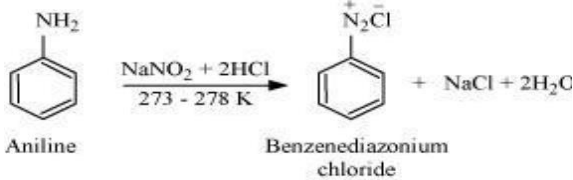


Marking Scheme - Sample Paper 2020-21

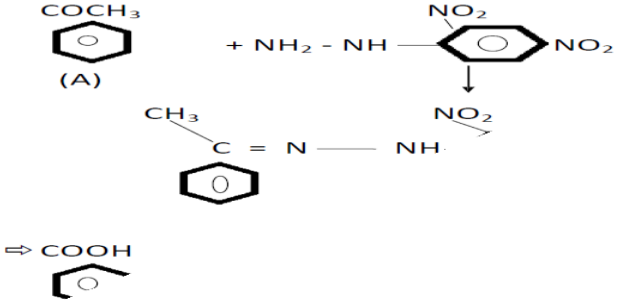
Q. No.	ANSWER	MARKS
1.	(i)(a) (ii) (d) (iii) (a) (iv) (b)	1X4
2.	(i)(b) (ii) (d) or (a) (iii) (a) (iv) (a)	1X4
3.	(c)	1
4.	(c) OR (d)	1
5.	(d)	1
6.	(a) OR (b)	1
7.	(d) Or (a)	1
8.	(a)	1
9.	(a)	1
10.	(c)	1
11.	(b)	1
12.	(b) OR (a)	1
13.	(b)	1
14.	(d)	1
15.	(a)	1
16.	d OR (c)	1
17.	a) Methyl halide < Allyl halide < benzyl halide < Tertiary Alkyl halide b) due to resonance C-X bond have partial double bond character and is difficult to break or any other reason .	1 1
18.	The elevation ( $\Delta T_b$ ) in the boiling point = $354.11 \text{ K} - 353.23 \text{ K} = 0.88 \text{ K}$ Substituting these values in expression (2.33) we get $M_2 = \frac{2.53 \text{ K kg mol}^{-1} \times 1.8 \text{ g} \times 1000 \text{ g kg}^{-1}}{0.88 \text{ K} \times 90 \text{ g}}$ $= 58 \text{ g mol}^{-1}$ Therefore, molar mass of the solute, $M_2 = 58 \text{ g mol}^{-1}$	$\frac{1}{2}$ 1 $\frac{1}{2}$
19.	Explanation by VBT - Hybridization : $d^2sp^3$ , geometry: octahedral OR (i) No. of unpaired electron = 5, paramagnetic moments = $\sqrt{5(5+2)}$ $= \sqrt{35} = 4.9 \text{ BM}$ (ii) due to presence of unpaired electrons in 3d orbitals $[\text{NiCl}_4]^{2-}$ is paramagnetic (Cl <sup>-</sup> is weak ligand which can not pair up the electrons of d orbitals and in $[\text{Ni}(\text{CO})_4]$ ligand CO is strong which pair up the d-electron therefore no unpaired electrons in d subshell therefore diamagnetic.	1+1 1 1
20.	(i) Rxn. is a complex one because $\frac{1}{2}$ atom of B is not possible. It means order of rxn. is 1.5 but molecularity is never in fractions. It means reaction occurs in more than one step so is a complex one . (ii) Units of K will be $\text{mol}^{-0.5} \text{L}^{0.5} \text{s}^{-1}$	2

	<p style="text-align: center;">OR</p> <p>Let order of reaction wrt A is x &amp; wrt B is y</p> $R_1 = k [A]^x \cdot [B]^y$ $R_1 = k(0.20)^x \cdot (0.03)^y = 5.07 \times 10^{-5}$ <hr/> $R_2 = k(0.20)^x \cdot (0.10)^y = 5.07 \times 10^{-5}$ <p>On Solving Eq. Y = 0</p> $R_1 = k(0.20)^x \cdot (0.03)^y = 5.07 \times 10^{-5}$ <hr/> $R_3 = k(0.40)^x \cdot (0.05)^y = 14.3 \times 10^{-5}$ <p>On solving x = 1.5 So order of reaction w.r.t. A is 1.5 and w.r.t. B is 0</p>	1
21.	<p>The formation of ether is a nucleophilic bimolecular reaction (<math>S_N2</math>) involving the attack of alcohol molecule on a protonated alcohol, as indicated below:</p> <p>(i) <math>\text{CH}_3\text{-CH}_2\text{-}\ddot{\text{O}}\text{-H} + \text{H}^+ \rightarrow \text{CH}_3\text{-CH}_2\text{-}\overset{\text{H}}{\underset{\text{H}}{\text{O}^+}}\text{-H}</math></p> <p>(ii) <math>\text{CH}_3\text{CH}_2\text{-}\ddot{\text{O}}\text{:} + \text{CH}_3\text{-CH}_2\text{-}\overset{\text{H}}{\underset{\text{H}}{\text{O}^+}} \rightarrow \text{CH}_3\text{CH}_2\text{-}\overset{\text{H}}{\underset{\text{H}}{\text{O}^+}}\text{-CH}_2\text{CH}_3 + \text{H}_2\text{O}</math></p> <p>(iii) <math>\text{CH}_3\text{CH}_2\text{-}\overset{\text{H}}{\underset{\text{H}}{\text{O}^+}}\text{-CH}_2\text{CH}_3 \rightarrow \text{CH}_3\text{CH}_2\text{-O-CH}_2\text{CH}_3 + \text{H}^+</math></p> <p style="text-align: center;">(I)                      (II)                      (III)                      (IV)                      (V)</p>	2
22.	$T = 2.303 / k \log A_0/A$ $t_{99\%} = 2.303/k \log 100/1 \quad \text{(i) Dividing Eq. (i) by (ii)}$ $t_{90\%} = 2.303/k \log 100/10 \quad \text{(ii)}$ $t_{99\%} = 2.303/k \log 100/1$ $\frac{t_{90\%}}{t_{99\%}} = \frac{2.303/k \log 100/10}{2.303/k \log 100/1}$ $t_{90\%} = 2 \log 10$ $t_{99\%} = 2 \log 10$ $t_{90\%} = 1 \log 10$ $t_{99\%} = 2 t_{90\%}$	<p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>
23.	Racemic mixture will be given by 2-Chlorobutane as it is an optically active compound	1+1

	When 2-Chlorobutane undergoes SN1 reaction, both front and rear attacks are possible resulting in formation of racemic mixture.	
24.	Correct str.	1+1
25.	<p><math>10^{-3}</math> mol percent means 100 moles of NaCl are doped with <math>10^{-3}</math> moles of <math>\text{AlCl}_3</math></p> <p><math>\therefore</math> 1 mole of NaCl is doped with <math>\text{AlCl}_3</math></p> <p><math>= 10^{-3} / 100 = 10^{-5}</math> mole</p> <p>Since each <math>\text{Al}^{3+}</math> ion introduces two cation vacancies</p> <p><math>\therefore</math> Concentration of cation vacancies</p> <p><math>= 2 \times 10^{-5}</math> mol/mol of NaCl</p> <p><math>= 2 \times 10^{-5} \times 6.02 \times 10^{23} \text{ mol}^{-1}</math></p> <p><math>= 2 \times 6.02 \times 10^{18} \text{ mol}^{-1}</math></p>	2
26.	<p>(i) The <math>E^0 (M^{2+}/M)</math> values are not regular which can be explained from the irregular variation of ionization energy and sublimation energy of Mn due to half-filled orbitals.</p> <p>(ii) due to small energy difference between (n-1) d &amp; ns orbital as a result both (n-1)d &amp; ns electrons take part in bond formation.</p> <p style="text-align: center;">OR</p> <p>(i) <math>E^0</math> for <math>\text{Cr}^{3+}/\text{Cr}^{2+}</math> is -0.4V i.e. negative, this means <math>\text{Cr}^{3+}</math> ions in the solution cannot be reduced to <math>\text{Cr}^{2+}</math> easily i.e. <math>\text{Cr}^{3+}</math> is stable. As <math>\text{Mn}^{3+}/\text{Mn}^{2+}</math> is +1.5V i.e. positive means <math>\text{Mn}^{3+}</math> can easily reduced to <math>\text{Mn}^{2+}</math> ions in comparison to <math>\text{Fe}^{3+}</math> ions. Thus relatively stability of these ions is:-</p> <p><math>\text{Mn}^{3+} &lt; \text{Fe}^{3+} &lt; \text{Cr}^{3+}</math></p> <p>(ii) The oxidation potentials for the given pairs will be +0.9V, +1.2V and 0.4V. Thus, the order of their getting oxidized will be in the order <math>\text{Mn} &gt; \text{Cr} &gt; \text{Fe}</math>.</p>	<p>2</p> <p>1</p> <p>1.5</p> <p>1.5</p>
27.	<p>(i) Aniline undergoes resonance and as a result, the electrons on the N-atom are delocalized over the benzene ring. Therefore, the electrons on the N-atom are less available to donate. On the other hand, in case of methylamine (due to the +I effect of methyl group), the electron density on the N-atom is increased. As a result, aniline is less basic than methylamine. Thus, <math>\text{pK}_b</math> of aniline is more than that of methylamine.</p> <p>(ii) Ethylamine is soluble in water whereas aniline is not: Ethylamine when added to water forms intermolecular H-bonds with water. Hence, it is soluble in water. But aniline does not undergo H-bonding with water to a very large extent due to the presence of a large hydrophobic <math>-\text{C}_6\text{H}_5</math> group. Hence, aniline is insoluble in water.</p> <p>(iii) Friedel-Crafts reaction is carried out in the presence of <math>\text{AlCl}_3</math>. But <math>\text{AlCl}_3</math> is acidic in nature, while aniline is a strong base. Thus, aniline reacts with <math>\text{AlCl}_3</math> to form a salt (as shown in the following equation). Due to the positive charge on the N-atom, electrophilic substitution in the benzene ring is deactivated.</p>	<p>1</p> <p>1</p> <p>1</p>

	<p>Hence, aniline does not undergo the Friedel-Crafts reaction.</p> <p style="text-align: center;">OR</p> <p>(i) Propanamine contains three carbons. Hence, the amide molecule must contain four carbon atoms. Structure and IUPAC name of the starting amide with four carbon atoms is</p> $\text{CH}_3-\text{CH}_2-\text{CH}_2-\underset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{NH}_2$ <p style="text-align: center;">Butanamide</p>	<p>1</p> <p>1</p>
	<p>ii)</p> <p>Aromatic primary amines react with nitrous acid (prepared in situ from <math>\text{NaNO}_2</math> and a mineral acid such as <math>\text{HCl}</math>) at low temperatures (273-278 K) to form diazonium salts. This conversion of aromatic primary amines into diazonium salts is known as diazotization. For example, on treatment with <math>\text{NaNO}_2</math> and <math>\text{HCl}</math> at 273–278 K, aniline produces benzenediazonium chloride, with <math>\text{NaCl}</math> and <math>\text{H}_2\text{O}</math> as by-products.</p> <div style="text-align: center;">  <p style="text-align: center;">Aniline <math>\xrightarrow[273 - 278 \text{ K}]{\text{NaNO}_2 + 2\text{HCl}}</math> Benzenediazonium chloride + <math>\text{NaCl} + 2\text{H}_2\text{O}</math></p> </div> <p>(iii) Methylamine and dimethylamine can be distinguished by the carbylamine test.</p> <p>Carbylamine test: Aliphatic and aromatic primary amines on heating with chloroform and ethanolic potassium hydroxide form foul-smelling isocyanides or carbylamines. Methylamine (being an aliphatic primary amine) gives a positive carbylamine test, but dimethylamine does not.</p> $\text{CH}_3-\text{NH}_2 + \text{CHCl}_3 + 3\text{KOH} \xrightarrow{\Delta} \text{CH}_3-\text{NC} + 3\text{KCl} + 3\text{H}_2\text{O}$ <p style="text-align: center;">Methylamine (<math>1^{\circ}</math>) <span style="margin-left: 150px;">Methyl isocyanide</span> (foul smell)</p> $(\text{CH}_3)_2\text{NH} + \text{CHCl}_3 + 3\text{KOH} \xrightarrow{\Delta} \text{No reaction}$	<p>1</p>
28.	<p>In <u>primary structure</u> specific sequence of amino acid are present joined by covalent bonds.</p> <p><u>Secondary structure</u> is responsible for the shape of a protein. <math>\alpha</math>-helix and <math>\beta</math>-pleated in which polypeptide chains have peptide bonds.</p> <p><u>Tertiary structure</u> represents overall folding of polypeptide chain and give rise to the fibrous or globular molecular shape.</p>	<p>1</p> <p>1</p> <p>1</p>
29.	$d = \frac{Z \times M}{a^3 \times N_A}$	<p>1</p>

	$Z=?$ , $a=289\text{ pm}=289 \times 10^{-10}\text{ cm}$ , $M=52\text{ g mol}^{-1}$ , $d=7.2\text{ g cm}^{-3}$  $Z = \frac{d \times a^3 \times N}{M} = \frac{7.2(\text{g cm}^{-3}) \times [289 \times 10^{-10}\text{ cm}]^3 \times 6.022 \times 10^{23}(\text{atom mol}^{-1})}{52\text{ g mol}^{-1}}$ Correct answer $Z = 2$	1 1
30.	(i) It is not soluble in blood even under high pressure. (ii) Being monoatomic they have weak dispersion forces.	1 1
	(ii) I-Cl bond is weaker than I-I bond	1
31.	(i) The gas 'A' is $\text{NO}_2$ whereas 'B' is $\text{N}_2\text{O}_4$ . $\text{XNO}_3 + \text{H}_2\text{SO}_4 \text{ ----} \rightarrow \text{XHSO}_4 + \text{HNO}_3$ Salt (conc.) $\text{Cu} + 4\text{HNO}_3 \text{ (Conc.)} \text{ ----} \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{NO}_2 + 2\text{H}_2\text{O}$ Blue Brown (A) $2\text{NO}_2 \text{ (on cooling)} \text{ ----} \rightarrow \text{N}_2\text{O}_4$ Colourless (B) (ii) (a) Acidic strength: $\text{HOCl} < \text{HClO}_2 < \text{HClO}_3 < \text{HClO}_4$ (b) Acidic strength: $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$ OR (i) (a) $6\text{XeF}_4 + 12\text{H}_2\text{O} \text{ ----} \rightarrow 4\text{Xe} + 2\text{XeO}_3 + 24\text{HF} + 3\text{O}_2$ (b) $\text{AgCl(s)} + 2\text{NH}_3 \text{ (aq)} \text{ ----} \rightarrow [\text{Ag}(\text{NH}_3)_2]\text{Cl(aq)}$ © $4\text{NaCl} + \text{MnO}_2 + 4\text{H}_2\text{SO}_4 \text{ ----} \rightarrow \text{MnCl}_2 + 4\text{NaHSO}_4 + 2\text{H}_2\text{O} + \text{Cl}_2$ (i) Partial hydrolysis of $\text{XeOF}_4$ $\text{XeF}_6 + \text{H}_2\text{O} \text{ ----} \rightarrow \text{XeOF}_4 + 2\text{HF}$ Structure-square pyramidal.	3 1 1 3 1+1
32.	Ans: $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3 + \text{H}_2\text{O} \xrightarrow{\text{H}_2\text{SO}_4}$ (A) Butyl Butanoate $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH (B)}$ + $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH (C)}$  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} \xrightarrow{\text{K}_2\text{Cr}_2\text{O}_7} \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ (e) (B)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} \xrightarrow[\text{H}_2\text{SO}_4]{\text{Conc.}} \text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2 \text{ (but-1-ene)}$	3           1+1
	(ii) (a) In 2,2,6 trimethyl cyclohexanone there is steric hinderance and inductive effect of 3 methyl groups, It does not form cyanohydrin in good yield.	1+1

	<p>(b) In benzoic acid the Carboxyl group is meta directing because it is electron-withdrawing There is +ve charge on ortho and para positions. Electrophilic substitution takes place at meta-position.</p> <p style="text-align: center;">OR</p>	3
	<div style="text-align: center;">  </div> <p>(i)</p> <p>(ii) (a) Alcohols have intermolecular H-bonding but Aldehydes do not . ( b ) Because it does not possess α-hydrogen atom.</p>	1+1
33.	<p>At anode: <math>\text{Al}(s) \rightarrow \text{Al}^{3+}(aq) + 3e^- ] \times 2</math>  At cathode: <math>\text{Ni}^{2+}(aq) + 2e^- \rightarrow \text{Ni}(s)] \times 3</math>  <math>2\text{Al}(s) + 3\text{Ni}^{2+}(aq) \rightarrow 2\text{Al}^{3+}(aq) + 3\text{Ni}(s)</math>  Here <math>n = 6</math>,  <math>[\text{Al}^{3+}] = 0.001\text{M} = 1 \times 10^{-3}\text{M}</math>, <math>[\text{Ni}^{2+}] = 0.5\text{M}</math>  Correct formula  Correct answer and unit <math>E_{\text{cell}} = 1.46\text{ V}</math>  (ii) Oxidation takes place at anode. Now higher the oxidation Potential, easier to oxidize. Oxidation potential of <math>\text{Br}^-</math>, <math>\text{H}_2\text{O}</math>, <math>\text{F}^-</math> are in the following order. 1.9, 1.23 . 2.87  OR  (i) Cell reaction is as follows. <math>\text{Zn}(s) + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}(s)</math>  <math>n=2</math>    <math>T=298\text{K}</math>  <math>E_{\text{cell}} = (E^{\circ}\text{Cu}^{2+}/\text{Cu} - E^{\circ}\text{Zn}^{2+}/\text{Zn}) - 0.0591/n \log[\text{Zn}^{2+}]/[\text{Cu}^{2+}]</math>  <math>0.34\text{V} - (-0.76) - 0.02955 \log 10^{-4}/10^{-2}</math>  <math>1.10 - 0.02955\text{V} \log 10^{-2}</math>  <math>= 1.10\text{V} + 2 \times 0.02955\text{V}</math>  <math>= 1.10\text{V} + 0.0591\text{ V}</math>  <math>= 1.1591\text{V}</math>  (ii) Emf of a cell depends on following factor-  Nature of electrodes , Temperature and Concentration of half cells</p>	1  1  1  2   1  1  1  2