

Name

Enrolment No:



Course: CHEM-1008G

(End Semester Examination May 2022)

Programme: B.Sc (H) Geology /Mathematics

Semester: II

Course Name: Chemical Energetics, Equilibria & Functional Group Organic Chemistry I

Time: 03 hrs.

Max. Marks:100

Instructions: Read all the below mentioned instructions carefully and follow them strictly:

- 1) Write your enrolment number on the top left of the question paper
- 2) Do not write anything on the question paper except your enrolment number
- 3) Attempt all part of a question at one place only
- 4) Internal choice is given for question number 9 and 11 only

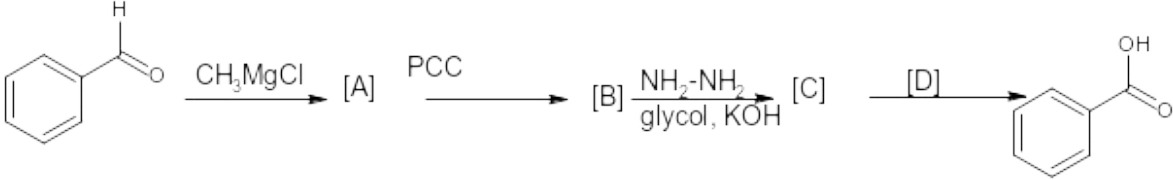
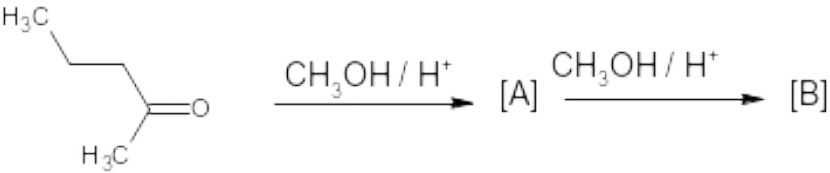
Section - A (Attempt all FIVE Questions)

1.	Calculate the pH of a solution obtained by mixing 30mL of 10^{-2} N HCl and 50mL of 10^{-6} N NaOH.	[4]	CO1
2.	The K_a of propionic acid is 1.34×10^{-5} . What is the pH of a solution containing 0.5M propionic acid and 0.5M sodium propionate? What happens to the pH of this solution when volume is doubled by the addition of water?	[4]	CO1
3.	For the Haber process, $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$, $K_p = 1.45 \times 10^{-5}$ at 500°C . In an equilibrium mixture of the three gases at 500°C the partial pressure of H_2 is 0.928 atm and that of N_2 is 0.432 atm. What is the partial pressure of NH_3 in this equilibrium mixture?	[4]	CO1
4.	Why is tertiary alkyl halide more prone to SN_1 reaction?	[4]	CO2
5.	Compare nucleophilic substitution reactions and elimination in alkyl halides.	[4]	CO2

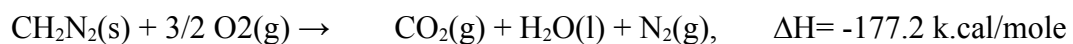
SECTION-B

(Question No. 6, 7 and 8 are Compulsory); attempt any one from 9A & 9B

6.	(i) Calculate the pH of 0.10 M acetic acid solution. Given that K_a is 1.8×10^{-5} . (ii) Two moles of PCl_5 were heated to 327°C in a closed two litre vessel and when equilibrium was achieved, PCl_5 was found to be 40% dissociated into PCl_3 and Cl_2 . Calculate K_c .	[5+5]	CO1
7.	i) Discuss the characteristics of chemical equilibrium. ii) Why do aldehydes and ketones undergo nucleophilic addition reactions? Why are ketones less reactive than aldehydes?	[4+6]	CO1 CO3
8.	Complete the following reaction sequence:	[10]	CO2

											
9.A	i) Explain Cannizzaro's reaction with example. ii) Why does dissociation of NH_4OH decrease on addition of NH_4Cl ? <p style="text-align: center;">OR</p>	[6+4]	CO3 CO1								
9B	i) Give three reagents, which can be used for oxidation of both primary and secondary alcohol. Why tertiary alcohols cannot be oxidized easily? ii) Why can we not consider hydrolysis of a salt of strong acid and strong base?		CO3 CO1								
SECTION - C (Question No. 10 is Compulsory; Attempt any one from question numbers 11A & 11B)											
10.	i) Derive an expression of hydrolysis constant for salt of weak acid and strong base. Consider degree of hydrolysis to be "h". ii) Complete the reaction with mechanism:  iii) With the help of suitable reaction explain Reimer Tiemann reaction. What is the electrophile in the reaction and how it is generated?	[8+8+4]	CO1 CO2 CO3								
11A.	i) Standard heat of combustion of acetylene, ethane and hydrogen are -1301, -1561 and -286 kJ/mole respectively. Calculate the heat of hydrogenation of acetylene. ii) From the following informations calculate the energy of C-H and C-C bonds. Energy absorbed in the dissociation of ethane into gaseous atoms is 584.6 kcal. (i) $\text{C(s)} + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g}), \quad \Delta\text{H} = -22.4 \text{ kcal}$ (ii) $\text{H}_2(\text{g}) \rightarrow 2\text{H}(\text{atom}, \text{g}), \quad \Delta\text{H} = 103 \text{ kcal}$ (iii) $\text{C(s)} \rightarrow \text{C}(\text{atom}, \text{g}), \quad \Delta\text{H} = 125 \text{ kcal}$ iii) Calculate the solubility, in grams per litre, of $\text{Al}(\text{OH})_3$ in water at 25°C , if $K_{\text{sp}} = 8.5 \times 10^{-32}$ <p style="text-align: center;">OR</p>	[8+8+4]	CO1 CO1 CO1								
11B.	i) Estimate the value of ΔH combustion for methane. Given the bond energies in kJ/mole: <table style="width: 100%; border: none;"> <tr> <td style="padding-right: 20px;">C-H</td> <td style="padding-right: 20px;">413</td> <td style="padding-right: 20px;">O=O</td> <td>498</td> </tr> <tr> <td>C=O</td> <td>803</td> <td>H-O</td> <td>463</td> </tr> </table> ii) Calculate the enthalpy of formation of cyanamide, CH_2N_2 , if enthalpy of formation of CO_2	C-H	413	O=O	498	C=O	803	H-O	463		CO1 CO1 CO1
C-H	413	O=O	498								
C=O	803	H-O	463								

and H₂O is -93.97 k.cal/mole and -68.32 k.cal/mole respectively. Given,



iii) A sample of hard water contains 0.005 mole of CaCl₂ per liter. What is the minimum concentration of Na₂SO₄, which must be added for removing Ca⁺² ions from this water sample? K_{sp} for CaSO₄ is 2.4 X 10⁻⁵.