MODEL QUESTION PAPER

CHEMISTRY

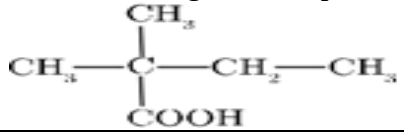
XII – STANDARD (CBSE)

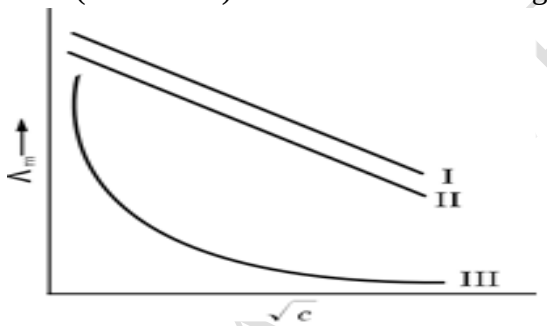
Time: 3 Hours **Max. Marks: 70**

Read the following instructions carefully.
(a) There are 33 questions in this question paper with internal choice.
(b) SECTION A consists of 16 multiple -choice questions carrying 1 mark each.
(c) SECTION B consists of 5 short answer questions carrying 2 marks each.
(d) SECTION C consists of 7 short answer questions carrying 3 marks each.
(e) SECTION D consists of 2 case - based questions carrying 4 marks each.
(f) SECTION E consists of 3 long answer questions carrying 5 marks each.
(g) All questions are compulsory.
(h) Use of log tables and calculators is not allowed.

SECTION-A **16x1=16**

Note: The following questions are multiple -choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

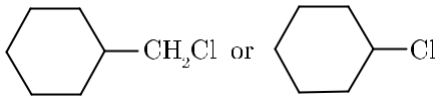
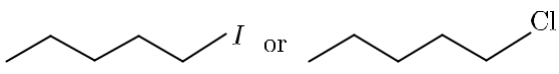
1	The boiling points of alcohols are higher than those of hydrocarbons of comparable masses due to a) Ion-dipole interaction b) Dipole-dipole interaction c) Hydrogen bonding d) Vander Waals forces	1
2	The role of a catalyst is to change a) Enthalpy of reaction b) Gibbs' energy of reaction c) Equilibrium constant d) Activation energy of reaction	1
3	The value of K_H for Ar(g), CO_2(g), HCHO(g) and CH_4(g) are 40.39, 1.67, 1.83 # $10^{-}5$ and 0.413 respectively. Arrange these gases in increasing order of solubility. a) Ar < CO2 < CH4 < HCHO b) Ar < CH4 < CO2 < HCHO c) HCHO < CH4 < CO2 < Ar d) HCHO < CO2 < CH4 < Ar	1
4	Out of the following, the strongest base in aqueous solution is a) Dimethylamine b)Aniline c) Methylamine d)Trimethylamine	1
5	Out of the following transition elements, the maximum number of oxidation states is shown by a) Cr (Z = 24) b)Sc (Z = 21) c)Fe (Z = 26) d) Mn (Z = 25)	1
6	What is the correct IUPAC name of the given compound? 	1

	a) 2-carboxyl-2-methylpropanoic acid b) 2-ethyl-2-methylpropanoic acid c) 3-methylabutance carboxylic acid d) 2, 2-dimethylbutanoic acid	
7	For the reaction, $2X + Y \$X_2 Y$ What will be the expression for the instantaneous rate of the reaction? a) +1/2 dy / dt b) -1/2 d(x2y) / dt c) -dx / dt d) None of these	1
8	For the reaction $2H_2O_2 \rightarrow 2H_2O + O_2$, r = k $[H_2O_2]$. The reaction is of a) First order b) Second order c) Third order d) Zero order	1
9	The compound obtained by the reaction of nitrous acid on aliphatic primary amine is a) Alkyl nitrite b) Alcohol c) Nitroalkane d) Secondary amine	1
10	A graph was plotted between the molar conductivity of various electrolytes (NaCl, HCl and NH_4OH) and $\sqrt{c}$ (in mol L-1). Which of the following is the correct set?  a) I (NH_4OH), II (HCl), III (NaCl) c) I (NaCl), II (HCl), (III) (NH_4OH) b) I (HCl), II (NaCl), III (NH_4OH) d) I (NH_4OH), II (NaCl), III (HCl	1
11	Using valence bond theory, the complex $[Cr(NH_3)_6]^{3+}$ can be described as a) *d* 2 *sp*3, inner orbital complex, paramagnetic b) *d* 2 *sp*3, outer orbital complex, diamagnetic c) *sp*3 *d* 2, outer orbital complex, paramagnetic d) *dsp*2, inner orbital complex, diamagnetic	1
12	Which of the following compounds will not undergo azo coupling reaction with benzene diazonium chloride? a) Phenol b) Aniline c) Nitrobenzene d) Anisole	1
13	The major product obtained on the reaction of 3-phenyl propene with HBr in the presence of organic peroxide is a) 3-phenyl-2-bromopropane b) 3-phenyl-1-bromopropane c) 1-phenyl-3-bromopropane d) 1-phenyl-2-bromopropane	1

14	During the dehydration of alcohols to alkenes by heating with concentrated H_2SO_4, the initiation step is a) Elimination of water b) Formation of an ester c) Protonation of alcohol molecule d) Formation of carbocation	1
15	Assertion: Vanadium had the ability to exhibit a wide range of oxidation states. Reason: The standard potentials of Vanadium are rather small, making a switch between oxidation states relatively easy. a) Both Assertion and Reason are true but Reason is not a correct explanation of Assertion. b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion. c) Assertion is fake but Reason is true. d) Assertion is true but Reason is fake.	1
16	Assertion: DNA has a double-strand helix structure. Reason: The two strands in a DNA molecule are exactly similar. a) Both Assertion and Reason are true but Reason is not a correct explanation of Assertion. b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion. c) Assertion is fake but Reason is true. d) Assertion is true but Reason is fake.	1

SECTION - B **5×2=10**

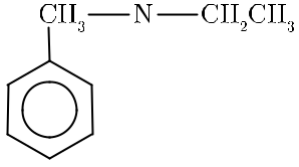
This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

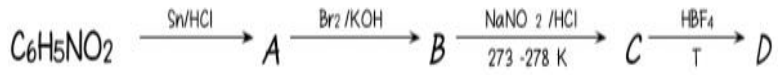
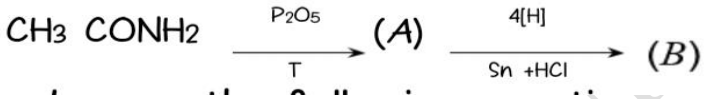
17	The time required to decompose SO_2Cl_2 to half of its initial amount is 60 minutes. If the decomposition is a first-order reaction, calculate the rate constant of the reaction.	2
18	Which one of the following pairs of substances undergoes S_N2 substitution reaction faster and why? (i)  (ii) 	2
19	(i) Sketch the zwitter ionic form of α-amino acetic acid. (ii) What type of linkage holds together the monomers in DNA?	2

20	A zinc rod is dipped in 0.1 M solution of $ZnSO_4$. The salt is 95% dissociated at this dilution at 298K. Calculate the electrode potential. [$Ec_{(Zn\ 2+/Zn)} = -0.76$ V]	2
21	(i) Give the electronic configuration of the *d* -orbitals of Ti in $[Ti(H_2O)_6]3+$ ion and explain why this complex is colored? [At. No. of Ti = 22] (ii)Write IUPAC name of $[Cr(NH_3)_3\ (H_2O)_3]Cl_3$. Determine the structure and magnetic behavior of $[CoCl_4]2-$ using valence bond theory.	2

SECTION – C **7x3=21**

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

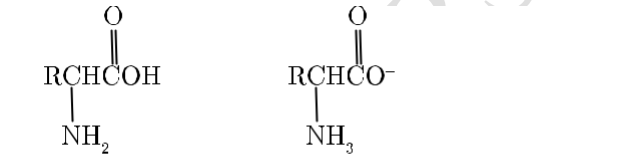
22	(i) Draw the structural formulas and write the IUPAC names of all the isomeric alcohols with the molecular formula $C_5H_{12}O$. (ii) Classify the isomers of alcohols given in part (a) as primary, secondary, and tertiary alcohols.	3
23	Answer the following questions :(Any three) (i) What do you mean by depression in freezing point? (ii) How can the molecular weight of a non-volatile substance be calculated by the freezing point depression method? Only give the formula. (iii) Measurement of the osmotic pressure method is preferred for the determination of the molar mass of macromolecules such as proteins and polymers. (iv) The elevation of the boiling point of 1M KCl solution is nearly double that of 1 M sugar solution.	3
24	(i) Write the IUPAC name of the following complex: $[Co(NH_3)_4(H_2O)Cl]C1_2$ (ii) What is the difference between an Ambidentate ligand and a Bidentate ligand? (iii) Out of $[Fe\ (NH_3)_6]^{3+}$ and $[Fe\ (C_2\ O_4)_3]^{3-}$, which complex is more stable and why?	3
25	What happens when: (i) N-ethylethanamine reacts with benzenesulphonyl chloride. (ii) Benzylchloride is treated with ammonia followed by the reaction with Chloromethane. (iii) Aniline reacts with chloroform in the presence of alcoholic potassium hydroxide. **Or** (i) Write the IUPAC name for the following organic compound: 	3

	(ii) Complete the following: 	
26	How will you convert ethanol to the following compounds? (i) Butane-1, 3-diol (ii) But-2-enal (iii) But-2-enoic acid	3
27	A cell is constructed between copper and silver Cu(s) y Cu 2+ (aq) z Aq + (aq) y Aq(s) If the two half-cells are working under standard conditions, then calculate the emf of the cell. Ec Cu 2+ /Cu =+ 0.34 V, Ec Ag + /Ag =+ 0.80 V	3
28	Identify compounds (A) and (B) in the following reactions and write the related balanced chemical equation:  Complete and name the following reaction: (i) RNH 2 + CHCl 3 + 3KOH ----> (ii) RCONH 2 + Br 2 + 4NaOH ---->	3

SECTION – D **2x4=8**

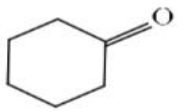
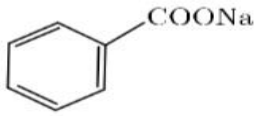
The following questions are case -based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.

29	The rate law for a chemical reaction relates the reaction rate with the concentrations or partial pressures of the reactants. For a general reaction *a*A + *b*B $C with no intermediate steps in its reaction mechanism, meaning that it is an elementary reaction, the rate law is given by $r = k$ [A]x [B]y, where [A] and [B] express the concentrations of A and B in moles per liter. Exponents x and y vary for each reaction and are determined experimentally. The value of k varies with conditions that affect reaction rate, such as temperature, pressure, surface area, etc. The sum of these exponents is known as the overall reaction order. A zero-order reaction has a constant rate that is independent of the concentration of the reactants. A first-order reaction depends on the concentration of only one reactant. A reaction is said to be second order when the overall order is two. Once we have determined the order of the reaction, we can go back and plug in one set of our initial values and solve for k. In the context of the given passage, answer the following questions: (i) Calculate the overall order of a reaction which has the following rate expression: Rate = $k[A]^{1/2}$ $[B]^{3/2}$ (ii) What is the effect of temperature on the rate of reaction?	4

	(iii) A first-order reaction takes 77.78 minutes for 50% completion. Calculate the time required for 30% completion of this reaction log 10 = 1, log 7 = 0.8450. (iv) A first-order reaction has a rate constant of 1 # 10-3 per sec. How long will 5g of this reactant take to reduce to 3 g? (log 3 = 0.4771; log 5 = 0.6990)	
30	An amino acid is a compound that contains both carboxyl group and an amino group. Although, many types of amino acids are known, the α-amino acids are the most significant in the biological world because they are the monomers from which proteins are constructed. A general structural formula of an α-amino acid is shown in figure below.  (a) Unionised form (b) Internal salt (Zwitter ion) form An α- amino acid Although figure (a) is a common way of writing structural formulas for amino acids, it is not accurate because it shows an acid (—COOH) and a base (—NH_2) within the same molecule. These acidic and basic groups react with each other to form a dipolar ion or internal salt (figure (b)). The internal salt of an amino acid is given the special name Zwitter ion. Note that a Zwitter ion has no net charge, it contains one positive charge and one negative charge. Because they exist as Zwitter ions, amino acids have many of the properties associated with salts. They are crystalline solids with high melting points and are fairly soluble in water but insoluble in non-polar organic solvents such as ether and hydrocarbon solvents. According to the above passage, answer the following questions: (i) Amino acids are usually colorless, crystalline solids. They behave like salts rather than simple amines or carboxylic acids. Why do amino acids show such a behavior? (ii) Amino acids are essential and non-essential depending upon their need. One of the essential amino acids is lysine. Can you say why lysine is considered an essential amino acid? (iii) Here are given some amino acids—lysine, Tyrosine, Glycine, and Alamine. One of these amino acids is not optically active. Which one is that amino acid? Also, provide the reason. (iv) The pk_{a1}, and pk_{a2}, of an amino acid are 2.3 and 9.7 respectively. What would be the isoelectric point of the amino acid? Calculate by defining it.	4

SECTION – E **3x5=15**

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

31	(i) The cell in which the following reaction occurs: $2Fe^{3+}$ (aq) + $2I^-$ (aq) $2Fe^{2+}$(aq) + I_2 (s) has E^c_{Cell} = 0.236 Volt at 298K. Calculate the standard Gibbs energy of the cell reaction. (Given: 1F = 96,500 C mol–1) (ii) How many electrons flow through a metallic wire if a current of 0.5 A is passed for 2 hours? (Given: 1F = 96,500 C mol–1) (iii) Explain the following with reason: (a) Chlorine can displace iodine from the KI solution but iodine cannot displace bromine from the KBr solution. (b) Following reaction is possible or not? $Hg + H_2SO_4 \rightarrow HgSO_4 + H_2$	5
32	(i) Account for the following: (a) Transition metals from a large number of complex compounds. (b) The lowest oxide of transition metal is basic whereas the highest oxide is amphoteric or acidic. (c) *E*c value for the Mn3+/Mn2+ couple is highly positive (+1.57 V) as compared to Cr^{3+}/Cr^{2+}. (ii) Write one similarity and one difference between the chemistry of lanthanoid and actinoid elements. **Or** (i) (a) How is the variability in oxidation states of transition metals different from that of the p-block elements? (b) Out of Cu+ and Cu2+, which ion is unstable in aqueous solution and why? (c) The orange color of the $Cr_2O_7$2- ion changes to a yellow color when treated with an alkali. Why? (iii) The chemistry of actinoids is complicated as compared to lanthanoids. Give two reasons.	5
33	(i) Write the product (s) in the following reactions: (a)  + HCN ⟶ ? (b)  + NaOH $\xrightarrow[\Delta]{CaO}$ (c) $CH_3 - CH = CH - CN \xrightarrow[(b)\ H_2O]{(a)\ DIBAL-H}$? ⟶	5

	(ii) Give a simple chemical test to distinguish between the following pairs of compounds: (a) Butanal and Butan-2-one. (b) Benzoic acid and Phenol. **Or** (i) An organic compound (A) with molecular formula C_3H_7NO on heating with Br_2 and KOH forms a compound (B), compound (B), on heating with $CHCl_3$ and alcoholic KOH produces a foul-smelling compound (C) and on reacting with $C_6H_5SO_2Cl$ forms a compound (D) which is soluble in alkali. Write the structures of (A), (B), (C), and (D). Give reasons to support the answer: (a) The presence of alpha hydrogen in aldehydes and ketones is essential for aldol condensations. (b)3-Hydroxy pentane-2-one shows positive results to Tollen's test.	