

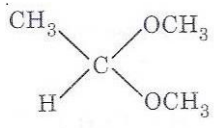
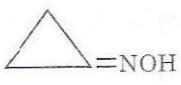
SCORING KEY
SAMPLE PAPER (CHEMISTRY)
CLASS XII

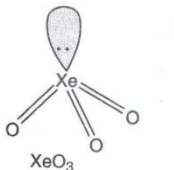
Q.No	Answers	Marks
1.	Metal excess or anionic vacancies or F-centres	1
2.	Catalysis by zeolites which depends on the shape and size of the reactants and the products as compared to those of the pores and cavities of zeolites.	1
3.	Neopentane or 2,2-Dimethylpropane	1
4.	3-Chloropropanamine, $\text{CH}_3\text{CH}(\text{Cl})\text{CH}_2\text{NH}_2$	$\frac{1}{2}$, $\frac{1}{2}$
5.	Three ions $[\text{Co}(\text{NH}_3)_6]^{2+}$, 2Cl^-	1
6.	No, the elevation in boiling point is not the same. Elevation in boiling point is a colligative property which depends on the number of particles. NaCl is an ionic compound which dissociates in solution to give more number of particles whereas sugar is made up of molecules and thus does not dissociate.	$\frac{1}{2}$ 1 $\frac{1}{2}$
7.	(a) As seen from the graph, electrolyte A is a strong electrolyte which is completely ionised in solution. With dilution, the ions are far apart from each other and hence the molar conductivity increases. (b) To determine the value of limiting molar conductivity for electrolyte B, indirect method based upon Kohlrausch law of independent migration of ions is used.	1 1
8.	(a) Scandium (Sc) (b) KMnO_4 or any other suitable example (c) Cerium (Ce) or any other example. (d) Chromite ore	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
9.	(a) $\text{I}_2 < \text{F}_2 < \text{Br}_2 < \text{Cl}_2$ (b) $\text{BiH}_3 < \text{SbH}_3 < \text{AsH}_3 < \text{PH}_3 < \text{NH}_3$	1 1
10.	(a) 1-Methylcyclohexene (b) $\text{C}_6\text{H}_6 \xrightarrow{\text{conc. H}_2\text{SO}_4, \Delta} \text{C}_6\text{H}_5\text{SO}_3\text{H} \xrightarrow{\text{NaOH, fuse, 575 K}} \text{C}_6\text{H}_5\text{ONa} \xrightarrow{\text{dil. HCl}} \text{C}_6\text{H}_5\text{OH}$ OR Any two isomers out of the following: (i) $\text{CH}_3\text{--CH}_2\text{--CH}_2\text{--CH}(\text{OH})\text{--CH}_3$ Pentan-2-ol (ii) $\text{CH}_3\text{--CH}_2\text{--CH}(\text{OH})\text{--CH}_2\text{--CH}_3$ Pentan-3-ol (iii) $\text{CH}_3\text{--CH}(\text{CH}_3)\text{--CH}(\text{OH})\text{--CH}_3$ 3-Methylbutan-2-ol (iv) $\text{CH}_3\text{--CH}_2\text{--C}(\text{CH}_3)(\text{OH})\text{--CH}_3$ 2-Methylbutan-2-ol	1 1 $\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$

11.	<p>For the bcc structure, $z = 2$</p> <p>Density $\rho = \frac{Z \times M}{a^3 \times N_o}$</p> $7.2 \text{ g cm}^{-3} = \frac{2 \times M}{(288 \times 10^{-10} \text{ cm})^3 \times (6.022 \times 10^{23}) \text{ mol}^{-1}}$ <p>Or $M = 51.8 \text{ g mol}^{-1}$</p> <p>By mole concept,</p> <p>51.8 g of the element contains 6.022×10^{23} atoms</p> <p>208 g of the element will contain $\frac{6.022 \times 10^{23} \times 208}{51.8}$ atoms</p> $= 24.17 \times 10^{23} \text{ atoms.}$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
12.	<p>Molar mass of KCl = $39 + 35.5 = 74.5 \text{ g mol}^{-1}$</p> <p>As KCl dissociates completely, number of ions produced are 2.</p> <p>Therefore, van't Hoff factor, $i = 2$</p> <p>Mass of KCl solution = $1000 \times 1.04 = 1040 \text{ g}$</p> <p>Mass of solvent = $1040 - 74.5 = 965.5 \text{ g} = 0.9655 \text{ kg}$</p> <p>Molality of the solution:</p> $\frac{\text{No. of moles of solute}}{\text{Mass of solvent in kg}} = \frac{1 \text{ mol}}{0.9655 \text{ kg}} = 1.0357 \text{ m}$ $\Delta T_b = i \times K_b \times m$ $= 2 \times 0.52 \times 1.0357 = 1.078^\circ \text{C}$ <p>Therefore, boiling point of solution = $100 + 1.078 = 101.078^\circ \text{C}$</p> <p>(deduct $\frac{1}{2}$ mark if unit not written/incorrect)</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p>
13.	<p>Anode reaction: $\text{Zn}(s) \rightarrow \text{Zn}^{2+}(aq) + 2e^-$</p> <p>Cathode reaction: $\text{Pb}^{2+}(aq) + 2e^- \rightarrow \text{Pb}(s)$</p> <p>Cell representation: $\text{Zn}(s) / \text{Zn}^{2+}(aq) // \text{Pb}^{2+}(aq) / \text{Pb}(s)$</p> <p>According to Nernst equation:</p> $E_{\text{cell}} = E^\circ_{\text{cell}} - \frac{0.059}{n} \log \frac{[\text{Zn}^{2+}]}{[\text{Pb}^{2+}]}$ $E_{\text{cell}} = [-0.13 - (-0.76)] - \frac{0.059}{2} \log \frac{0.1}{0.02}$ $= 0.63 - 0.02955 \times \log 5$ $= 0.63 - 0.02955 \times 0.6990$ $= 0.63 - 0.0206 = 0.6094 \text{ V}$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
14.	<p>(a) A reddish brown coloured colloidal solution is obtained.</p> <p>(b) Stability of lyophilic sols is due to:</p>	1

	<p>(i) same charge on all the colloidal particles.</p> <p>(ii) solvation of the colloidal particles.</p> <p>(c) At high pressures, amount of gas adsorbed (x/m) becomes independent of pressure (P)</p> $\frac{x}{m} = k \times P^o$	<p>$1/2+1/2$</p> <p>1</p>
15.	<p>The feasibility of thermal reduction can be predicted on the basis of Ellingham diagram. Metals for which the standard free energy of formation ($\Delta_f G^\circ$) is more negative can reduce those metals for which $\Delta_f G^\circ$ is less negative. At a given temperature, any metal will reduce the oxide of other metals which lie above it in the Ellingham diagram.</p> <p>(a) Below the temperature approx 1623K), corresponding to the point of intersection of Al_2O_3 and MgO curves, Mg can reduce alumina.</p> <p>(b) At temperatures below 1073K, the CO, CO_2 line lies Fe, FeO line, thus CO is a better reducing agent.</p> <p>At temperatures above 1073K, Coke will reduce FeO and itself get oxidised to CO.</p> <p style="text-align: center;">OR</p> <p>(a) Entropy is higher when a metal is in the liquid state than when it is in the solid state. Thus $T\Delta S$ increases, thus ΔG° becomes more negative and the reduction becomes easier. ($\Delta G = \Delta H - T\Delta S$)</p> <p>(b) Limestone provides the flux (CaO) which combines with the impurities (SiO_2) to form slag ($CaSiO_3$). Thus it helps in the removal of impurities.</p> <p>(c) Pine oil (Collector) enhances the non wettability of the ore particles, which become lighter and hence rise to the surface along with the froth.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
16.	<p>(i)(a) Cr^{3+}/Cr^{2+} has a negative reduction potential. Hence Cr^{3+} cannot be reduced to Cr^{2+}. Cr^{3+} is most stable. Mn^{3+}/Mn^{2+} have large positive E° values. Hence Mn^{3+} can be easily reduced to Mn^{2+}. Thus Mn^{3+} is least stable. Fe^{3+}/Fe^{2+} couple has a positive E° value but small. Thus the stability of Fe^{3+} is more than Mn^{3+} but less stable than Cr^{3+}.</p> <p>(b) If we compare the reduction potential values, Mn^{2+}/Mn has the most negative value i.e its oxidation potential value is most positive. Thus its most easily oxidised. Thus the decreasing order for their ease of oxidation is $Mn > Cr > Fe$.</p> <p>(ii) $K_4[Mn(CN)_6]$</p> <p>Mn is in +2 oxidation state. Magnetic moment 2.2 indicates that it has one unpaired electron and hence forms inner orbital or low spin complex. In presence of CN^- is a strong ligand, hybridisation involved is d^2sp^3 (octahedral complex)</p>	<p>1</p> <p>1</p> <p>1</p>
17.	<p>(i) Fe exists as Fe^{2+}. There are 4 unpaired electrons. Water is a weak ligand. Thus the hybridisation involved is sp^3d^2. It is an octahedral outer orbital complex.</p> <p>(marks to be granted if hybridisation is depicted diagrammatically)</p>	<p>1</p>

	<p>(ii) The ionisation isomer is $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$. The IUPAC name is Pentaamminesulphatocobalt(III)bromide.</p> <p>The isomer $[\text{Co}(\text{NH}_3)_5 \text{Br}] \text{SO}_4$ gives a white precipitate of BaSO_4 with BaCl_2 solution whereas the isomer $[\text{Co}(\text{NH}_3)_5 \text{SO}_4]\text{Br}$ does not form this precipitate. (or any other relevant test)</p>	<p>1</p> <p>1</p>
18.	<p>(a) Due to greater s-character, a sp^2 hybrid carbon is more electronegative than a sp^3 hybrid carbon. Therefore, the sp^2 hybrid carbon of C-Cl bond in chlorobenzene has less tendency to release electrons to Cl than a sp^3 hybrid carbon of cyclohexyl chloride. (marks to be granted if shown with the help of a figure)</p> <p>(b) Since the alkyl halide reacts with KOH to form a racemic mixture, it must be a 3° alkyl halide and the reaction will follow $\text{S}_{\text{N}}1$ mechanism.</p> <div style="text-align: center;"> <p style="text-align: center;"> $\begin{array}{c} \text{CH}_3 \\ \\ \text{C}_3\text{H}_7-\text{C}-\text{Br} \\ \\ \text{C}_2\text{H}_5 \end{array} \longrightarrow \begin{array}{c} \text{CH}_3 \\ \\ \text{C}_3\text{H}_7-\text{C}^+ \\ \\ \text{C}_2\text{H}_5 \\ \text{3}^\circ \text{ Carbocation} \end{array} + \text{Br}^-$ $\begin{array}{c} \text{CH}_3 \\ \\ \text{C}_3\text{H}_7-\text{C}^+ \\ \\ \text{C}_2\text{H}_5 \end{array} + \text{OH}^- \longrightarrow \begin{array}{c} \text{CH}_3 \\ \\ \text{C}_3\text{H}_7-\text{C}-\text{OH} \\ \\ \text{C}_2\text{H}_5 \\ \text{(Racemic mixture)} \end{array}$ </p> </div>	<p>1</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p>
19.	<p>(a) A – $\text{C}_6\text{H}_5\text{NH}_2$ B – $\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^-$ C – $\text{C}_6\text{H}_5\text{-N}_2\text{-C}_6\text{H}_4\text{-OH}$</p> <p>(b) A - $\text{C}_6\text{H}_5\text{CN}$ B - $\text{C}_6\text{H}_5\text{COOH}$ C - $\text{C}_6\text{H}_5\text{CONH}_2$</p>	<p>$\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$</p> <p>$\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$</p>
20.	<p>(a) A – Sucrose ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) The mixture of D-(+)- glucose and D-(-)-Fructose is known as invert sugar. The linkage which holds the two monosaccharide units through oxygen atom is called glycosidic linkage.</p> <p>(b) The amino acids exist as dipolar zwitter ion. Due to this dipolar salt like character they have strong dipole dipole attractions Thus their melting points are higher than the corresponding haloacids which do not exist as zwitter ions.</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>1</p>
21.	<p>(a) Phenacetin is an antipyretic, while the rest are tranquilizers.</p> <p>(b) 0.2% solution of phenol acts as antiseptic whereas 1% solution of phenol acts as disinfectant.</p> <p>(c) Carbohydrates, proteins, nucleic acids, lipids (any two)</p>	<p>$\frac{1}{2}+\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}+\frac{1}{2}$</p>
22.	<p>(i) Since the alkyl halide is a 3° halide and $\text{C}_2\text{H}_5\text{ONa}$ is a strong base, therefore elimination occurs preferably. The product obtained is 2-Methylprop-1-ene. $\text{CH}_3\text{-C}(\text{CH}_3)=\text{CH}_2$</p> <p>(ii) To prepare t-Butyl ethyl ether, the alkyl halide should be 1° i.e. chloroethane and the nucleophile should be sodium t-butoxide because the 3°</p>	<p>1</p> <p>$\frac{1}{2}+\frac{1}{2}$</p>

	<p>(ii)</p>  <p>(iii)</p> 	1
25.	<p>(a) For a first order reaction</p> $k = \frac{2.303}{t} \log \frac{[R]_o}{[R]}$ <p>where $[R]_o$ = initial concentration, $[R]$ = conc. after time t</p> <p>When half of the reaction is completed, $[R] = [R]_o/2$. Representing, the time taken for half of the reaction to be completed, by $t_{1/2}$, equation becomes:</p> $k = \frac{2.303}{t_{1/2}} \log \frac{[R]_o}{[R]_o/2}$ $t_{1/2} = \frac{2.303}{k} \log 2$ $t_{1/2} = \frac{2.303}{k} \times 0.3010$ $t_{1/2} = \frac{0.693}{k}$ <p>The above equation shows that half life first order reaction is independent of the initial concentration of the reactant.</p> <p>(b) For a first order reaction</p> $t = \frac{2.303}{k} \log \frac{a}{a-x}$ $t_{99\%} = \frac{2.303}{k} \log \frac{a}{a-0.99a}$ $t_{90\%} = \frac{2.303}{k} \log \frac{a}{a-0.90a}$ $\frac{t_{99\%}}{t_{90\%}} = \left(\frac{2 \times 2.303}{k} \right) / \frac{2.303}{k} = 2$ $t_{99\%} = 2 \times t_{90\%}$ <p style="text-align: center;">OR</p> <p>(a) $r = k[R]^n$</p> <p>When concentration is increased three times, $[R] = 3a$</p>	<p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p>

	$27r = k(3a)^n$ $\frac{27r}{r} = \frac{k(3a)^n}{ka^n} \quad \text{or} \quad 27 = 3^n \quad \text{or} \quad 3^3 = 3^n$ $n = 3$ <p>(b)</p> <p>According to Arrhenius equation,</p> $\log k = \log A - \frac{E_a}{2.303RT}$ <p>For uncatalysed reaction</p> <p>(i) $\log k_1 = \log A - \frac{E_a(1)}{2.303RT}$</p> <p>For catalysed reaction</p> <p>(ii) $\log k_2 = \log A - \frac{E_a(2)}{2.303RT}$</p> <p>A is equal for both the reactions.</p> <p>Subtracting equation(i) from equation(ii)</p> $\log \frac{k_2}{k_1} = \frac{E_a(1) - E_a(2)}{2.303RT}$ $\log \frac{k_2}{k_1} = \frac{(75.2 - 50.14) \text{ kJ mol}^{-1}}{2.303 \times 8.314 \text{ JK}^{-1} \text{ mol}^{-1} \times 298 \text{ K}}$ $\log \frac{k_2}{k_1} = 4.39$ $\frac{k_2}{k_1} = \text{anti log}(4.39)$ $= 2.45 \times 10^4$ <p>Rate of reaction increases by 2.45×10^4 times.</p>	<p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>1</p>
26.	<p>(a) (i) $\text{XeF}_6(s) + 3\text{H}_2\text{O}(l) \rightarrow \text{XeO}_3(s) + 6\text{HF}(aq)$</p> <p>(ii) $4\text{H}_3\text{PO}_3 \xrightarrow{\text{heat}} \text{PH}_3 + 3\text{H}_3\text{PO}_4$</p> <p>(b) XeO_3 is isostructural with BrO_3^-. (pyramidal structure)</p> <div style="text-align: center;">  <p>XeO_3</p> <p>Pyramidal</p> </div> <p>(c) The bond dissociation enthalpy of F-F bond is lower than that of Cl-Cl bond and hydration enthalpy of F^- ion is much higher than that of Cl^- ion.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>

	<p>These two factors more than compensate the less negative electron gain enthalpy of F_2. Thus, F_2 is a stronger oxidizing agent than Cl_2.</p> <p>(d) H_2SO_4 ionises in two stages and hence has two dissociation constants. $K_{a_2} \ll K_{a_1}$.</p> <p>This is because the negatively charged HSO_4^- ion has much less tendency to donate a proton to H_2O as compared to neutral H_2SO_4.</p> <p style="text-align: center;">OR</p> <p>(a) Due to stronger H-F bond than HCl bond, HF ionises less readily than HCl in aqueous solution to give H^+ ions. Therefore HF is a weaker acid than HCl.</p> <p>(b) In solid state, PCl_5 consists of ions $[PCl_4]^+[PCl_6]^-$. On melting these ions become free to move and hence conducts electricity in the molten state.</p> <p>(c) In SF_6, S is sterically protected by six F atoms and hence does not allow H_2O molecules to attack the S molecule. Also, F does not have d-orbitals to accept the electrons donated by H_2O molecules.</p> <p>(d) In the structure of H_3PO_3, it contains only two ionisable H-atoms which are present as -OH groups, thus it behaves as a dibasic acid.</p> <p>(e) Except radon which is radioactive, Xenon has least ionisation energy among noble gases and hence it readily forms chemical compounds particularly with O_2 and F_2.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
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