Federal Board HSSC-I Examination
Chemistry Model Question Paper

(Curriculum 2022-2023)

| | ROLL NUMBER | | | | | | | Version No. | | | |

Section - A (Marks 17)

Time Allowed: 25 minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. *Do not use lead pencil*.
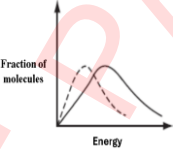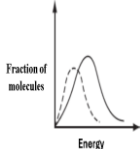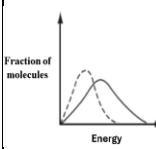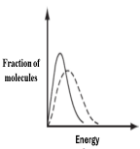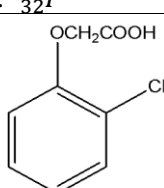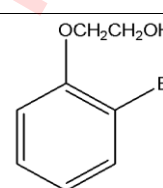
Candidate Sign._____   Invigilator Sign. _____

Q1. **Fill the relevant bubble against each question according to curriculum**. **Each part carries one mark.**

	Question	A	B	C	D	A	B	C	D
i.	0.1 mole of NaCl contains 6.02×10^{22}	molecules	formula units	ions	atoms	O	O	O	O
ii.	Which solid-line curve most accurately represents the distribution of molecular energy in a gas at 500 K if the dotted-line curve represents the corresponding distribution for the same gas at 300 K?					O	O	O	O
iii.	For the rate law , **Rate** $= k[A]^{\frac{1}{2}}$**[B],** predict order with respect to A, the order with respect to B and the total order.	$\frac{1}{2}$; 0; $\frac{1}{2}$	$\frac{1}{2}$; 1; 1	$\frac{1}{2}$; 1; $\frac{3}{2}$	$\frac{1}{2}$; 1; 2	O	O	O	O
iv.	1st Electron affinity of oxygen atom is greater than nitrogen because of,	greater nuclear charge of Nitrogen	more Screening effect of oxygen	less nuclear force of attraction of Nitrogen	greater nuclear force of attraction of oxygen	O	O	O	O
v.	If the total energy of the product is greater than the reactants, identify the reaction.	Exothermic	Endothermic	Reduction	oxidation	O	O	O	O
vi.	Suggest volume occupied by one mole of gas at STP.	224.14dm^3	2.414dm^3	0.022414cm^3	22414cm^3	O	O	O	O

vii.	When bromine reacts with propene in an organic solvent at room temperature, what is the mechanism by which the bromine attacks the propene?	Electrophilic substitution	Electrophilic addition	Nucleophilic addition	Nucleophilic substitution	O	O	O	O
viii.	Which one of the following reacts with aldehyde to give red precipitates of copper(I) oxide	Grignard's Reagent	Fehlings solution	Tollen's solution	$KMnO_4$	O	O	O	O
ix.	Identify termination step in free radical substitution reaction of methane with chlorine.	$CH_4 + Cl^{\cdot} \longrightarrow HCl + CH_3^{\cdot}$	$CH_3^{\cdot} + Cl^{\cdot} \longrightarrow CH_3Cl$	$Cl_2 \longrightarrow 2Cl^{\cdot}$	$Cl^{\cdot} + H_2 \longrightarrow HCl + H^{\cdot}$	O	O	O	O
x.	Predict the geometry of XeF_4	Tetrahedral	Trigonal planner	Square planner	V-shaped	O	O	O	O
xi.	Which electronic configuration represents the most electronegative element?	ns^2np^2	ns^2np^1	ns^2np^4	ns^2np^5	O	O	O	O
xii.	Predict which specie upon hydrolysis gives acidic solution?	Na_2CO_3	$NaNO_3$	$Cu(OH)_2$	$AlCl_3$	O	O	O	O
xiii.	Identify the most basic amine.	$CH_3CH_2NH_2$	$(CH_3)_3N$	CH_3NHCH_3	$CH_3CH_2NHCH_3$	O	O	O	O
xiv.	Which one of the following is a nucleophile?	NH_4^+	SO_3	NH_3	NO_2^{1+}	O	O	O	O
xv.	Identify which reagent is used to convert ethanal into ethanol?	$KMnO_4$	Zn/HCl	H_2SO_4	$LiAlH_4$	O	O	O	O
xvi.	Suggest why I_2 is solid while Br_2 is liquid at room temperature?	Due to strong hydrogen bonding in I_2	Due to stronger London dispersion forces in I_2	Due to dipole dipole force in Br_2	Due to ion dipole force in Br_2	O	O	O	O
xvii.	Identify carbonyl compound that forms an iodoform.	Propanal	Methanal	3-hexanone	Propanone	O	O	O	O

SECTION – B (Marks 42)

Q. 2	Attempt the following questions			(11x3 = 33)	
(i)	Explain with equations the reactions of the following chlorides with water, Also mention pH of resulting mixture. a. $AlCl_3$ b. PCl_3	1.5+1.5	**OR**	Draw the shape of 3s, $3p_x$ and $3dz^2$ orbitals.	3
(ii)	Identify alcohol and carboxylic acid use to prepare methyl propanoate. Give equation for the reaction.	03	**OR**	Write three points of differences between amorphous and crystalline solids.	1+1+1
(iii)	When Chloro ethane reacts with sodium hydroxide different products are formed under different sets of conditions used. Write down the structural formulae of the products which are formed under these conditions. Also write the type of each reaction.	1+1+1	**OR**	Reducing power of halide ions increases down the group. Explain this fact with the help of reaction of **Cl⁻** and **Br⁻¹** ions with conc. H_2SO_4.	1.5+1.5
(iv)	Calculate the enthalpy (ΔH) change of reaction by using the following data $C_2H_2 + \frac{5}{2}O_2 \rightarrow 2CO_2 + H_2O$ ΔH_f of $CO_2 = -393.5$ KJ mol⁻¹ ΔH_f of $H_2O = -285.5$ KJ mol⁻¹ ΔH_f of $C_2H_2 = 227.3$ KJmol⁻¹	03	**OR**	Starting from 20g of N_2, calculate the mass of gaseous product (NH_3) in the given reaction. $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	1+2
(v)	The table lists the equations for six processes. For each process, predict the sign of ΔS. 	Process	Sign of Δ*S*
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$NaCl(s) + (aq) \rightarrow NaCl(aq)$	
$H_2O(g) \rightarrow H_2O(l)$	
$2H_2O(g) \rightarrow 2H_2(g) + O_2(g)$	
$CuSO_4(s) + 6H_2O(l) \rightarrow CuSO_4.6H_2O(s)$	
$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$	
$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$			$\frac{1}{2} \times 6$	**OR**	Oxygen molecules show a paramagnetic behavior. Draw molecular orbital diagram of O_2 molecule and explain this statement on the basis of MOT.	03
(vi)	Explain the preparation of ethene from, a. Ethanol b. Chloro ethane	1.5+1.5	**OR**	Identify types of intermolecular forces among the following molecules. Also write the ascending order of their strength. HCl, NH_3, O_2, HF	2+1
(vii)	Write chemical equations involved in the preparation of Propan-1-ol from the following reagents a) Propene b) 1-Chloro Propane	1.5+1.5	**OR**	Catenation increases diversity of organic compounds. Define catenation and explain this statement with suitable examples.	1+2
(viii)	Give role of NOx in the formation of PAN (Peroxyacetyl nitrate). Explain with chemical reactions.	1+2	**OR**	Describe mechanism of the formation of CH_3Cl by the reaction of methane with chlorine.	03
(ix)	Write electronic configuration of following elements. a. $^{55}_{25}Mn$ b. $^{64}_{32}P$	1.5+1.5	**OR**	Give two possible ways to recognize an equilibrium.	1.5+1.5
(x)	[Structures of compounds A (OCH_2COOH, Cl) and B (OCH_2CH_2OH, Br)] How can you distinguish the above compounds **A** and **B** from each other. Give a chemical test?	1.5+1.5	**OR**	Describe the preparation methods of diethyl amine, $(C_2H_5)_2NH$ using a. nucleophilic substitution reactions b. reduction of nitro compounds	1.5+1.5

(xi)	A naturally occurring sample of cerium contains only four isotopes. ^{136}Ce having isotopic mass of 135.91 and %age abundance 0.185%, ^{138}Ce having isotopic mass of 137.91 and %age abundance of 0.25%, ^{140}Ce having isotopic mass of 139.91 and %age abundance of 88.45%. The relative atomic mass of the Ce is 140.116. Use these data to calculate the relative isotopic mass of the fourth isotope in this sample of cerium.	1+2	OR	Lead(II) chloride is sparingly soluble in water. Solubility of lead (II) chloride at 25 ℃ is 0.5 gdm^{-3}. Calculate Ksp of lead(II) chloride at 25 ℃.	1.5+1.5

(xii)	For 6f orbital, give allowed values of following quantum numbers.
	   i. Principal quantum number
	   ii. Azimuthal quantum number
	  iii. Magnetic quantum number
		1+1+1	OR	Define the following with at least one equation in each case.
				
				 a. Standard enthalpy of atomization (ΔH_{atm}).
				
				 b. Standard enthalpy of Lattice ($\Delta H_{lattice}$)
					1.5+1.5

(xiii)	Define electronegativity. Explain the trend of electronegativity down the group of the periodic table.	1+2	OR	Calculate volume of 4.5g of H_2 at STP by using mole-volume relationship.	03
(xiv)	What is meant by vapour pressure? Following is a table of the vapour pressure of water, ethanol and pentane. <table><tr><td>Liquid</td><td>Vapour Pressure</td></tr><tr><td>Water (H_2O)</td><td>2.44</td></tr><tr><td>Ethanol (C_2H_5OH)</td><td>5.83</td></tr><tr><td>Pentane (C_5H_{10})</td><td>59.9</td></tr></table> Explain these variations in vapour pressure.	1+2	OR	Calculate pH of a buffer solution containing 0.11M HCOOH and 0.11M HCOONa. pKa of methanoic acid at 25 ℃ is 3.76.	1+2

SECTION – C (Marks 26)

Note: Attempt the following questions

Q.3	Given the following data for a first-order reaction: Initial concentration of reactant (A): $[A]_0 = 0.10$ $moldm^{-3}$ Initial rate at $[A]^0$:$Rate_1 = 2.0 \times 10^{-3}$ $moldm^{-3}s^{-1}$ Concentration of reactant A after a certain time: $[A] = 0.05$ $moldm^{-3}$ Half-life of the reaction: $t_{\frac{1}{2}} = 100$ s Calculate the numerical value of the rate constant (k) for this reaction using the initial rates and half-life method.	3+3	OR	Ammonia is produced by the following reaction. $2NH_4Cl + Ca(OH)_2 \longrightarrow CaCl_2 + 2H_2O + 2NH_3$ When 200 g of ammonium chloride and 100 g calcium hydroxide are used then a. Calculate the amount of ammonia in grams produced during this reaction. b. Calculate the amount of excess reactant left unreacted after the completion of chemical reaction.	3+3
Q.4	Write down the reagents and conditions used to prepare propanoic acid from following. a. Propanal b. Propane nitrile c. Methyl propanoate	2+2+2	OR	The following is an important industrial reaction, $2SO_2 + O_2 \rightleftharpoons 2SO_3$ $\Delta H = -250 kJmol^{-1}$ Explain three factors that can increase the yield sulphur trioxide in this reaction.	2+2+2
Q.5	Consider an alcohol with molecular formula $C_4H_{10}O$. It exists in different isomeric forms. a. Write structural formulas of four isomers, also write their names.	6+1	OR	a. Compare the reactivity of different Alkyl halides (R-F, R-Cl, R-Br and R-I). Explain your answer. b. Write down the identifying test of halogens present in the alkyl halides. Also write down the equations involved.	3+4

	b. What type of isomerism is shown by these compounds?				

Q.6	Ethanol reacts with HBr, $SOCl_2$ and PCl_5 by substitution reactions.
	 a. Define substitution reactions.
	 b. Write complete balanced equations for the reaction of ethanol with these three reagents. Also write the conditions involved in each reaction.
		1+6	**OR**	What is meant by sp^3-hybridization. Explain in detail the type of hybridization in the following molecules. Also draw diagrams of hybridized orbitals.
				   a. PH_3
				   b. C_2H_2
					1+6