

B.Sc. 2nd Semester Examination

Subject: **CHEMISTRY (Back)**

Subject Code: CCH-102

Title: Inorganic +Organic + Physical (Theory)

Full Marks: 50

The figures in the margin indicate full marks questions.

(Answer all questions)

1. Explain with examples the Lewis theory of acids and bases 8
OR
Explain with examples the Lewis Bronsted-Lowery theory of acids and bases 8
2. What is diagonal relationship ?
Give comparative studies of the S-block elements in respect of the followings
(i) Hydrides and (ii) Solvation and complexation tendencies. 1+4+4 =9
OR
Give comparative studies of the P-block elements in respect of the followings
(ii) Hydrides (ii) Oxides and (iii) Oxyacids 3+3+3 =9
3. State and explain with example the following
(i) Markownikoff's rule
(ii) Ozonolysis of alkanes 4+4 =8
OR
Discuss the Kekulé structure of benzene 8
4. Write the SN₂ and SN₁ mechanism of nucleophilic substitution reactions of alkyl halides . 8
OR
(a) Give two general methods of preparation of alcohols from carbonyl compounds.
(b) How will you convert glycerol to acrolin, give reaction. 3+3+2 =8
5. (a) state Raoult's law
(c) What are ideal and non-ideal solutions ?
(c) Explain with diagram the mutual solubility curve of phenol-water system. 1+2+6=9
OR
Derive thermodynamically the relation $\Delta T_b = K_b m$ 9
6. Derive the relation $\Delta G^\circ = -RT \ln K_p$ 8
OR
(a) Give two methods of preparation of colloidal solutions
(b) Write brief notes on
(i) Brownian movement
(ii) Tyndall effect 4+4 =8

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B.Sc. 2nd Semester Examination, 2021 (June)

Subject: **CHEMISTRY (HONOURS)**

Subject Code: CCH-105

Title: **ORGANIC CHEMISTRY-II (Theory)**

Full Marks: 50

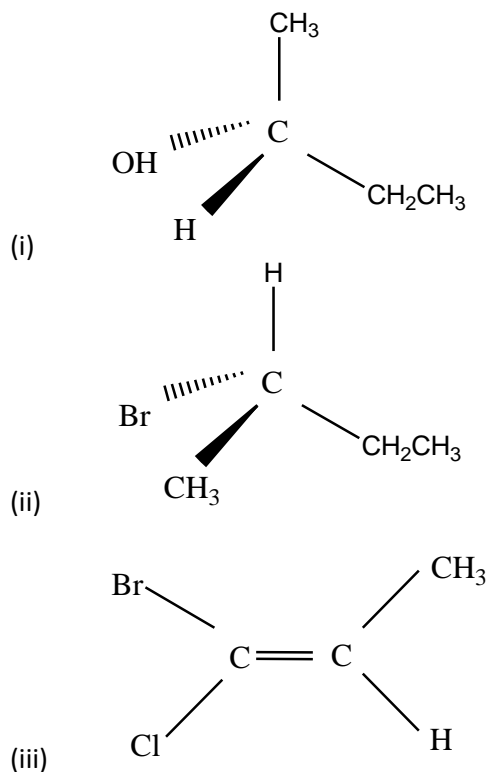
Answer only one of the questions of your choice. Each choice question has equal weightage (10 marks). Answer all questions.

1. (a) Define a chiral centre. Give two examples where C-atom bears a chiral centre. 2+2=4
(b) Discuss and demonstrate with examples the relationship between chirality, optical activity and mirror images of stereoisomers. 6

OR

2+2=4

- (a) What are stereoisomers? Classify them with proper examples. 2x3=6
(b) Assign E/Z or R/S nomenclature to the following compounds using CIP rules:



2. (a) How does the electronegativity of the combining atoms forming a covalent bond influence the dipole moment and inductive effect of an organic compound? 4
4+2=6
- (b) What are carbocations and carbanions? Giving examples, discuss their types and relative stabilities. How are they different from free radicals and carbenes?

OR

- (a) What are electrophiles and nucleophiles? Give examples. 4
2x3=6
- (b) Briefly explain the following reactions and discuss how these reagents (electrophiles and nucleophiles) initiate them:
(i) Substitution Reactions
(ii) Addition Reactions
(iii) Elimination Reactions
3. (a) State Huckel's rule of aromaticity. Name two aromatic molecular species having a system of 6π electrons. 3
- (b) Discuss the reaction mechanism involved in the nitration of benzene in the presence of a mixture of nitric acid and sulphuric acid. Explain the formation of different products if the starting compound for nitration is
(i) toluene
(ii) nitrobenzene
State the major products formed. 3+2+2=7

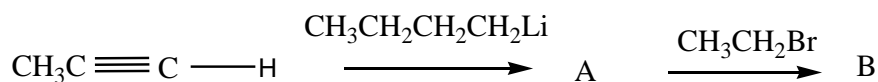
OR

- (a) State Huckel's rule of aromaticity. Name two heterocyclic compounds which are aromatic and explain how the π -electron system makes it aromatic. 4
3+3=6
- (b) Explain the reaction mechanism involved in the Friedel-Craft's alkylation of benzene with tert-butylchloride in the presence of $AlCl_3$. What will be the product formed if tert-butylchloride is replaced by acetyl chloride in similar reaction conditions? Give reaction mechanism.

4. (a) State Baeyer Strain Theory. Discuss the factors responsible for the large ring strain in cyclopropane with appropriate diagrams. 4
- (b) Explain why cyclohexane has no ring strain by describing its three different conformations. Show the relative stability of the different conformers of cyclohexane using a conformational energy diagram. 3+3=6

OR

- (a) State Baeyer Strain Theory. Discuss the conformational analysis of n-butane giving its energy diagram. 3+5=8
- (b) Which conformer of butane is the most stable and which is the least stable? 2
5. (a) Describe the Wurtz reaction for the preparation of alkane. How does it differ from the Wurtz-Fittig reaction? 2+2=4
- (b) Discuss the general mechanism of acid-catalyzed dehydration of alcohol to give alkenes. Show with proper orientations, the products obtained on acid-catalyzed dehydration of 2-butanol. 4
- (c) Predict the products A and B of the following reaction: 2



OR

- (a) With specific examples, give the reaction mechanism of: 2x5=10
- (i) Dehydrohalogenation of 2-bromobutane in KOH(alc)
 - (ii) Markownikoff addition of HBr to propene
 - (iii) Ozonolysis of 2-methylpropene
 - (iv) Addition of HBr to 1,3-butadiene at 40°C
 - (v) Hydration of propyne in presence of HgSO₄ in aqueous sulphuric acid

CHEMISTRY HONOURS

Second Semester

(Physical Chemistry –II)

Theory

Full Marks : 50

Figures in the margin indicate full marks for the questions. Answer all the questions.

1. (a) State the First Law of Thermodynamics.
 (b) Derive the relation: $C_p - C_v = R$.
 (c) Show that: $PV^\gamma = \text{constant}$

1+4+5=10

OR

- (a) Define the following terms:
 (i) Enthalpy of Combustion
 (ii) Resonance Energy

- (b) For the reaction,



Calculate ΔH for the reaction.

- (c) Calculate the bond energy of HCl given that the bond energies for H–H bond, Cl–Cl bond are 433 kJ mol^{-1} and 242 kJ mol^{-1} respectively and ΔH_f HCl is -91 kJ mol^{-1} .

2+4+4=10

2. (a) State the Second Law of Thermodynamics.
 (b) Calculate the entropy change for a reversible process.
 (c) Derive Gibbs-Helmholtz equation: $\Delta G = \Delta H + T \left[\frac{\partial(\Delta G)}{\partial T} \right]_P$

1+4+5=10

OR

- (a) State the Third Law of Thermodynamics.
 (b) The C_v for uranium metal is $3.04 \text{ JK}^{-1}\text{mol}^{-1}$ at 20°C . Calculate the absolute entropy of the metal.
 (c) Define Joule-Thomson coefficient and show that: $\left[\frac{\partial(\Delta U)}{\partial T} \right]_V = \Delta C_v$

1+4+5=10

3. (a) Establish the relation: $\sum_i n_i d\mu_i = 0$
(b) Deduce an expression for the variation of chemical potential of a component i with pressure.

5+5=10

OR

- (a) Define Chemical Potential.
(b) Show that the chemical potential of a component in a system is a direct measure of the escaping tendency of that component.
(c) Establish the relation: $\mu_i = \mu_i^\circ + RT \ln P_i$

2+3+5=10

4. (a) What is meant by degree of advancement of a chemical reaction?
(b) State and explain the terms Reaction potential and Thermodynamic potential.

4+3+3=10

OR

Derive the relation: $\Delta G^\circ = -RT \ln k_p$ using chemical potential. 10

5. Using chemical potential, derive the relation: $\Delta T_b = k_b^m$ 10

OR

Using chemical potential, derive the relation: $\Pi = C_2 RT$ 10

CHEMISTRY PASS
 Second Semester
 (Physical Chemistry –I and Organic Chemistry-II)
 Theory
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1. Name and outline the mechanism for the reaction of benzene with acid chloride in the presence of AlCl_3 . 3

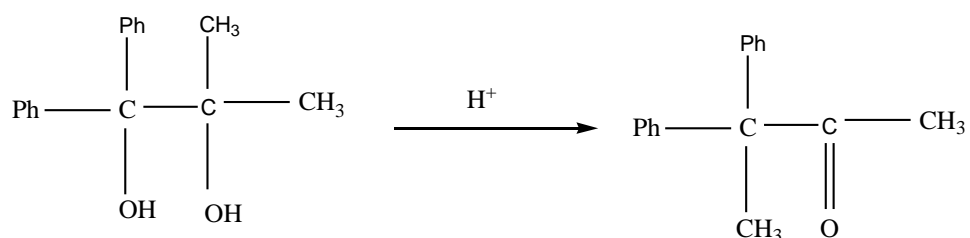
OR

What is Friedel-Crafts alkylation reaction? Complete the reaction and provide mechanism:



3

2. (a) Give mechanistic steps for the following transformation. Name the reaction.



- b) What is Lucas reagent? How can 1°, 2°, 3° alcohols be differentiated on the basis of Lucas reagent?

6

OR

- (a) How can phenols be prepared from:
- (i) Cumene
 - (ii) Aniline
- (b) What are the products formed when phenol reacts with :
- (i) Conc. HNO_3
 - (ii) Br_2/CS_2
 - (iii) $\text{C}_6\text{H}_5\text{OCl}/\text{NaOH}$
 - (iv) $\text{CHCl}_3/\text{NaOH}$

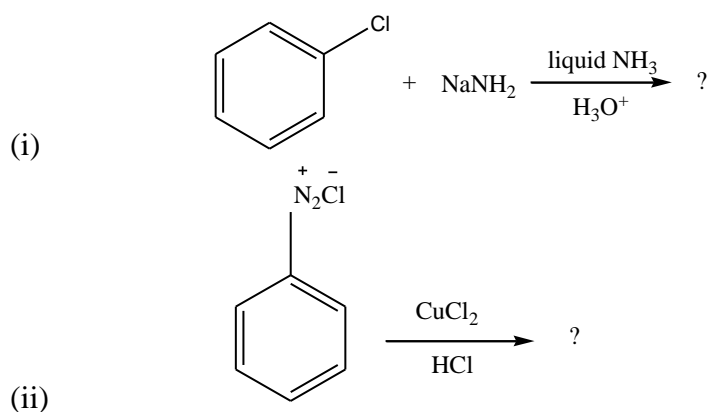
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3. Write the reaction and give relevant mechanism of any two of the following:

- (i) Aldol condensation
- (ii) Benzoin condensation
- (iii) Cannizzaro Reaction
- (iv) Clemmensen Reduction
- (v) Houben-Holsch Reaction

4+4=8

4. (a) Write the products and provide mechanism of the following reactions:

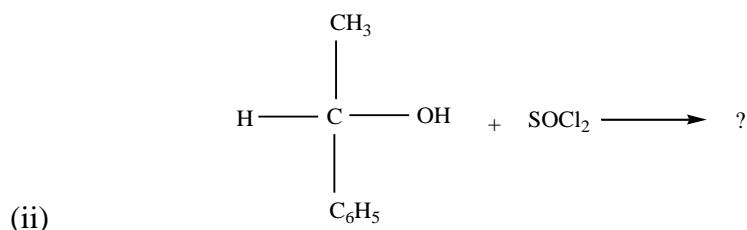
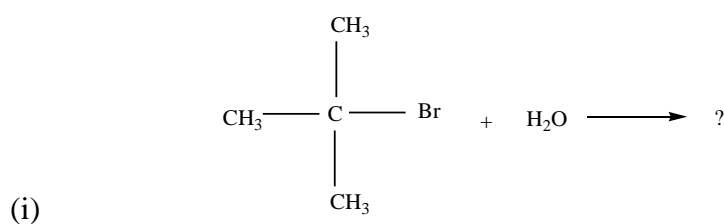


(b) How is methoxy methane prepared by Williamson's synthesis. Write its mechanism.

4+4=8

OR

(a) Complete the following reactions and write down the mechanistic steps of the given reactions:



(b) What are the factors which affect the rate of $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$ mechanism.

4+4=8

5. (a) What is bond energy?
(b) Explain Hess's Law of Constant Heat Summation to calculate the enthalpies of reaction.

2+6=8

OR

- (a) Define Third Law of Thermodynamics.
(b) Derive Kirchoff's equation for the variation of heat of reaction with temperature.

2+6=8

6. Derive the expression of chemical equilibrium constant from thermodynamic consideration.

8

OR

State Le Chatelier Principle.

Derive the relationship between K_c , K_p and K_x .

2+6=8

7. What is pH and pOH scale?
Deduce the ionisation constant for weak acid and base.

3+6=9

OR

What is common ion effect?

What is solubility product principle and explain it for the precipitation of group IIIA and IIIB.

2+7=9

CHEMISTRY PASS
 Second Semester
 (Physical Chemistry –I and Organic Chemistry-II)
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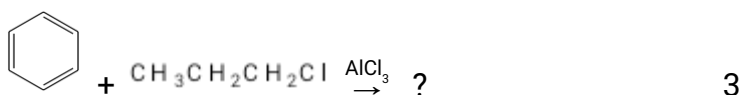
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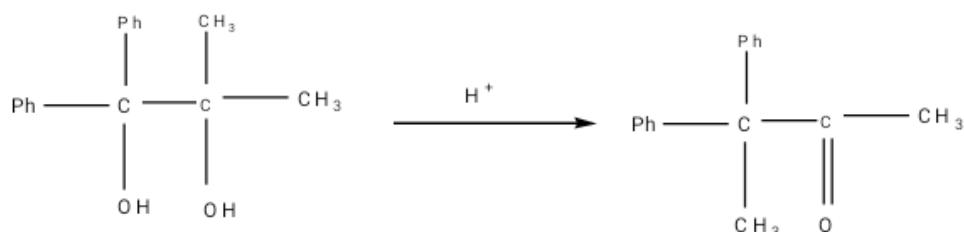
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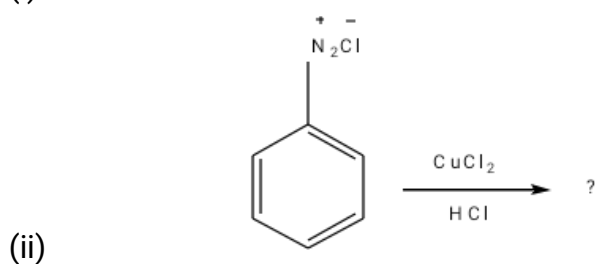
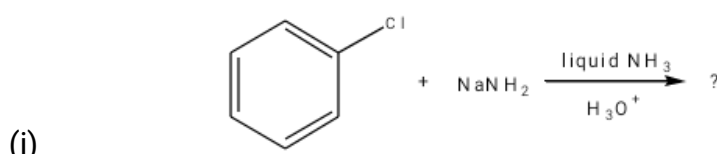
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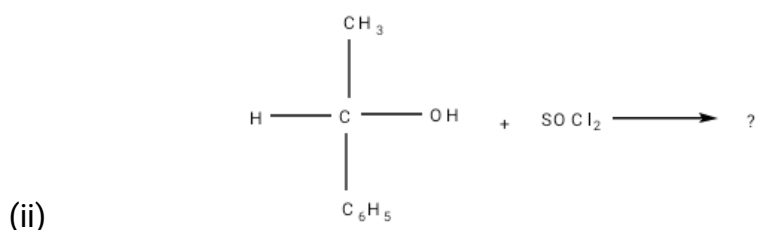
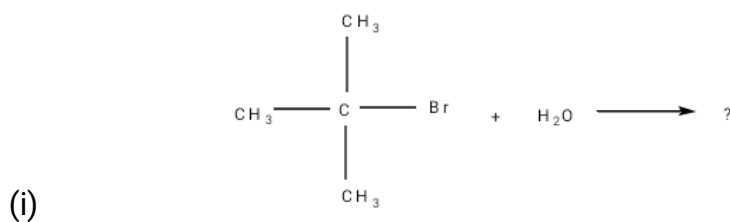


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