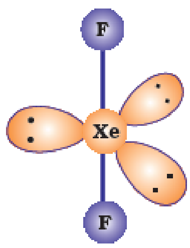
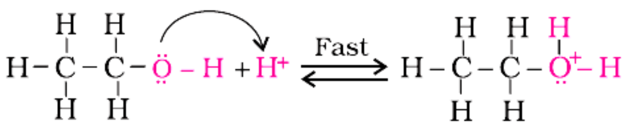
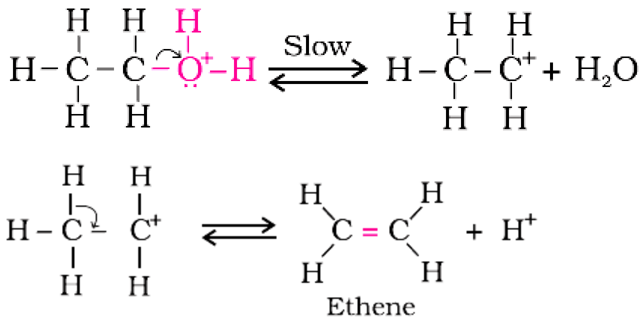
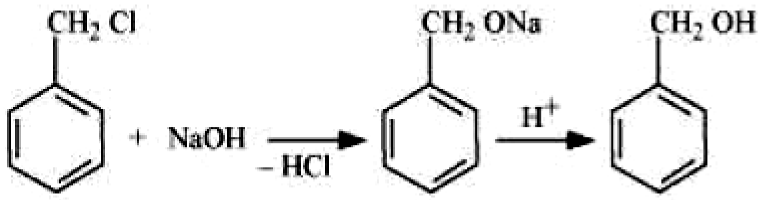
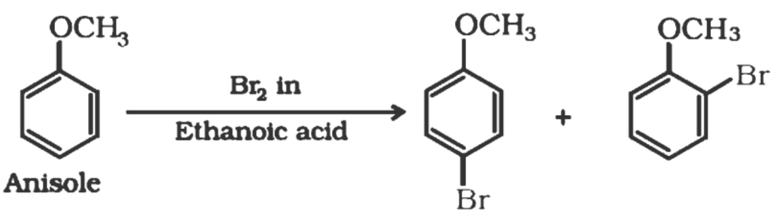
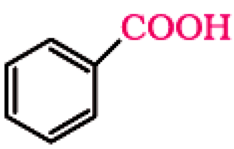
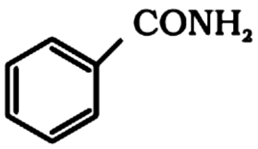
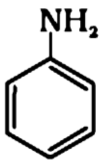
CHEMISTRY MARKING SCHEME

SET -56/1/1

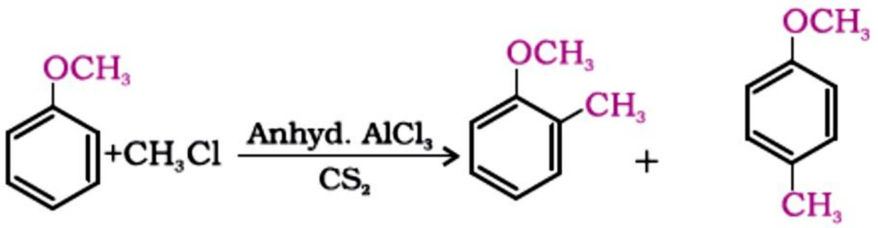
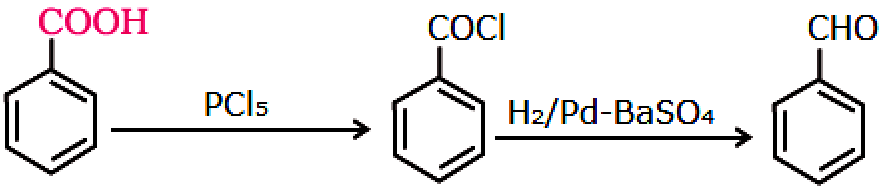
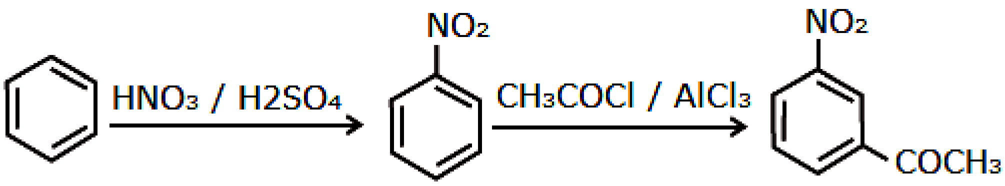
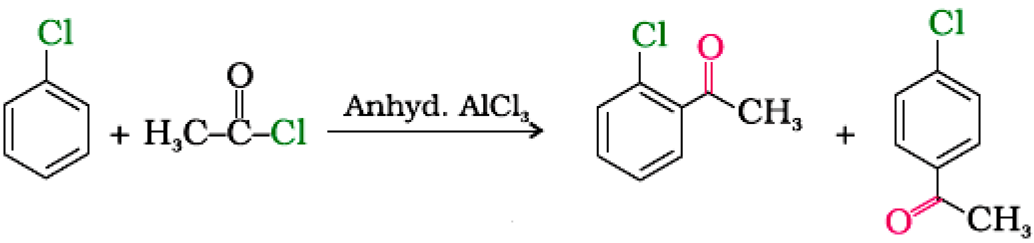
Ques.	Value points	Marks
1	2	1
2	It is a process of removing a dissolved substance from a colloidal solution by means of diffusion through a suitable membrane.	1
3	Hexaamninenickel (II) chloride	1
4	$CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-CH_2-CHO$	1
5	$Ar\overset{+}{N_2}\overset{-}{Cl} + H_3PO_2 + H_2O \longrightarrow ArH + N_2 + H_3PO_3 + HCl$ (where Ar is C_6H_5)	1
6.	The external pressure which is applied on solution side to stop the flow of solvent across the semi-permeable membrane. The osmotic pressure is directly proportional to concentration of the solution. / π = CRT	1 1
7.	The half-life of a reaction is the time in which the concentration of a reactant is reduced to one-half of its initial concentration. Rate constant is the rate of reaction when the concentration of the reactant is unity.	1 1
8.	i)  ii) 	1+1
9	Disproportionation : The reaction in which an element undergoes self-oxidation and self-reduction simultaneously. For example – $2Cu^+ (aq) \longrightarrow Cu^{2+} (aq) + Cu(s)$ (Or any other correct equation) OR	1 1
9	i) Due to presence of unpaired electrons in d-orbitals. ii) Due to incomplete filling of d-orbitals.	1 1
10		½

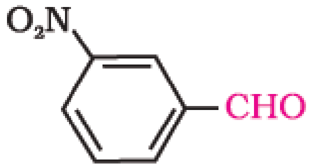
		½ 1
11	i) The defect in which equal number of cations and anions are missing from the lattice. ii) Due to dislocation of smaller ion from its normal site to an interstitial site. iii) Anionic vacancies are occupied by unpaired electron.	1 1 1
12	i) $\Delta T_f = K_f\, m$ $\Delta T_f = K_f \frac{w_B \times 1000}{M_B \times w_A}$ $\Delta T_f = \frac{1.86 K\ kg\ mol^{-1} \times 45 g \times 1000\ g\ kg^{-1}}{60 g mol^{-1} \times 600\ g}$ $\Delta T_f = 2.325 K$ or $2.325^0 C$ ii) $T_f^0 - T_f = 2.325^0 C$ $O^0C - T_f = 2.325^0 C$ $T_f = -2.325^0 C$ or 270.675 K	½ ½ 1 1
13	$\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$ $\log\frac{0.07}{0.02} = \left(\frac{E_a}{2.303 \times 8.314\ JK^{-1}mol^{-1}}\right)\left[\frac{700-500}{700 \times 500}\right]$ $0.544 = E_a \times 5.714 \times 10^{-4}/19.15$ $E_a = 0.544 \times 19.15/5.714 \times 10^{-4} = 18230.8\ J$	1 1 1
14	i) The movement of colloidal particles under an applied electric potential towards oppositely charged electrode is called electrophoresis. ii) The accumulation of molecular species at the surface rather than in the bulk of a solid or liquid is termed adsorption. iii) The catalytic reaction that depends upon the pore structure of the catalyst and the size of the reactant and product molecules is called shape-selective catalysis.	1 1 1
15	i) The impure metal is evaporated to obtain the pure metal as distillate. ii) This method is based on the principle that the impurities are more soluble in the melt than in the solid state of the metal. iii) The impure metal is made to act as anode. A strip of the same metal in pure form is used as cathode. They are put in a suitable electrolytic bath containing soluble salt of the same metal. The more basic metal remains in the solution and the less basic ones go to the anode mud. OR	1 1 1

15	$3Fe_2O_3 + CO \rightarrow 2Fe_3O_4 + CO_2$ (Iron ore) $Fe_3O_4 + CO \rightarrow 3FeO + CO_2$ $CaCO_3 \rightarrow CaO + CO_2$ (Limestone) $CaO + SiO_2 \rightarrow CaSiO_3$ (Slag) $FeO + CO \rightarrow Fe + CO_2$ $C + CO_2 \rightarrow 2CO$ Coke $C + O_2 \rightarrow CO_2$ $FeO + C \rightarrow Fe + CO$ (any four correct equations) Cast iron has lower carbon content (about 3%) than pig iron / cast iron is hard & brittle whereas pig iron is soft.	½ x 4 = 2 1
16	The steady decrease in atomic radii from La to Lu due to imperfect shielding of 4f – orbital. Consequences – i) Members of third transition series have almost identical radii as coresponding members of second transition series. ii) Difficulty in separation.	1 1+1
17	a) Linkage isomerism b) Optical isomerism c) Cis - trans / Geometrical isomerism	1 1 1
18	a) Butan – 2 – ol b) 2 – bromotoluene c) 2, 2-dimethylchlorpropane	1 1 1
19	i) $CH_3CH=CH_2 + H_2O \xrightleftharpoons{H^+} CH_3-\underset{\displaystyle OH}{\underset{\vert}{CH}}-CH_3$ ii)  iii) 	1 1 1
20	A –  Benzoic acid	½ + ½

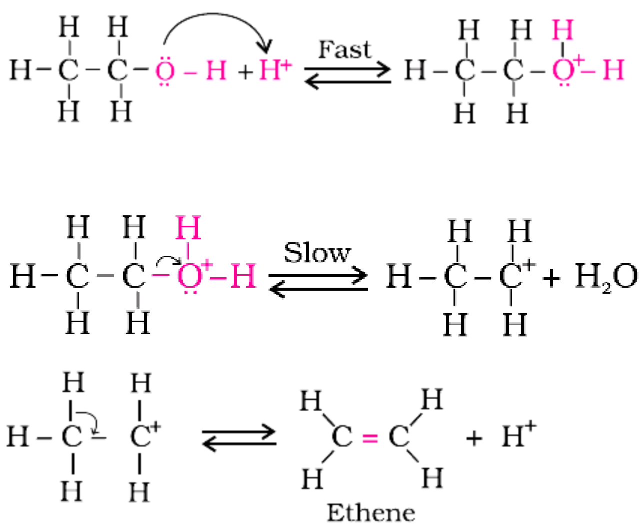
	B –  Benzamide C -  Aniline	½ + ½ ½ + ½
21	Fat soluble vitamin- Vitamin A, D Water soluble vitamin-Vitamin B,C Vitamin K	½+½ ½+½ 1
22	i) $CH_2 = CH - CH = CH_2$ and $C_6H_5CH{=}CH_2$ 1, 3-Butadiene Styrene ii) $CH_2{=}C(Cl){-}CH{=}CH_2$ Chloroprene /2-Chloro-1, 3-butadiene iii) $CF_2 = CF_2$ Tetrafluoroethene	½ + ½ ½ + ½ ½ + ½
23	i) Aspartame, Saccharin (any one) ii) No iii) Social concern, empathy, concern, social awareness (any 2)	1 1 2
24	a)i)Molar conductivity of a solution at a given concentration is the conductance of the volume *V* of solution containing one mole of electrolyte kept between two electrodes with area of cross section *A* and distance of unit length. ii) Secondary battery- can be recharged by passing current through it in opposite direction so that it can be used again. iii) Galvanic cells that are designed to convert the energy of combustion of fuels like hydrogen, methane, methanol, etc. directly into electrical energy are called fuel cells. b)i) The amount of chemical reaction which occurs at any electrode during electrolysis by a current is proportional to the quantity of electricity passed through the electrolyte (solution or melt). ii) Limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anion and cation of the electrolyte. OR	1 1 1 1 1

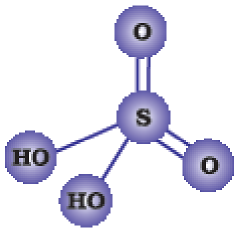
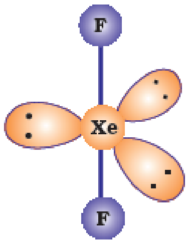
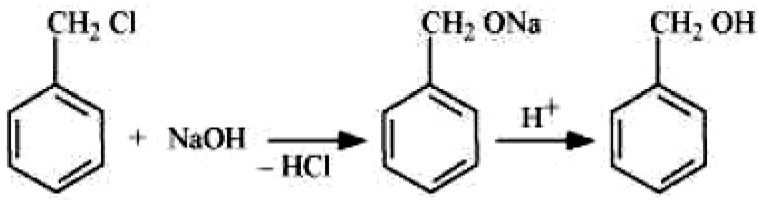
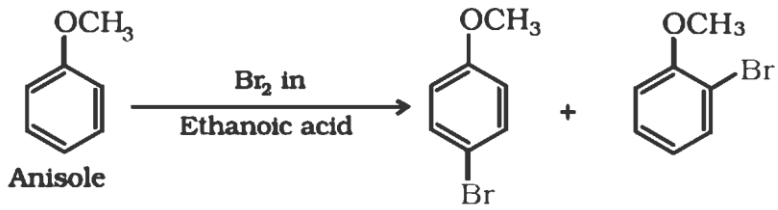
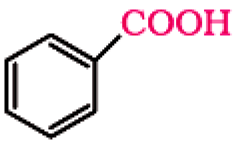
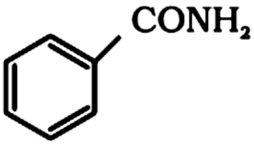
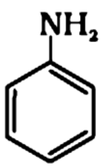
24	a) Degree of dissociation is the extent to which electrolyte gets dissociated into its constituent ions. $\alpha = \frac{\Lambda_m}{\Lambda_m^\circ}$ b) $E^0cell = E^0_{Ag+ / Ag} - E^0_{Ni2+ / Ni}$ $= 0.80V – 0.25V$ $= 0.55V$ $1og\ K_c = (\frac{nE^0cell}{0.059})$ $= \frac{2x0.55V}{0.059}$ $log\ K_c = 18.644$ $\Delta G^0 = -\ nFE^0cell$ $= -2x96500\ Cmol^{-1}\ x\ 0.55V$ $= -106,150\ Jmol^{-1}$ Max.work =+106150 $Jmol^{-1}$ or 106.150k $Jmol^{-1}$	1 1 ½ ½ ½ ½ 1
25	a) i) $3Cu + 8\ HNO_3(dilute) \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$ ii) $P_4 + 3NaOH + 3H_2O \rightarrow PH_3 + 3NaH_2PO_2$ b) i) Due to absence of d-orbital, nitrogen cannot expand its valency beyond four. ii) Because of pπ – pπ multiple bonding in dioxygen which is absent in sulphur. iii) Due to excitation of electron by absorption of radiation from visible region. OR	1 1 1 1 1
25	a) i) $2Ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2 + CaCl_2 + 2H_2O$ ii) $C + 2H_2SO_4(conc.) \rightarrow CO_2 + 2\ SO_2 + 2\ H_2O$ b) It is manufactured by Contact Process which involves following steps: i) burning of sulphur or sulphide ores in air to generate SO_2. ii) conversion of SO_2 to SO_3 by the reaction with oxygen in the presence of a catalyst (V_2O_5) iii) absorption of SO_3 in H_2SO_4 to give *Oleum* ($H_2S_2O_7$). The oleum obtained is diluted to give sulphuric acid $2SO_2(g) + O_2(g) \xrightarrow{V_2O_5} 2SO_3(g)$ Reaction condition – pressure of 2 bar and temperature of 720 K Catalyst used is V_2O_5 Yield – 96 – 98% pure	1 1 1 1 1
26	a) i) Carboxylic acids lose carbon dioxide to form hydrocarbons when their sodium salts are heated with sodalime (NaOH and CaO). $R\text{-}COONa \xrightarrow[Heat]{NaOH\ \&\ CaO} R\text{-}H + Na_2CO_3$ ii) When the alkyl / acyl group is introduced at ortho and para positions by reaction with alkyl halide / acyl halide in the presence of anhydrous aluminium chloride (a Lewis acid) as catalyst.	1

	 (Note : Award full marks if correct equation is given) b) i)  ii)  iii) $CH_3CH_2OH \xrightarrow{CrO_3} CH_3\text{–}CHO \underset{}{\overset{\text{dil. NaOH}}{\rightleftharpoons}} CH_3\text{–}CH(OH)\text{–}CH_2\text{–}CHO$ (or any other correct method) OR	1 1 1 1
26	a) i) When the acyl groups are introduced at ortho and para positions by reaction with acyl halide in the presence of anhydrous aluminium chloride (a Lewis acid) as catalyst.  ii) Aldehydes and ketones having at least one ∝-hydrogen undergo a reaction in the presence of dilute alkali as catalyst to form ∝-hydroxy aldehydes (aldol) or ∝ −hydroxy ketones (ketol), respectively. $2\ CH_3\text{–}CHO \overset{\text{dil. NaOH}}{\rightleftharpoons} CH_3\text{–}CH(OH)\text{–}CH_2\text{–}CHO$ (Note : Award full marks if correct equation is given) b)i) $CH_3 - CH(OH) - CH_3$	1 1 1

	ii) 	1
	iii) CH_3COCl	1

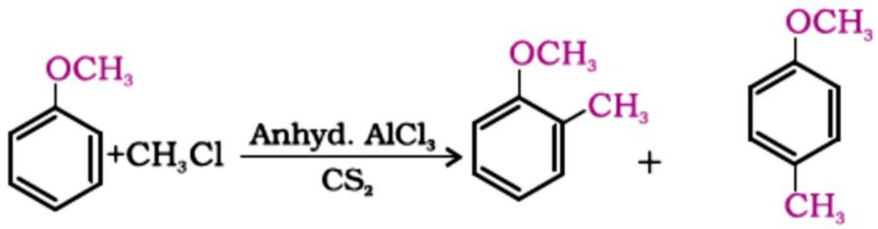
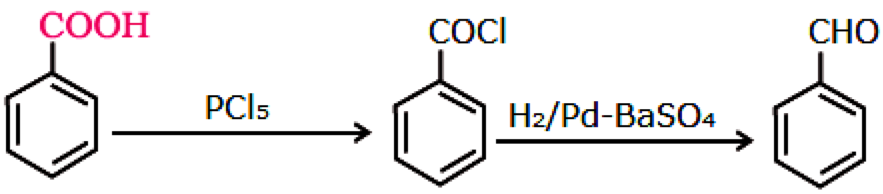
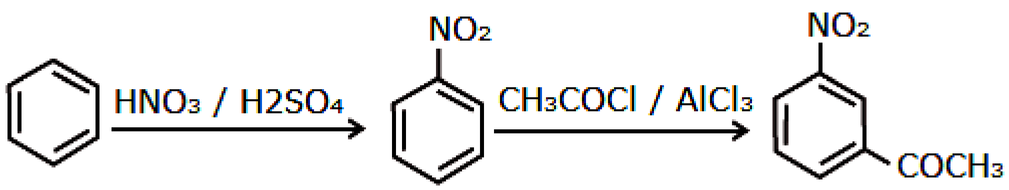
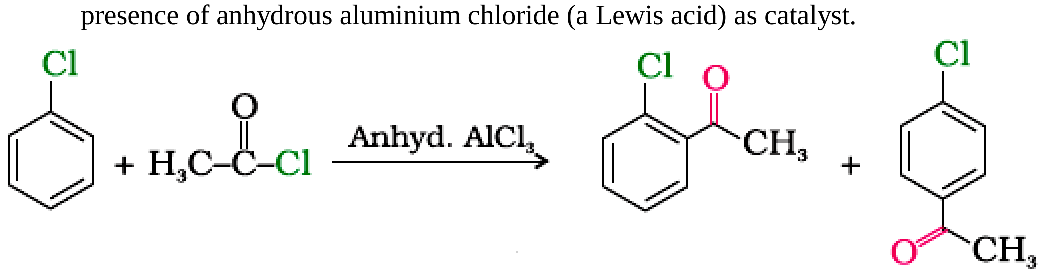
CHEMISTRY MARKING SCHEME
SET -56/1/2
Compt. July, 2015

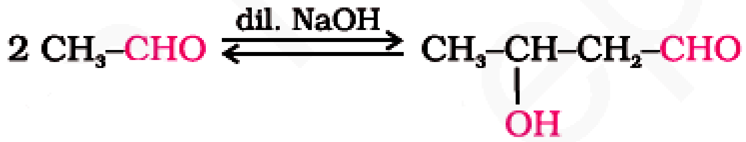
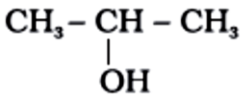
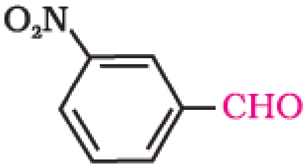
Ques.	Value points	Marks
1	It is a process of removing a dissolved substance from a colloidal solution by means of diffusion through a suitable membrane.	1
2	Hexaamninenickel (II) chloride	1
3	$CH_3 - CH_2 - \underset{\displaystyle CH_3}{\underset{\vert}{CH}} - CH_2 - CHO$	1
4	$Ar\overset{+}{N}_2\overset{-}{Cl} + H_3PO_2 + H_2O \longrightarrow ArH + N_2 + H_3PO_3 + HCl$ (where Ar is C_6H_5)	1
5	2	1
6	Disproportionation : The reaction in which an element undergoes self-oxidation and self-reduction simultaneously. For example – $2Cu^+ (aq) \longrightarrow Cu^{2+} (aq) + Cu(s)$ (Or any other correct equation) OR	1 1
6	i) Due to presence of unpaired electrons in d-orbitals. ii) Due to incomplete filling of d-orbitals.	1 1
7		½ ½ 1
8	The external pressure which is applied on solution side to stop the flow of solvent across the semi-permeable membrane. The osmotic pressure is directly proportional to concentration of the solution. / π = CRT	1 1

9	The half-life of a reaction is the time in which the concentration of a reactant is reduced to one-half of its initial concentration. Rate constant is the rate of reaction when the concentration of the reactant is unity.	1 1
10	i)  ii) 	1+1
11	a) Linkage isomerism b) Optical isomerism c) Cis - trans / Geometrical isomerism	1 1 1
12	a) Butan – 2 – ol b) 2 – bromotoluene c) 2, 2-dimethylchlorpropane	1 1 1
13	i) $CH_3CH=CH_2 + H_2O \underset{}{\overset{H^+}{\rightleftharpoons}} CH_3-\underset{OH}{\underset{\vert}{CH}}-CH_3$ ii)  iii) 	1 1 1
14	A –  Benzoic acid B –  Benzamide C -  Aniline	½ + ½ ½ + ½

		½ + ½
15	Fat soluble vitamin- Vitamin A, D Water soluble vitamin-Vitamin B,C Vitamin K	½+½ ½+½ 1
16	i) $CH_2 = CH - CH = CH_2$ and $C_6H_5CH{=}CH_2$ 1, 3-Butadiene Styrene ii) $CH_2{=}C(Cl){-}CH{=}CH_2$ Chloroprene /2-Chloro-1, 3-butadiene iii) $CF_2 = CF_2$ Tetrafluoroethene	½ + ½ ½ + ½ ½ + ½
17	i) The defect in which equal number of cations and anions are missing from the lattice. ii) Due to dislocation of smaller ion from its normal site to an interstitial site. iii) Anionic vacancies are occupied by unpaired electron.	1 1 1
18	i) $\Delta T_f = K_f\, m$ $\Delta T_f = K_f \frac{w_B \times 1000}{M_B \times w_A}$ $\Delta T_f = \frac{1.86 K\ kg\ mol^{-1} \times 45 g \times 1000\ g\ kg^{-1}}{60 g mol^{-1} \times 600\ g}$ $\Delta T_f = 2.325 K$ or $2.325^0 C$ ii) $T_f^0 - T_f = 2.325^0 C$ $O^0C - T_f = 2.325^0 C$ $T_f = -2.325^0 C$ or 270.675 K	½ ½ 1 1
19	$\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$ $\log\frac{0.07}{0.02} = \left(\frac{E_a}{2.303 \times 8.314\ JK^{-1}mol^{-1}}\right)\left[\frac{700-500}{700 \times 500}\right]$ $0.544 = E_a \times 5.714 \times 10^{-4}/19.15$ $E_a = 0.544 \times 19.15/5.714 \times 10^{-4} = 18230.8\ J$	1 1 1
20	i) The movement of colloidal particles under an applied electric potential towards oppositely charged electrode is called electrophoresis. ii) The accumulation of molecular species at the surface rather than in the bulk of a solid or liquid is termed adsorption. iii) The catalytic reaction that depends upon the pore structure of the catalyst and the size of the reactant and product molecules is called shape-selective catalysis.	1 1 1

21	i) The impure metal is evaporated to obtain the pure metal as distillate. ii) This method is based on the principle that the impurities are more soluble in the melt than in the solid state of the metal. iii) The impure metal is made to act as anode. A strip of the same metal in pure form is used as cathode. They are put in a suitable electrolytic bath containing soluble salt of the same metal. The more basic metal remains in the solution and the less basic ones go to the anode mud. OR	1 1 1
	$3Fe_2O_3 + CO \rightarrow 2Fe_3O_4 + CO_2$ (Iron ore) $Fe_3O_4 + CO \rightarrow 3FeO + CO_2$ $CaCO_3 \rightarrow CaO + CO_2$ (Limestone) $CaO + SiO_2 \rightarrow CaSiO_3$ (Slag) $FeO + CO \rightarrow Fe + CO_2$ $C + CO_2 \rightarrow 2CO$ Coke $C + O_2 \rightarrow CO_2$ $FeO + C \rightarrow Fe + CO$ (any four correct equations) Cast iron has lower carbon content (about 3%) than pig iron / cast iron is hard & brittle whereas pig iron is soft.	½ x 4 = 2 1
22	The steady decrease in atomic radii from La to Lu due to imperfect shielding of 4f – orbital. Consequences – i) Members of third transition series have almost identical radii as coresponding members of second transition series. ii) Difficulty in separation.	1 1+1
23	i) Aspartame, Saccharin (any one) ii) No iii) Social concern, empathy, concern, social awareness (any 2)	1 1 2
24	a) i) $3Cu + 8HNO_3(dilute) \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$ ii) $P_4 + 3NaOH + 3H_2O \rightarrow PH_3 + 3NaH_2PO_2$ b) i) Due to absence of d-orbital, nitrogen cannot expand its valency beyond four. ii) Because of pπ – pπ multiple bonding in dioxygen which is absent in sulphur. iii) Due to excitation of electron by absorption of radiation from visible region. OR	1 1 1 1 1
	a) i) $2Ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2 + CaCl_2 + 2H_2O$ ii) $C + 2H_2SO_4(conc.) \rightarrow CO_2 + 2SO_2 + 2H_2O$ b) It is manufactured by Contact Process which involves following steps: i) burning of sulphur or sulphide ores in air to generate SO_2. ii) conversion of SO_2 to SO_3 by the reaction with oxygen in the presence of a catalyst (V_2O_5) iii) absorption of SO_3 in H_2SO_4 to give *Oleum* ($H_2S_2O_7$). The oleum obtained is diluted to give sulphuric acid $2SO_2(g) + O_2(g) \xrightarrow{V_2O_5} 2SO_3(g)$ Reaction condition – pressure of 2 bar and temperature of 720 K Catalyst used is V_2O_5	1 1 1 1 1

	Yield – 96 – 98% pure	
25	a) i) Carboxylic acids lose carbon dioxide to form hydrocarbons when their sodium salts are heated with sodalime (NaOH and CaO). $$R\text{-}COONa \xrightarrow[\text{Heat}]{\text{NaOH \& CaO}} R\text{-}H + Na_2CO_3$$ ii) When the alkyl / acyl group is introduced at ortho and para positions by reaction with alkyl halide / acyl halide in the presence of anhydrous aluminium chloride (a Lewis acid) as catalyst.  (Note : Award full marks if correct equation is given)	1 1
	b) i)  ii)  iii) $$CH_3CH_2OH \xrightarrow{CrO_3} CH_3\text{–}CHO \underset{}{\overset{\text{dil. NaOH}}{\rightleftharpoons}} CH_3\text{–}\underset{\displaystyle OH}{\underset{\vert}{CH}}\text{–}CH_2\text{–}CHO$$ (or any other correct method) OR	1 1 1
25	a) i) When the acyl groups are introduced at ortho and para positions by reaction with acyl halide in the presence of anhydrous aluminium chloride (a Lewis acid) as catalyst.  ii) Aldehydes and ketones having at least one ∝-hydrogen undergo a reaction in the presence of dilute alkali as catalyst to form ∝-hydroxy aldehydes (aldol) or ∝ −hydroxy ketones (ketol), respectively.	1 1

	 (Note : Award full marks if correct equation is given) b)i)  ii)  iii) CH_3COCl	1 1 1
26	a)i)Molar conductivity of a solution at a given concentration is the conductance of the volume *V* of solution containing one mole of electrolyte kept between two electrodes with area of cross section *A* and distance of unit length. ii) Secondary battery- can be recharged by passing current through it in opposite direction so that it can be used again. iii) Galvanic cells that are designed to convert the energy of combustion of fuels like hydrogen, methane, methanol, etc. directly into electrical energy are called fuel cells. b)i) The amount of chemical reaction which occurs at any electrode during electrolysis by a current is proportional to the quantity of electricity passed through the electrolyte (solution or melt). ii) Limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anion and cation of the electrolyte. OR	1 1 1 1 1
26	a) Degree of dissociation is the extent to which electrolyte gets dissociated into its constituent ions. $\alpha = \frac{\Lambda_m}{\Lambda_m^\circ}$ b) $E^0cell = E^0_{Ag+ / Ag} - E^0_{Ni2+ / Ni}$ $= 0.80V – 0.25V$ $= 0.55V$ $1log\ K_c = (\frac{nE^0cell}{0.059})$ $= \frac{2x0.55V}{0.059}$ $log\ K_c = 18.644$ $\Delta G^0 = -\ nFE^0cell$ $= -2x96500\ Cmol^{-1}\ x\ 0.55V$ $= -106{,}150\ Jmol^{-1}$ Max.work $=+106150\ Jmol^{-1}$ or $106.150k\ Jmol^{-1}$	1 1 ½ ½ ½ ½ 1

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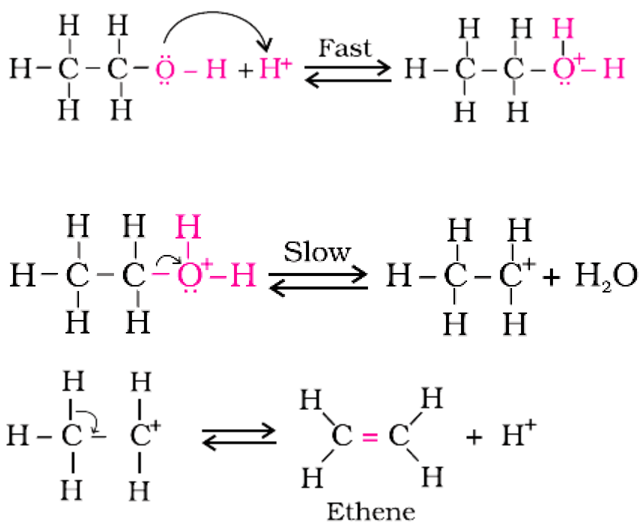
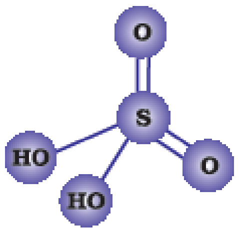
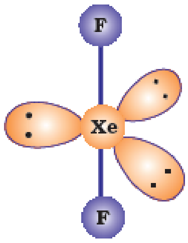
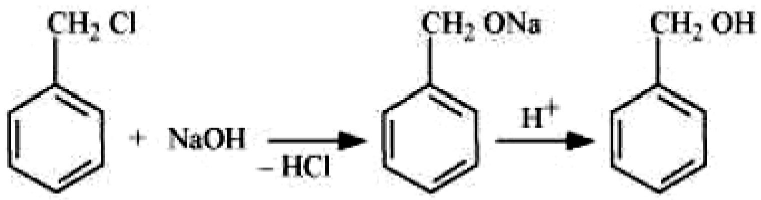
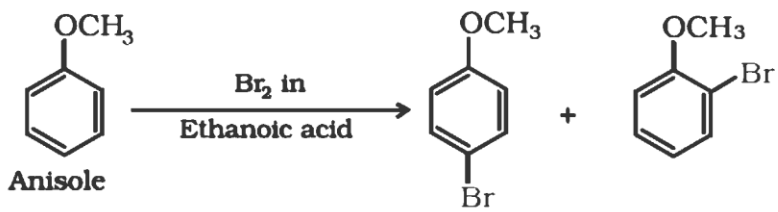
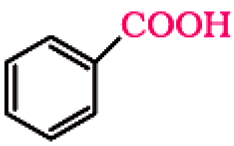
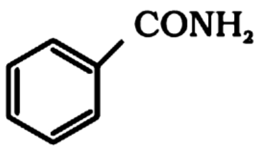
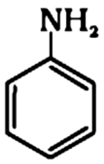
Ms. Garima Bhutani

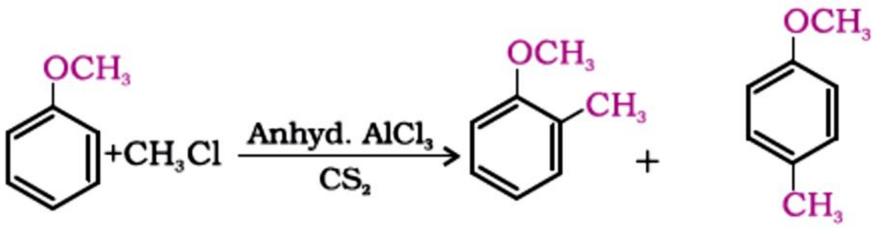
CHEMISTRY MARKING SCHEME
SET -56/1/3
Compt. July, 2015

Ques.	Value points	Marks
1	Hexaamninenickel (II) chloride	1
2	$CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-CH_2-CHO$	1
3	$Ar\overset{+}{N_2}\overset{-}{Cl} + H_3PO_2 + H_2O \longrightarrow ArH + N_2 + H_3PO_3 + HCl$ (where Ar is C_6H_5)	1
4	2	1
5	It is a process of removing a dissolved substance from a colloidal solution by means of diffusion through a suitable membrane.	1
6		½ ½ 1
7	The external pressure which is applied on solution side to stop the flow of solvent across the semi-permeable membrane. The osmotic pressure is directly proportional to concentration of the solution. / π = CRT	1 1
8	The half-life of a reaction is the time in which the concentration of a reactant is reduced to one-half of its initial concentration. Rate constant is the rate of reaction when the concentration of the reactant is unity.	1 1

9	i)  ii) 	1+1
10	Disproportionation : The reaction in which an element undergoes self-oxidation and self-reduction simultaneously. For example – $2Cu^{+}(aq) \longrightarrow Cu^{2+}(aq) + Cu(s)$ (Or any other correct equation) OR	1 1
10	i) Due to presence of unpaired electrons in d-orbitals. ii) Due to incomplete filling of d-orbitals.	1 1
11	i) $CH_3CH=CH_2 + H_2O \overset{H^+}{\rightleftharpoons} CH_3-\underset{OH}{CH}-CH_3$ ii)  iii) 	1 1 1
12	A –  Benzoic acid B –  Benzamide	½ + ½ ½ + ½

	 C - Aniline	½ + ½
13	Fat soluble vitamin- Vitamin A, D Water soluble vitamin-Vitamin B,C Vitamin K	½+½ ½+½ 1
14	i) $CH_2=CH-CH=CH_2$ and $C_6H_5CH=CH_2$ 1, 3-Butadiene Styrene ii) $CH_2=C(Cl)-CH=CH_2$ Chloroprene /2-Chloro-1, 3-butadiene iii) $CF_2=CF_2$ Tetrafluoroethene	½ + ½ ½ + ½ ½ + ½
15	i) The defect in which equal number of cations and anions are missing from the lattice. ii) Due to dislocation of smaller ion from its normal site to an interstitial site. iii) Anionic vacancies are occupied by unpaired electron.	1 1 1
16	i) $\Delta T_f = K_f\, m$ $\Delta T_f = K_f \frac{w_B \times 1000}{M_B \times w_A}$ $\Delta T_f = \frac{1.86 K\ kg\ mol^{-1} \times 45 g \times 1000\ g\ kg^{-1}}{60 g mol^{-1} \times 600\ g}$ $\Delta T_f = 2.325 K$ or $2.325^0 C$ ii) $T_f^0 - T_f = 2.325^0 C$ $O^0C - T_f = 2.325^0 C$ $T_f = -2.325^0 C$ or 270.675 K	½ ½ 1 1
17	$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$ $\log \frac{0.07}{0.02} = \left(\frac{E_a}{2.303 \times 8.314\ JK^{-1}mol^{-1}}\right)\left[\frac{700-500}{700 \times 500}\right]$ $0.544 = E_a \times 5.714 \times 10^{-4}/19.15$ $E_a = 0.544 \times 19.15/5.714 \times 10^{-4} = 18230.8\ J$	1 1 1
18	i) The movement of colloidal particles under an applied electric potential towards oppositely charged electrode is called electrophoresis. ii) The accumulation of molecular species at the surface rather than in the bulk of a solid or liquid	1 1

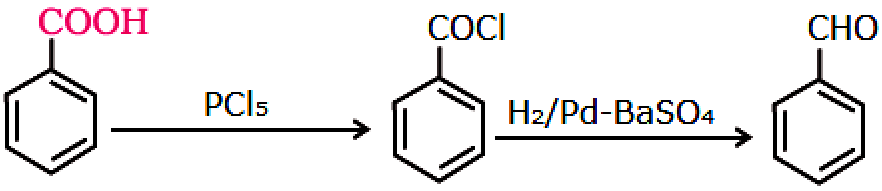
	is termed adsorption. iii) The catalytic reaction that depends upon the pore structure of the catalyst and the size of the reactant and product molecules is called shape-selective catalysis.	1
19	i) The impure metal is evaporated to obtain the pure metal as distillate. ii) This method is based on the principle that the impurities are more soluble in the melt than in the solid state of the metal. iii) The impure metal is made to act as anode. A strip of the same metal in pure form is used as cathode. They are put in a suitable electrolytic bath containing soluble salt of the same metal. The more basic metal remains in the solution and the less basic ones go to the anode mud. OR	1 1 1
19	$3Fe_2O_3 + CO \rightarrow 2Fe_3O_4 + CO_2$ (Iron ore) $Fe_3O_4 + CO \rightarrow 3FeO + CO_2$ $CaCO_3 \rightarrow CaO + CO_2$ (Limestone) $CaO + SiO_2 \rightarrow CaSiO_3$ (Slag) $FeO + CO \rightarrow Fe + CO_2$ $C + CO_2 \rightarrow 2CO$ Coke $C + O_2 \rightarrow CO_2$ $FeO + C \rightarrow Fe + CO$ (any four correct equations) Cast iron has lower carbon content (about 3%) than pig iron / cast iron is hard & brittle whereas pig iron is soft.	½ x 4 = 2 1
20	The steady decrease in atomic radii from La to Lu due to imperfect shielding of 4f – orbital. Consequences – i) Members of third transition series have almost identical radii as coresponding members of second transition series. ii) Difficulty in separation.	1 1+1
21	a) Linkage isomerism b) Optical isomerism c) Cis - trans / Geometrical isomerism	1 1 1
22	a) Butan – 2 – ol b) 2 – bromotoluene c) 2, 2-dimethylchlorpropane	1 1 1
23	i) Aspartame, Saccharin (any one) ii) No iii) Social concern, empathy, concern, social awareness (any 2)	1 1 2
24	a) i) Carboxylic acids lose carbon dioxide to form hydrocarbons when their sodium salts are heated with sodalime (NaOH and CaO). $R\text{-}COONa \xrightarrow[\text{Heat}]{\text{NaOH \& CaO}} R\text{-}H + Na_2CO_3$ ii) When the alkyl / acyl group is introduced at ortho and para positions by reaction with alkyl halide / acyl halide in the presence of anhydrous aluminium chloride (a Lewis acid) as catalyst.	1



1

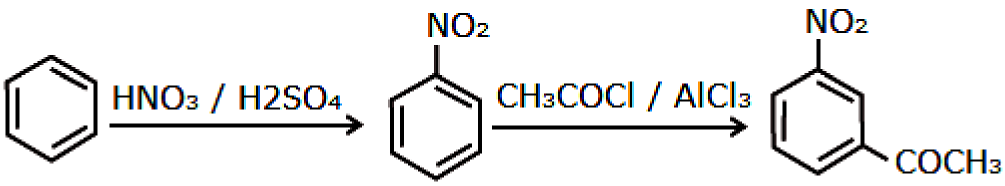
(Note : Award full marks if correct equation is given)

b) i)



1

ii)



1

iii)

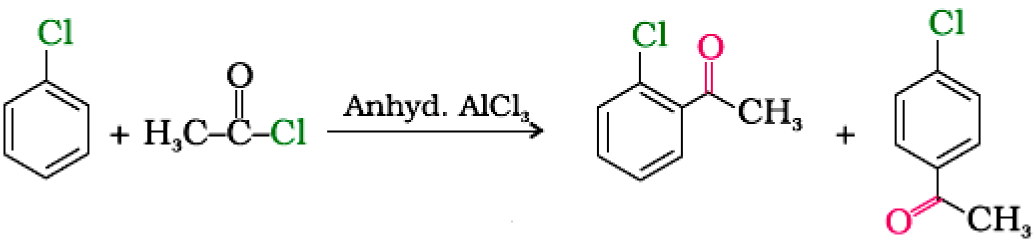
$$CH_3CH_2OH \xrightarrow{CrO_3} CH_3-CHO \overset{dil.\ NaOH}{\rightleftharpoons} CH_3-\underset{OH}{\underset{|}{CH}}-CH_2-CHO$$

1

(or any other correct method)

OR

24 a) i) When the acyl groups are introduced at ortho and para positions by reaction with acyl halide in the presence of anhydrous aluminium chloride (a Lewis acid) as catalyst. 1



ii) Aldehydes and ketones having at least one ∝-hydrogen undergo a reaction in the presence of dilute alkali as catalyst to form ∝-hydroxy aldehydes (aldol) or ∝ −hydroxy ketones (ketol), respectively. 1

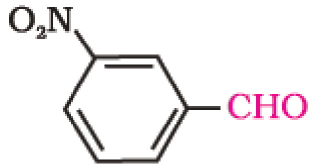
$$2\ CH_3-CHO \overset{dil.\ NaOH}{\rightleftharpoons} CH_3-\underset{OH}{\underset{|}{CH}}-CH_2-CHO$$

(Note : Award full marks if correct equation is given)

b)i)

$$CH_3-\underset{OH}{\underset{|}{CH}}-CH_3$$

1

	ii)  iii) CH_3COCl	1 1
25	a) i) $3Cu + 8\ HNO_3(dilute) \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$ ii) $P_4 + 3NaOH + 3H_2O \rightarrow PH_3 + 3NaH_2PO_2$ b) i) Due to absence of d-orbital, nitrogen cannot expand its valency beyond four. ii) Because of pπ – pπ multiple bonding in dioxygen which is absent in sulphur. iii) Due to excitation of electron by absorption of radiation from visible region. OR	1 1 1 1 1
25	a) i) $2Ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2 + CaCl_2 + 2H_2O$ ii) $C + 2H_2SO_4(conc.) \rightarrow CO_2 + 2\ SO_2 + 2\ H_2O$ b) It is manufactured by Contact Process which involves following steps: i) burning of sulphur or sulphide ores in air to generate SO_2. ii) conversion of SO_2 to SO_3 by the reaction with oxygen in the presence of a catalyst (V_2O_5) iii) absorption of SO_3 in H_2SO_4 to give *Oleum* ($H_2S_2O_7$). The oleum obtained is diluted to give sulphuric acid $2SO_2(g) + O_2(g) \xrightarrow{V_2O_5} 2SO_3(g)$ Reaction condition – pressure of 2 bar and temperature of 720 K Catalyst used is V_2O_5 Yield – 96 – 98% pure	1 1 1 1 1
26	a)i)Molar conductivity of a solution at a given concentration is the conductance of the volume *V* of solution containing one mole of electrolyte kept between two electrodes with area of cross section *A* and distance of unit length. ii) Secondary battery- can be recharged by passing current through it in opposite direction so that it can be used again. iii) Galvanic cells that are designed to convert the energy of combustion of fuels like hydrogen, methane, methanol, etc. directly into electrical energy are called fuel cells. b)i) The amount of chemical reaction which occurs at any electrode during electrolysis by a current is proportional to the quantity of electricity passed through the electrolyte (solution or melt). ii) Limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anion and cation of the electrolyte. OR	1 1 1 1 1
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	$= 0.55V$	½
	$1\log K_c = (\frac{nE^0 cell}{0.059})$	½
	$= \frac{2x0.55V}{0.059}$	
	$\log K_c = 18.644$	½
	$\Delta G^0 = - nFE^0 cell$	½
	$= -2x96500\ Cmol^{-1} \times 0.55V$	
	$= -106{,}150\ Jmol^{-1}$	1
	Max.work =+106150 $Jmol^{-1}$ or 106.150k $Jmol^{-1}$	

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