Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES

End Semester Examination, December 2024

Course: Basic Chemistry **Semester: I**

Program: B.Tech. Chemical Engineering **Time: 03 hrs.**

Course Code: CHEM 1030 **Max. Marks: 100**

Instructions:

1. **Mention Roll No. at the top of the question paper.**
2. **ATTEMPT ALL THE PARTS OF A QUESTION AT ONE PLACE ONLY.**
3. **Internal choice is given in Q 9 of section B and Q 11 of section C only.**

SECTION A

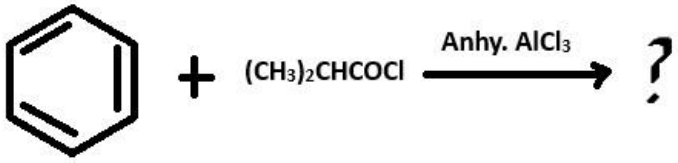
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	How many phases, components and degree of freedom are present in the following systems? (i) An aqueous solution of NaCl (ii) $CaCO_3(s)$ is in equilibrium with $CaO(s)$ and $CO_2(g)$	**4**	**CO1**
Q 2	Define ionization energy. Discuss its trend along a period and down the group in the periodic table with proper reasoning.	**4**	**CO1**
Q 3	Arrange the following in increasing order of stability: a. $C_6H_5CH_2^+$, $(CH_3)_2CH^+$, $(C_6H_5)_3C^+$, $(CH_3)_3C^+$ b. $C_6H_5CH_2^-$, $^-CH_2Cl$, $^-CHCl_2$, $(CH_3)_2CH^-$	**4**	**CO2**
Q 4	The rate law for decomposition of $N_2O_5(l)$ is Rate=k$[N_2O_5]$, where k = $6.22x10^{-4}$ sec^{-1}. Calculate the number of seconds it will take for an initial concentration of N_2O_5 of 0.100 M to drop to 0.0100 M.	**4**	**CO3**
Q 5	Illustrate the difference between open, closed and isolated thermodynamic systems.	**4**	**CO1**

SECTION B

(4Qx10M= 40 Marks)

Q 6	Describe electron displacement effects? Explain inductive and mesomeric effect with the help of suitable example.	**10**	**CO1**
Q 7	Discuss the mechanism of SN_1 reactions with suitable example. Comment on its stereochemical implications.	**10**	**CO2**
Q 8	What is the order of a reaction? Briefly discuss the four methods used to determine the order of a reaction.	**10**	**CO2**

Q 9	Calculate the pH of a buffer solution containing 0.5 M acetic acid and 0.05 M sodium acetate. (Ka of acetic acid = 1.75×10^{-5}) **OR** For the reaction, $2NOCl\ (g) \rightleftharpoons 2NO\ (g) + Cl_2\ (g)$ 10 moles of NOCl were initially placed in a 5 litre flask. After the equilibrium, the flask contained 3.30 moles of NOCl. Calculate the equilibrium constant at 25^0C for this reaction.	**10**	**CO3**
SECTION-C (2Qx20M=40 Marks)			
Q 10	(i) Complete the following reaction with mechanism:  (ii) Pentan-2-one on reaction with ethyl magnesium bromide followed by hydrolysis yields an alcohol (A), which on dehydration under acidic condition gives three positional isomeric alkenes. The alkene as major product (B) reacts with Br_2 to give dibromo compound (C). Identify compounds A, B, and C.	**10** **10**	**CO3**
Q 11	(i) Methyl chloride undergoes nucleophilic substitution reaction whereas chlorobenzene undergoes electrophilic substitution. Write both the reactions and account for it with proper reasoning. (ii) Sketch out the mechanism of unimolecular β-elimination reactions (E1). **OR** (i) Discuss the following terms with examples: a) Carbanions b) Electrophilic reagents (ii) What is Markownikov's rule? Justify Markownikov's addition of HBr to CH_3-CH=CH_2. Also explain the mechanism of this addition.	**10 + 10**	**CO2**