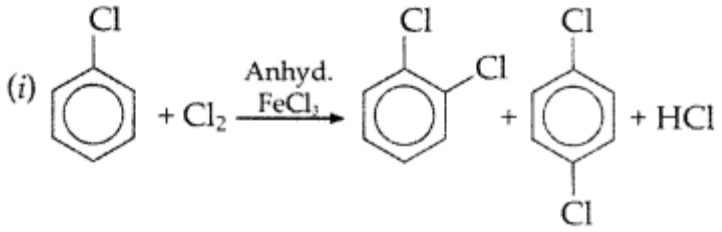
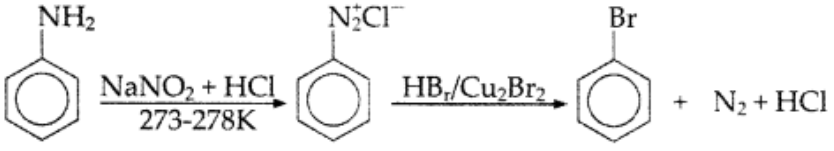
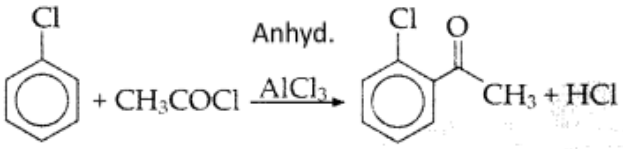
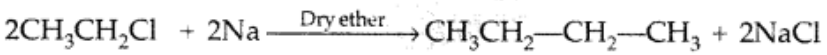
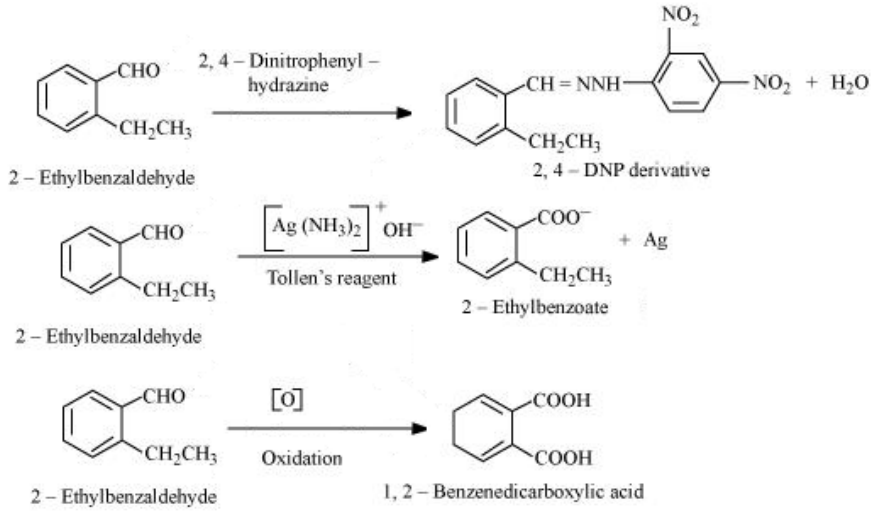
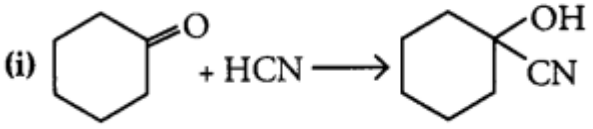
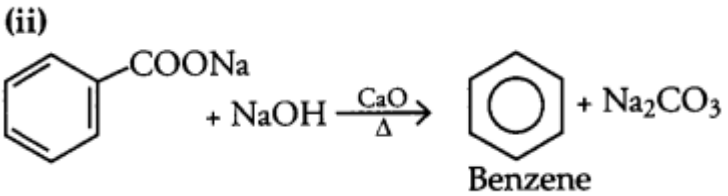
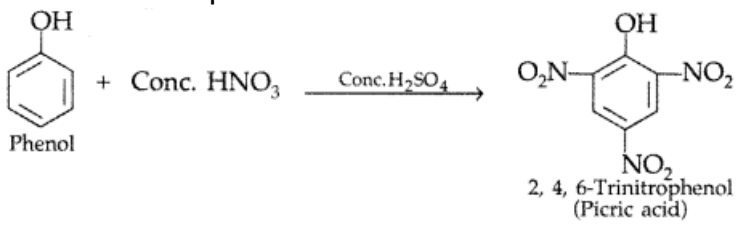
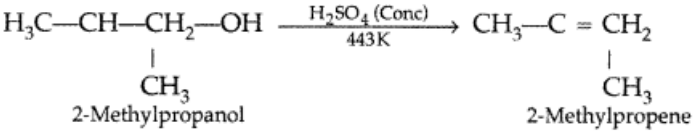
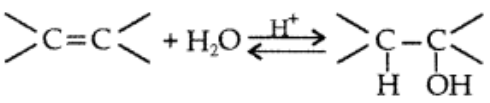
MARKING SCHEME

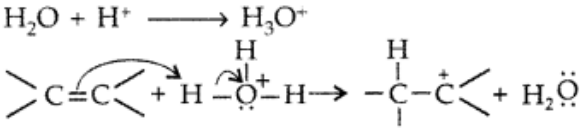
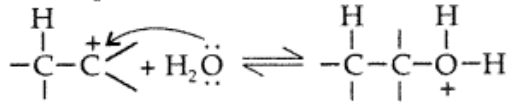
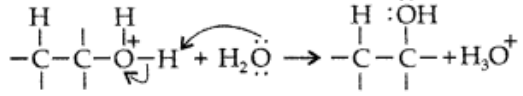
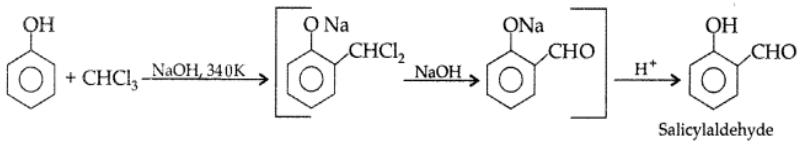
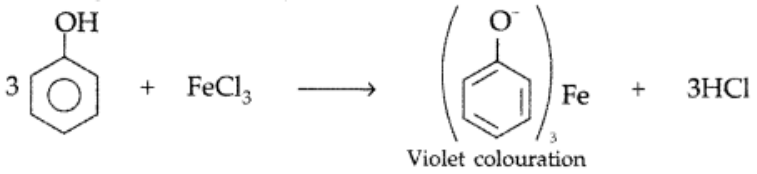
Q.No	EXPECTED ANSWER / VALUE POINTS	MARKS
1	a	1
2	c	1
3	c	1
4	a	1
5	a	1
6	b	1
7	c	1
8	b	1
9	d	1
10	b	1
11	d	1
12	b	1
13	c	1
14	b	1
15	d	1
16	d	1
17	a	1
18	a	1
19	(a) because the magnitude of osmotic pressure is large even for very dilute solution and it can be measured at room temperature . (b) due to the presence of more oxygen . Solubility of oxygen in water increases with decrease in temperature as dissolution process is exothermic in nature .	1 1
20	$\lambda_m = k \times 1000/M$ $=4.95 \times 10^{-5} \times 1000/0.001$ $= 49.5\ S\ cm^2\ mol^{-1}$ Now, degree of dissociation α, is given by $\alpha = \frac{\Lambda_m}{\Lambda^\circ_m}$ Putting the values, $\alpha = \frac{49.5}{390.5}\ S\ cm^2\ mol^{-1}$ $= 0.1267$	1 1/2 1/2
21	Correct reactions Correct reason or Correct definition Correct reactions	1/2+1/2 1 1 1/2+1/2
22	The sum of powers to which the concentration terms are raised in the rate law expression . (a) First order (b) Zero order	1 1/2 + 1/2
23	Coordination isomerism $[Cr(NH_3)_6]\ [Co(CN)_6]$.	1 1
24	$(CH_3)_3C$-Br reacts faster because it is a tertiary halide (3° halide).	1/2 +1/2

	Correct mechanism involving two steps. or	1/2+1/2
	(i)  1,2-dichlorobenzene 1,4-dichlorobenzene (ii) $CH_3CH_2Cl + AgNO_2 \longrightarrow CH_3CH_2NO_2 + AgCl$ Nitro ethane	1 1
25	• p-Nitrophenol has intermolecular H-bonding hence has high BP and o- Nitrophenol has intra molecular H-bonding • Sec and ter- alkyl halides in presence of strong base undergo elimination reaction.	1 1
26	$4FeCr_2O_4 + 8\ Na_2CrO_4 + 7O_2 \rightarrow 8\ Na_2CrO_4 + 2\ Fe_2O_3 + 8\ CO_2$ Sodium chromate (A) $2Na_2CrO_4 + 2\ H^+ \rightarrow Na_2Cr_2O_7 + 2\ Na^+ + H_2O$ Sodium dichromate (B) $Na_2Cr_2O_7 + 2\ KCl \rightarrow K_2Cr_2O_7 + 2\ NaCl$ Potassium dichromate (C) $Cr_2O_7^{2-} + 3H_2S + 8H^+ \rightarrow 2Cr^{3+} + 3S + 7H_2O$ (D)	1 1/2 1/2 1
27	Let the rate law expression $r = k[A]^p[B]^q$ $6.0\times10^{-3} = k[0.1]^p[0.1]^q$ -----(i) $7.2\times10^{-2} = k[0.3]^p[0.2]^q$ ------(ii) $2.88\times10^{-1} = k[0.3]^p[0.4]^q$ -------(iii) $2.4\times10^{-2} = k[0.4]^p[0.1]^q$ -------(iv) On dividing (iv) by (i) P=1 on dividing (iii) by (ii) q=2 Hence rate law expression – $r = K[A]^1[B]^2$ therefore order of reaction = 1+2 =2 or $t_{1/2}$ =5730 years $[R]_0 = 100$ [R] = 80 t = ?	 1 1 1/2+1/2

	Then $K=0.693/ t_{1/2}$ $= 0.693/5730$ $=1.2 \times 10^{-4}\ y^{-1}$ $t=2.303/K\ (\log [R]_0/[R])$ $= 2.303/ 1.2 \times 10^{-4}\ \log(100/80)$ = 1845 years	1/2+ 1/2 1/2 1 1/2
28	$NaCl \rightarrow Na^+ + Cl^-$ i=2 $\Delta T_f = i\ K_f\ m$ $\Delta T_f = i \times K_f \times W_B\ / M_B \times W_A$ $3= 2 \times 1.86 \times W_B\ / 58.5 \times 1$ $W_B = 47.17$ g	1/2 1/2 1 1/2 +1/2
29	(a) $CHCl_3$ is stored in dark coloured bottles to cut off light because $CHCl_3$is slowly oxidised by air in presence of light to form an extremely poisonous gas, carbonyl chloride, popularily known as phosgene. (b) Both enantiomeric forms cancel the optical rotation of each other . (c) Due to +R effect partial double character arises / due to sp^2 hybridised C of haloarenes to which halogen is attached . or **Aniline to Bromo benzene**  Benzene diazonium chloride **Chlorobenzene to 2-chloroacetophenone**  **Chloroethane to butane** 	1 1 1 1 1 1

30	 (Identification + reaction)	1/2+1/2 1/2+1/2 1/2+1/2
31	(a) Formic acid on heating with tollen's reagent forms silver mirror . (b) Di-tert butyl ketone < Methyl tert –butyl ketone < Acetone < Acetaldehyde (c)   or (i) correct conversion (ii) correct conversion	1 1 1 1 1 1
32	(a)Cu^{2+} due to presence of unpaired elelctron . (b)No unpaired electron in 3d subshell /weak metallic bonding . (c) (i) Due to participation of (n-1)d and ns electron in bond formation . (ii) In 3d series Mn shows the highest oxidation state of +7 as it has maximum no. of unpaired e^- . or (i) Many Cu(I) compounds are unstable in aqueous solution and undergo disproportionation. $2Cu^+ \rightarrow Cu^{2+} + Cu$ The stability of Cu^{2+} rather than Cu^+ is due to more –ve hydration enthalpy of Cu^{2+} than Cu^+ which is much more and compensate for the II ionisation enthalpy . (ii) Due to similar metallic radii .	1 1 1 1/2+1/2 1 1

33	(a)Any two correct differences . (b) $Sn(s) \rightarrow Sn^{2+}(aq) + 2e^-$ $2H^+(aq) + 2e^- \rightarrow H_2(g)$ $Sn(s) + 2H^+(aq) \rightarrow Sn^{2+}(aq) + H_2(g)$ $E^\circ_{cell} = E^\circ_{(H^+/H_2)} - E^\circ_{(Sn^{2+}/Sn)}$ $= 0.00 - (-0.14)$ $= +0.14V$ $E_{cell} = E^\circ_{cell} - \frac{0.0591}{n} \log \frac{[Sn^{2+}]}{[H^+]^2}$ $= 0.14 - \frac{0.0591}{2} \log \frac{(4 \times 10^{-3})}{(2 \times 10^{-2})^2}$ $= 0.14 - 0.0295 \log 10$ $= 0.14 - 0.0295$ $= 0.1105$ V or (a)The limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anion and cation of the electrolyte . $\lambda^\circ_m CH_3COOH = \lambda^\circ_m CH_3COO^- + \lambda^\circ_m H^+$ (b)Correct definition Correct explanation for strong electrolyte Correct explanation for strong electrolyte	1+1 1/2 1/2 1 1/2+1/2 (unit) 1 1 1 1 1
34	.(a) (i) Picric acid from phenol :  Phenol 2, 4, 6-Trinitrophenol (Picric acid) (ii) **2-Methylpropene from 2-methylpropanol :**  2-Methylpropanol 2-Methylpropene (b) ethanol < p-methoxyphenol < phenol < p-nitrophenol (c)Acid catalysed hydration : Alkenes react with water in the presence of acid as catalyst to form alcohols  Mechanism : It involves three steps :	1 1 1

	(i) Protonation of alkene to form carbocation by electrophilic attack of H_3O^+  (ii) Nucleophilic attack of water on carbocation  (iii) Deprotonation to form an alcohol  or (a) (i) Reimer-Tiemann reaction : Treatment of phenol with $CHCl_3$ in presence of aqueous NaOH at 340K followed by hydrolysis gives salicylaldehyde.  Salicylaldehyde (ii) Williamson's ether synthesis : The reaction of alkyl halide with sodium alkoxide to form ether is called Williamson synthesis . $R—X + R'ONa \longrightarrow R—O—R' + NaX$ Alkyl halide Sod. alkoxide Ether (b) (i) Pentan-2-ol on heating with I_2 and NaOH gives yellow ppt. of Iodoform while Pentan-3-ol does not give this test. (ii) Phenol gives violet coloured solution with $FeCl_3$ while methanol does not.  Violet colouration (c) Nitro group being EWG stabilizes the phenoxide ion formed while methoxy being ERG destabilizes the phenoxide ion .	1 1/2 1/2 1 1 1 1 1
35	(a) tetracyanidonickelate(II) ion , dsp^2 ,square planar ,diamagnetic (b)Correct explanation + Correct diagram (c)$Fe_4[Fe(CN)_6]_3$	1/2+1/2+ 1/2+1/2 1+1 1