INTRODUCTION TO ORGANIC CHEMISTRY
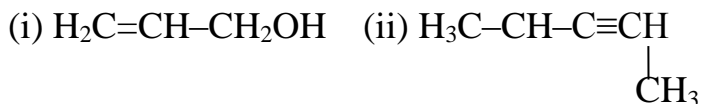
Questions carry two marks:

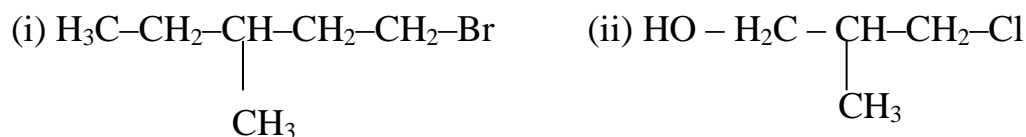1.   Give the IUPAC names of

(i) $H_2C=CH-CH_2OH$ (ii) $H_3C-CH-C≡CH$
$\qquad\qquad\qquad\qquad\qquad\quad |$
$\qquad\qquad\qquad\qquad\qquad CH_3$

2.   Give the IUPAC names for

$\qquad\qquad CH_3$
$\qquad\qquad\ |$
(i) $CH≡C-C-CH=CH_2$ (ii) $CH_3-CH-CHO$
$\qquad\qquad |\qquad\qquad\qquad\qquad\qquad |$
$\qquad\quad CH_3\qquad\qquad\qquad\qquad C_2H_5$

3.   Write the IUPAC names of
(i) $H_3C-CH_2-CH-CH_2-CH_2-Br$ (ii) $HO - H_2C - CH-CH_2-Cl$
$\qquad\qquad\qquad |\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad |$
$\qquad\qquad\ CH_3\qquad\qquad\qquad\qquad\qquad\qquad\qquad CH_3$
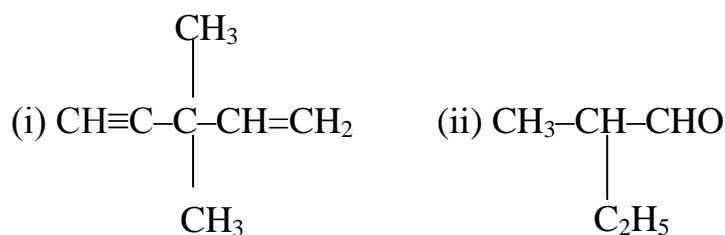
4.   Give the IUPAC name for the following

(i) $CH_3-CH-CH_2-CH-COOH$ (ii) $CH_3-CH=CH-C-H$
$\qquad\quad |\qquad\qquad\quad |\qquad\qquad\qquad\qquad\qquad\quad |\qquad\quad ||$
$\qquad\ OH\qquad\ CH_3\qquad\qquad\qquad\qquad\qquad\qquad O$
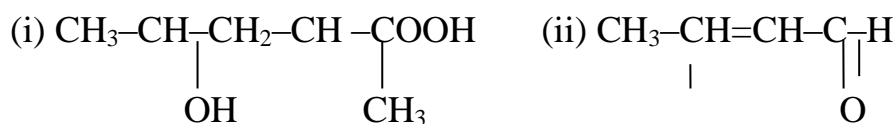
5.   (i) Write the IUPAC nomenclature for CH_3 -$C≡CH_2-C-H$
$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad ||$
$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad O$

(ii) Write the structural formula of 4-Hydroxy-2-butananone.

6.   Write the IUPAC name of

(i) $CH_2=C–CH=CH_2$ (ii) $CH_3–CH=CH–CHO$

        $|$

        CH_3
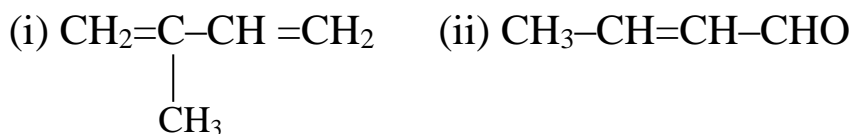
7. What is inductive effect ?give an example

8. What is carbene? Give an example.

9. How are halogen detected in organic compounds?

10. How is chlorine detected in an organic compound by Lassaigne's test?

11. Define hyperconjugation.

12. Outline the principle involved in the detection of nitrogen Lassaigne's test.

Questions carry four marks:

1.Write the structure of the following

(i) 3-bromobutanol   (ii) 2-methyl propane-2-ol

2. How nitrogen ina organic compound detected? Explain.

3. How nitrogen and sulphur detected in an organic compound?

4. Write a note on (i) inductive effect   (ii)hyperconjugation.

5. How are carbon and hydrogen detected in organic compound?

6. What are carbocations? How are they formed? Give an example.

HYDROCARBONS

Questions carry two marks:

1. Explain the Markovnikov's rule with an example.
2. What is peroxide effect?
3. How ozone acts on ethane?
4. Mention the different conformers of n-butane.

Questions carry four marks:

1. Explain the mechanism of the addition to HCl to propane.
2. Write a note on Diels-Alder reaction.

3. What is a conjugation diene? Give the method of preparation of 1,3butadiene.

4. Give an example for conjugate diene. How does it react with HCl.

5. State morkovnikov's rule and give the mechanism of adding HCl to propene.

6. What is acetylides? Give its preparation.

CYCLOHEXANE

Questions carry two marks:

1. Define (i) Angle   (ii) Torsional strain   (iii) conformational analysis

2. How does cyclopropane reacts with

(i) Br_2/UV light   (ii) Br_2/CCl_4 in dark

3. Explain why cyclohexane is more resistant to ring opening than cyclopropane.

4. Give the limitations for Bayer's strain theory.

Questions carry four marks:

1. Explain the stabilities of cyclo alkanes based on Bayer's strain theory

2. Write the chair and boar forms of cyclohexane. Which one of them is more stable and why?

3. Write the structure of cyclohexane and indicate the axial and equatorial bonds. What is Sachse-Mohr theory?

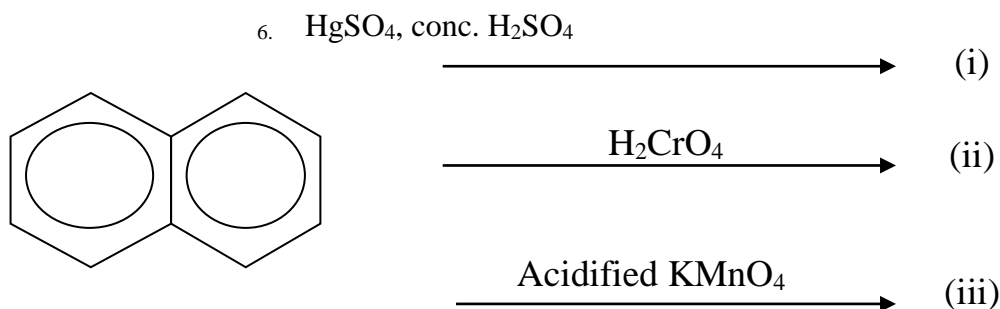4. What are strainless rings? Explain with an example.

ARENES

Questions carry two marks:

1. Define the term aromaticity.

2. Give the mechanism of Friedel-Craft's reaction.

3. State Hackle's rule.

4. Draw the resonance structures of benzene.

5. Write the structural formulae of (i)Anthracene (ii)phenanthrene
   (iii)diphynyld

Questions carry four marks:

6. $HgSO_4$, conc. H_2SO_4
    _____→ (i)

    H_2CrO_4
    _____→ (ii)

    Acidified $KMnO_4$
    _____→ (iii)

1. Identify the products (i), (ii) and (iii) by giving names or structures.
   With electronic interpretation explain the orientation influence of methyl
   group in toluene.
2. Discuss the aromaticity in benzene.
3. Write a note on $4n + 2$ rule.
4. Toluene on electrophilic substitution, gives ortho and para derivatives
   whereas nitrobenzene fives meta derivatives. Explain with electronic
   interpretation

ALKYL HALIDES AND ORGANOMETALLIC COMPOUNDS

Questions carry two marks:

1. Explain S_N2 mechanism?
2. CH_3–M –Br is an example for organometallic compound where as CH-$_3$–O–Na is not. Explain.
3. What is Grignard's reagent? Give example
4. Give two differences between S_N1 and S_N2 mechanism.
5. How is Grignard's reagent prepared?
6. Distinguish the E_1 & E_2 reactions.

Questions carry four marks:

1. starting from Grignard's reagent how would you prepare a primary and
   secondary alcohol?
2. Explain the mechanism of the elimination reaction of n-butyl chloride.

3. How is acetaldehyde prepared from Grignard's reagent?

4. How is methane prepared from Grignard's reagent?

5. Explain Hoffmann's elimination reaction.

6. Explain S_N1 mechanism taking primary alkyl halide as an example.

7. How you prepare (i) acetic acid (ii) ketoneusuing Grignard's reagent

8. Explain E_1 mechanism taking suitable example.

ALCOHOL

Questions carry two marks:

1. Give the uses of glycerol.

2. What are glycols? give an example.

3. How do you convert glycerol to acrolein.

4. Give the uses of glycols.

Questions carry four marks:

5. give the synthesis of glycerol from propane.

6. How does ethanol reacts with (i) sodium metal (ii) acidified potassium dichromate?

7. Using Lucas test, how would you distinguish between primary, secondary and tertiary alcohols?

8. How does monohydric alcohols reacts with (i) PCl_5 (ii) conc.HNO_2 (iii) CH_3COOH/H_2SO_4.

9. How will you distinguish primary, secondary and tertiary alcohols using Victory Meyer's test?

10. How does glycerol react with (i) dil.HNO_3 (ii) con.HNO_3 (iii) con.HNO_3 and conc. H_2SO_4 (iv) $KHSO_4$.

11. How do you distinguish primary, secondary and tertiary alcohols using dichromate test or oxidation reaction.

12. How does ethanol react with (i) PCl_5 (ii) Cu/ 300^oC (iii) conc.H_2SO_4. (iv) NH_3

PHENOLS

Questions carry two marks:

1. Explain the acidity of phenol.
2. What happens when bromine water reacts with phenol?
3. How do you prepare salicylic acid from phenol.
4. Phenols are acidic while alcohols are not although both have OH group. Explain.

Questions carry four marks:

1. What is Remier- Tiemann reaction? write its mechanism.
2. Write the mechanism for Kolbe's reaction.

CARBONYL COMPOUNDS

Questions carry four marks:

1. Give the reactions of an alcohol with aldehyde and ketone.
2. Give the mechanism of an addition of HCN to.CH_3CHO
3. Out of CH_3CHO and CH_3COCH_3 which is more reactive towards nucleophilic addition?
4. Explain the mechanism of aldol reaction?
5. Why aldehydes are more reactive than ketones?
6. How aldehydes and ketones racts with phenylhdrazine?
7. Complete the following eqation.
8.
$$CH_3CHO + [O] \xrightarrow{KMnO_4} ?$$

$$CH_3CHO + 4[H] \xrightarrow{ZnHg} ?$$
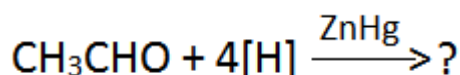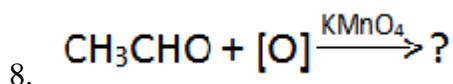
Questions carry four marks:

1. Explain tautomersim with an example.
2. Define keto-enol isomerism with an example.
3. Give the mechanism of addition of HCN to acetaldehyde.
4. Explain the mechanism of claisen condensation.
5. How do aldehydes and ketones react with ammonia derivatives? Give any two reactions.
6. How does p-Benzoquinone undergo Diels-Alder reaction.

GASES

Questions carry two marks:

1. What are critical constants of gases?
2. Define most probable velocity.
3. Give Vander Waal's equation foe n moles of a gas. Explain the terms in it.
4. Give the postulates of kinetic theory of gases.

Questions carry four marks:

1. Define critical temperature. How is critical temperature measured experimentally?
2. Explain average velocity, root mean square velocity and most probable velocity.
3. How is critical pressure of a gas experimentally determined?
4. Write Maxwell's equation for distribution of molecular velocities and explain the terms in it.
5. Explain root mean square velocity.
6. Calculate the most probable velocity of a hydrogen molecule at 300K
   $(R = 8.314 \ JK^{-1}mol^{-1)}$
7. Discuss Maxwell's distribution curves with respect to (i) Distribution of velocity at a given temperature (ii) effect of temperature an the velocity distribution.
8. Give the virial equation of state and mention the conditions at which it becomes an ideal gas equation.
9. What is most probable velocity of a gas? How is it affected by temperature?
10. Define (i) critical temperature (ii) critical pressure. Explain the experimental determination of the above terms.

SOLIDS

Questions carry two marks:

1. Define the terms (i) centre of symmetry (ii) unit cell.
2. What are Miller Indices?
3. What is unit cell? How many crystal systems exists?
4. Explain Miller Indices.
5. What is plain of symmetry? Represent the planes of symmetry in a cube.
6. What are Weiss Indices?
7. Name the seven crystal systems.

Questions carry four marks:

1. What are elements of symmetry?
2. Define (i) space lattice (ii) unit cell.
3. State and explain the law of rational Indices?
4. What is four fold axis of symmetry? How many of them can a cube have?
5. Calculate the number of particles in a unit cell of a face centred cubic lattice.
6. List out the differences between crystalline and amorphous solids.

CHEMICAL EQUILIBRIUM

Questions carry two marks:

1. Write the chemical equilibrium constants for the following equation

$$XA + YB \rightleftharpoons bC + mD$$

2. What is heterogeneous reaction? Give an example.
3. Give an example and explain homogeneous equilibrium.
4. What is redox equilibria?
5. Give two differences between heterogeneous and homogeneous equilibria.

Questions carry four marks:

1. What are reversible and irreversible reactions?
2. What is meant by redox equilibria? Give the difference between homogeneous and heterogeneous Equilibria.
3. Give the limitations for the equation of chemical equilibrium.
4. What are the characteristics and limitations of chemical equilibrium? Define chemical equilibrium. what is effect of catalyst on it?
5. Write three characteristics of chemical equilibrium.

REACTION KINETICS

Questions carry four marks:

1. What is negative catalysis? Give one example.
2. Define order of molecularity with suitable example.
3. Define rate constant. Give example for zero order reaction.
4. What is heterogeneous reaction? Give an example.
5. Differentiate between order and molecularity.
6. Write Arrhenius energy of activation equation and explain the terms in it.
7. What is a zero order reaction? Give an example.

8. What are homogeneous catalytic reactions? Give an example.
9. Give any two applications of catalyst.
10. Why are catalysts more effective in their finally derived form?
11. What is pseudo unimolecular reaction? Give an example.
12. What is effect of catalysts on the equilibrium?
13. Discuss briefly the effect of increase in temperature on the rate of a reaction.
14. What is the effect of promoters and catalytic poisons on the activity of a catalyst?
15. Write the kinetic equation of 1st order and 2nd order reaction?

Questions carry four marks:

1. What is enzyme catalysis? Explain the characteristics of enzyme catalysis.
2. What is order of a reaction? Give any two examples for second order reaction.
3. Derive an expression for energy of activation using Arrhenius equation.
4. Mention the general characteristics of a catalyst.
5. Define activation energy and threshold energy.
6. Explain the intermediate compound formation theory of catalysis.
7. Derive an expression for the rate constant of second order reaction.
8. Derive an expression for the rate constant for a first order reaction.
9. Give the potential energy diagram and explain the transition state theory in brief.
10. What is effect of pH on an enzyme catalysed reaction? Explain with a graph.
11. Give the factors which influence the rate of reaction.
12. At 298K the half-life period for the decomposition of N_2O_5 in 5.7 hrs and is independent of initial pressure of N_2O_5. Calculate the rate constant

THERMODYNAMICS

Questions carry two marks:

1. State the different forms of the II law of thermodynamics.
2. Explain isolated system and state function.
3. Explain the term entropy.
4. Give the mathematical expression for the first law of thermodynamics and explain the terms.
5. What is meant by standard free energy change of a chemical reaction?
6. What happens to entropy in a spontaneous reaction?
7. Define the term chemical potential.

8. What are the differences between exergonic and endergonic reactions?
9. Entropy decreases when a liquid solidifies and increases when a solid liquefies. Explain.
10. Give any two application of Gibbs-Helmholtz equation.
11. Even though endergonic reactions are non-spontaneous, they take place in biological systems. Explain.
12. State the first and second law of thermodynamics.
13. Give the equation relating the free energy change and entropy change of the reaction.

Questions carry four marks:

1. What are exergonic and endergonic reactions?
2. Distinguish between adiabatic and isothermal processes.
3. The enthalpy change in a reaction is -9456 KJ and the entropy change for this reaction is -189.12 KJ. Calculate the free energy change at 325K.
4. Give an equation for the relationship between free energy change and equilibrium constants of a reaction. Using this equation, indicate spontaneity and non-spontaneity of a reaction in terms of equilibrium constants.
5. Calculate the equilibrium constant for a reaction given $\Delta G^0 = 305.04$ KJ mol^{-1} and change in entropy is -17.32KJ mol^{-1}.
6. Calculate the enthalpy change of a reaction at 308k in which the change in free energy is -121KJ mol^{-1} and change in entropy is -17.32KJ mol$^{-1.}$

PHASE RULE

Questions carry two marks:

1. State Gibb's phase rule? Explain the terms involved.
2. What is partition co-efficient?
3. What is phase rule?
4. State Nernst distribution law.
5. Mention any two applications of distribution law.
6. For one component system, the triple point is invariant. Explain why?

Questions carry four marks:

1.Give one example for one component and two component system.
2.Discuss the phase diagram for the phenol-water system.
3.Discuss the phase equilibria of phase equilibrium.
4.Give few applications of phase rule.