Marking Scheme of Sample Question Paper
Chemistry XI
2023-24

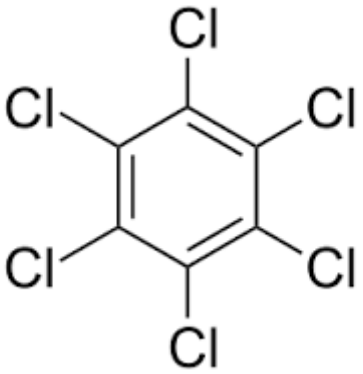
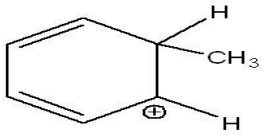
Q. No	Sub part	Value Points	Step wise marks	Total Marks
1		d	1	1
2		b	1	1
3		b	1	1
4		c	1	1
5		b	1	1
6		d	1	1
7		c	1	1
8		d	1	1
9		d	1	1
10		b	1	1
11		c	1	1
12		b	1	1
13		c	1	1
14		d	1	1
15		c	1	1
16		a	1	1
17		According to Heisenberg uncertainty principle: $\Delta x \Delta p \geq h/4\pi$ And, $\Delta p = m.\Delta v$ Thus, $\Delta x, m\Delta v \geq h/4\pi$ The value of $\Delta v.\Delta x$ (product of uncertainity) obtained for	1	

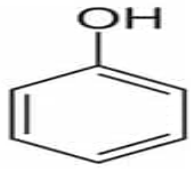
		macroscopic particle is extremely small in comparison to microscopic particle. and thus it is insignificant for the uncertainty principle to apply to macroscopic particle.	1	2
18	a b	Boron belongs to second period and has only four valence orbitals (2s and 2p) available for bonding therefore its covalency can't exceed beyond four. Aluminium belongs to the third period and has d orbital available for bond formation and hence its covalency can exceed beyond four. Atomic configuration of element is [Rn] $4f^{14}\ 6d^{10}\ 7s^2\ 7p^5$ Group = 17 Period= 7	1 ½+½	2
19		Decrease in enthalpy is not a criterion for spontaneity,as many endothermic processes occurring in nature,are also spontaneous.For example,Evaporation of water, though an endothermic process is spontaneous.So Decrease in enthalpy is not the only criteria for spontaneity.	2	2
20		Reduction Half reaction: $MnO_4^- \rightarrow Mn^{2+}$ $MnO_4^- + 5e^- \rightarrow Mn^{2+}$ $MnO_4^- + 5e^- \rightarrow Mn^{2+} + 4H_2O$ $MnO_4^- + 5e^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O$ (i) Oxidation Half reaction: $SO_3^{2-} \rightarrow SO_4^{2-}$ $SO_3^{2-} \rightarrow SO_4^{2-} + 2e^-$ $SO_3^{2-} + H_2O \rightarrow SO_4^{2-} + 2e^-$	½ ½	

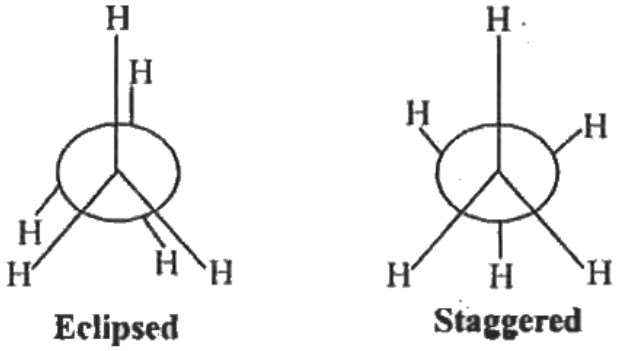
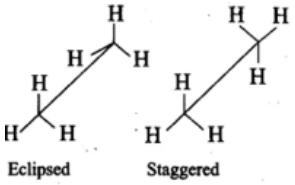
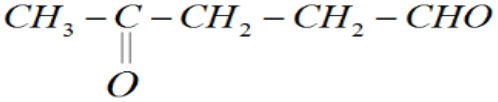
		$SO_3^{2-} + H_2O \rightarrow SO_4^{2-} + 2e^- + 2H^+$ (ii) Multiply equation (i) by 2 $[MnO_4^- + 5e^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O]$ X 2 $2\ MnO_4^- + 10e^- + 16H^+ \rightarrow 2Mn^{2+} + 8H_2O$ (iii) Multiply equation (ii) by 5 $[SO_3^{2-} + H_2O \rightarrow SO_4^{2-} + 2e^- + 2H^+]$ X 5 $5SO_3^{2-} + 5H_2O \rightarrow 5SO_4^{2-} + 10e^- + 10H^+$ (iv) Adding equation (iii) & (iv) $2\ MnO_4^- + 6H^+ + 5SO_3^{2-} \rightarrow 2Mn^{2+} + 3H_2O + 5SO_4^{2-}$ OR $MnO_4^- + I^- \rightarrow MnO_2 + I_2$ Reduction Half reaction: $MnO_4^- \rightarrow MnO_2$ $MnO_4^- + 3e^- \rightarrow MnO_2$ $MnO_4^- + 3e^- \rightarrow MnO_2 + 2H_2O$ $MnO_4^- + 3e^- + 4H^+ \rightarrow MnO_2 + 2H_2O$ $MnO_4^- + 3e^- + 4H^+ + 4OH^- \rightarrow MnO_2 + 2H_2O + 4OH^-$ $MnO_4^- + 3e^- + 2H_2O \rightarrow MnO_2 + 4OH^-$ (i) Oxidation Half Reaction $I^- \rightarrow I_2$ $2I^- \rightarrow I_2$ $2I^- \rightarrow I_2 + 2e^-$ (ii) Multiplying equation (ii) by 3	½ ½ ½ ½	2

		$6I^- \rightarrow 3I_2 + 6e^-$ (iii) Multiplying equation (i) by 2 $2MnO_4^- + 6e^- + 4H_2O \rightarrow 2MnO_2 + 8OH^-$ (iv) Adding equation (iii) & (iv) $2MnO_4^- + 4H_2O + 6I^- \rightarrow 2MnO_2 + 8OH^- + 3I_2$	½	2
21		$FeCO_3(s) \rightarrow FeO(s) + CO_2(g)$ $\Delta H = q_p = 80$ kJ $\Delta H = \Delta U = \Delta n_g RT$ $\Rightarrow 80$ kJ = [1x8.314 298]/1000 kJ $\Rightarrow \Delta U = 77.522$ kJ	½ 1 1/2	2
22		a)Molarity = No. of moles of solute/Volume of solution (L) Volume of Solution (mL) = Mass of solution/Density of solution $=100g/1.10gmL^{-1}$ M = 36.5 X 1.10 X1000 / 36.5 X 100 = 11 M b) $M_1V_{1\ (Conc.\ HCl)} = M_2V_{2(Dil.\ HCl)}$ $_{11X}\ V_1 = 0.1$ X 1 $V_1 = 9.09$ X10 $^{-3}$ L =9.09 mL	½ ½ ½ ½ ½ ½	2+1=3
23		a) MgO reacts with water to form base $Mg(OH)_2$ whereas SO_2 forms acid H_2SO_3. b) After losing one electron Na^+ acquires	1	

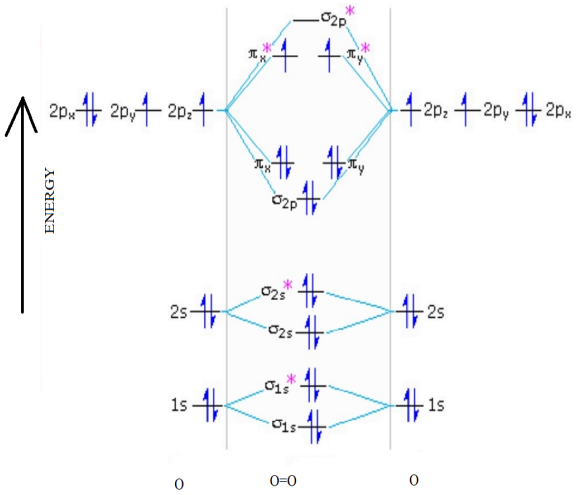
		noble gas electronic configuration and lot of energy is required to remove one more electron from Na^+. c) Li has high polarizing power due to its small size, large charge/radius ratio and high electronegativity.	1 1	3
24	a b c	Chromatography Carbon dioxide reacts with potassium hydroxide to form potassium carbonate and water.Thus, the mass of the U-tube containing KOH increases. This increase in the mass of U-tube gives the mass of produced. From its mass, the percentage of carbon in the organic compound can be estimated. **OR** As the boiling point of an alkane depends on the surface area of a molecule, more the surface area, higher the boiling point of alkane. The branched-chain isomer of an alkane has a lower surface area than that of its straight-chain isomer, so the branched-chain isomer of an alkane has a lower boiling point than its straight-chain isomer.	1 2 2	 3
25		$\lambda = \frac{h}{mc}$, $m = 100\text{g} = \frac{100}{1000} = 0.1\text{kg}.$ $c = 100\ \text{km/h} = \frac{100\times1000\text{m}}{60\times60\text{s}} = \frac{1000}{36}\ \text{ms}^{-1}$ $h = 6.626 \times 10^{-34}\ \text{Js}$ $\lambda = \frac{6\cdot626\times10^{-34}\ \text{Js}}{0\cdot1\ \text{kg} \times \frac{1000}{36}\ \text{ms}^{-1}}$ $= 6.626 \times 10^{-36} \times 36\ \text{m}$ $= 2.385 \times 10^{-34}\ \text{m}$ Since mass of the ball is large, therefore, λ is very small thus, the wave nature cannot be observed.	½ ½ 1 1	3

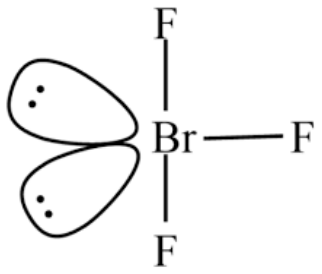
26		The balanced equation for the reaction is $AgNO_3(aq.) + NaCl(aq.) \rightarrow AgCl(s) + NaNO_3(aq.)$ Number of moles of NaCI in $500cm^3$ (0.5L) of 0.200M NaCI solution = 0.200X0.5 = 0.1mol Number of moles of $AgNO_3$ in $100cm^3$ (0.1L)0f of 0.500 M $AgNO_3$ solution =0.500x0.1==0.05 mol The reaction equation shows that 1 mole of $AgNO_3$ reacts with 1 mole of NaCI to give 1 mole of AgCI. 0.05 mol of $AgNO_3$ will react with 0.05 mol of NaCI to give 0.05 mole of AgCI. NaCI is present in excess. $AgNO_3$ is therefore ,the limiting reagent. Molar mass of AgCI =143.4g Mass of 0.05 mol of AgCI = O.O5 X143.4g of AgCl = 7.2g of AgCl.	½ ½ ½ ½ 1	3
27		A-  B-  		

		C- $H_2SO_4(SO_3)$ D-  E- NaOH/CaO,△ F- HC≡CH	½ X 6	3
28	a b	Greater the $P_{ext.}$ value , higher will be the work done. For expansion work, $P_{ext.}$ should be less than $P_{int.}$ and hence $P_{ext.}$ can only be infinitesimally higher than $P_{int.}$. This can be achieved when the process is carried out infinitesimally slowly (reversibly) Ratio of two extensive properties gives intensive property. Density is mass per unit volume and independent of the amount of matter present.	2 1	3
29	a b c	No, for each metal there is a characteristic minimum frequency(threshold frequency) below which photoelectric effect is not observed. Intensity is number of photons of light per unit area. Photoelectric current is directly proportional to intensity of light. Threshold frequency is the minimum frequency which the photon must have to eject the electron from the metal surface. The extra energy is converted into kinetic energy of electron. Or Cs is most suitable for photoelectric cell because the amount of energy required to eject electron from the cesium surface is relatively small.	1 1 2	

			2	4
30	a b c	D Eclipsed Newman projection of Ethane  OR Sawhorse projections of Ethane  	1 1 2 2	 4
31	a b c d e f	Inductive effect-It is slight displacement of sigma electrons towards more electronegative atom or group of atom in carbon chain. Hyperconjugation  Retention factor Hyperconjugation /+I -Effect NH_2NH_2 (Any five to be attempted)	 1X5	 5
32	a	It can be defined as a shift in equilibrium on adding a substance that provides more of an ionic species already present in the		

		dissociation equilibrium. HCI (aq)----------H^+(aq) + CI^- (aq) H^2S $\rightleftharpoons$ $2H^+ + S^{2-}$ passing of H_2S gas will result in the decreasing the concentration of sulphide ion i.e. dissociation of H_2S is suppressed.	1 1	
	b	Given, the solubility of $BaSO_4$ in water= 8×10^{-5} g/L The equation of dissociation of $BaSO_4$ will be- $BaSO_4 \rightleftharpoons Ba^{2+} + SO4^{2-}$ (S' is the solubility of Ba^{2+} in 0.01 H_2SO_4) S <<< 0.01, so it can be neglected We know that $K_{sp} = S^2$ $K_{sp} = (8\times10^{-5})^2$ $= 64\times10^{-10}$ Now, Ksp= (S') (0.01) $S' = 64 \times10^{-10}/0.01 = 6.4\times10^{-7}$ Hence solubility of $BaSO_4$ in 0.01 mol dm^{-3} of H_2SO_4 is 6.4×10^{-7}	½ ½ ½ ½ ½ ½	2+3=5
OR	a	(i) The conjugate base of a strong acid is weak therefore the decreasing order of basic strength will be; RO- > OH- > CH3COO- > Cl- (ii) The decreasing order of pH will be: $NH_4Cl > KNO_3 > CH_3COONa$ CH_3COONa is a salt of a weak acid (CH_3COOH) and strong base (NaOH) KNO_3 is a salt of strong acid	1 1	

		(HNO_3)-strong base (KOH) NH_4Cl is a salt of a strong acid (HCl) and a weak base (NH_4OH)		
	b	HOCl(aq) + H_2O (l) ⇌ H_3O+(aq) + ClO^-(aq) Initial concentration (M) = 0.08 0 0 At equilibrium (.08 – x) x x Ka = {[H_3O+][ClO^-] / [HOCl]} = x^2 / (0.08 –x) As x << 0.08, therefore 0.08 – x= 0.08 x^2 / 0.08 = 2.0× 10^{-5} x^2 = 2.0 ×10^{-5} X .08= 1.6 X 10^{-6}, thus, x = 1.26 × 10^{-3} [H+] = 1.26 × 10^{-3} M. Therefore, Percent dissociation = {[HOCl]dissociated / [HOCl]initial }× 100 = 1.26 X 10^{-3} X 100/ 0.08 = 1.575 %. pH = –log(1.26 × 10^{-3}) = 2.9.	½ ½ ½ ½ ½ ½	2+3=5
33	a b	NH_3 and H_2O MO diagram of O_2  Since Molecular orbitals have single electrons ,it is paramagnetic in nature. Bond Order=½(N_b-N_a,)=½(10-6)=2	½ x 2=1 2 1 1	5

	a	OR BrF_3  	1	
	b	According to VSEPR Geometry : Trigonal bipyramidal Shape: T- shape Lewis structure of O_3 is  F.C on the O-1 atom $= 6 - 2 - \frac{1}{2}(6) = +1$ F.C on the O-2 atom $= 6 - 4 - \frac{1}{2}(4) = 0$ F.C on the O-3 atom $= 6 - 6 - \frac{1}{2}(2) = -1$	1 1 ½ ½ X3	5