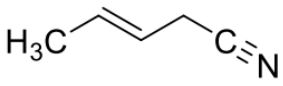
Mahishadal Raj College
Internal Assessment
Sem-1

C1T1: ORGANIC CHEMISTRY-I

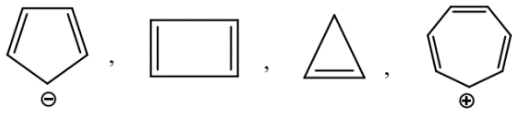
2018-19

F.M 10 2x5

1. The dipole moment of cis-2-butene is more than that of its trans isomer. Explain with reason.
2. Draw the orbital picture of



3. The boiling point of carboxylic acids are higher than those of alcohols of comparable molecular weights. Explain.
4. Classify the following molecules as aromatic or antiaromatic:



5. t-butyl bromide on heterolytic cleavage of C-Br bond generates a reactive carbon intermediate but the corresponding homolytic cleavage gives the opposite polarity reactive carbon intermediate. Drae the intermediate and explain their opposite electronic behavior.

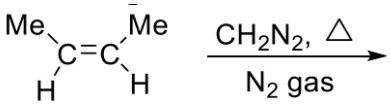
Mahishadal Raj College
Internal Assessment
Sem-III

C7T: Organic Chemistry-III

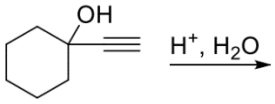
2018-19 (05/09/2018)

F.M 10 2x5

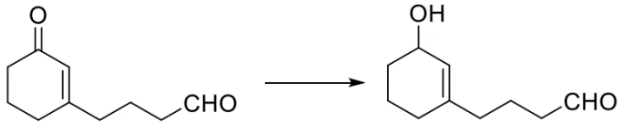
1. Give the product(s) of the following reaction.



2. Give the product of the following reaction.



3. Find the suitable reagent for the following reaction.



4. Which product is formed on treatment of dimethyl malonate with propyl bromide/NaOEt?
5. Why NBS is always used with CCl_4?

Mahishadal Raj College
Internal Assessment
Sem-II

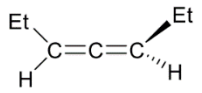
C4T: ORGANIC CHEMISTRY-II

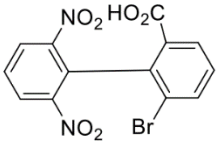
2018-19 (14/03/2019)

F.M 10 2x5

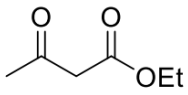
1. The pro-R hydrogen of chloroacetic acid is substituted by bromine with inversion of configuration
. Predict the configuration of final product showing the pro-R hydrogen of the original substrate.

2. Are the compounds shown below chiral or achiral? Justify your answer.

(i) 

(ii) 

3. Which of the following compounds has higher enol content? Explain.



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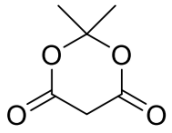

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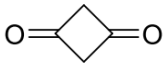
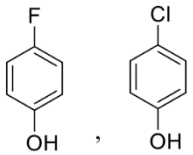


4. Solvolysis of (+) $C_6H_5CH(CH_3)Cl$ leads to 98% racemisation whereas solvolysis of (+) $C_6H_{13}CH(CH_3)Cl$ leads to only 34% racemisation. Explain why.

5. Compare acidity between the following two compounds.



Mahishadal Raj College
Internal Assessment
Sem-IV

C10T: ORGANIC CHEMISTRY-IV

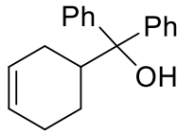
2018-19 (14/03/2019)

F.M 10 2x5

1. The α,β unsaturated ketone, mesityl oxide shows λmax 230 nm (Ɛmax = 12,600) and 329 nm
(Ɛmax = 41) in hexane and λmax 243 nm (Ɛmax = 10,000) and 305 nm (Ɛmax = 60) in water. Explain.

2. Though the electronegativity of cyano group is greater than that of the chlorine atom the chemical shift value of acetonitrile (CH_3-CN) is δ 1.97 ppm whereas, methyl chloride (CH_3-Cl) is δ 3.05 ppm. Explain.

3. Write the possible retrosynthetic analysis of the following compound and mention forward synthesis also.



4. How can you prepare primary amine by Gabriel's phthalimide synthesis? Explain.

5. Define stereoselective and stereospecific reaction with example.

Session 2019-2020

Mahishadal Raj College
Internal Assessment
Sem-1

C1T1: ORGANIC CHEMISTRY-I

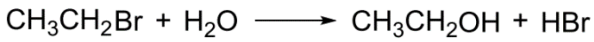
2019-20 (05/09/2019)

F.M 10 2x5

1. Give the formal charge on 'N' in the following structure: 

2. Compare the dipole moment of CH_3F and CH_3Cl.

3. Calculate ΔH^o for the following reaction.



Bond dissociation energy for CH_3CH_2-Br = 285 KJ/mol, H-OH = 498 KJ/mol, CH_3CH_2-OH = 393 KJ/mol and H-Br = 368 KJ/mol.

4. Draw the stereostructure of tertbutyl cation and how does it differ from tert butyl anion?

5. Why dipole moment of cyclopenta dieneone is less than cyclopentanone?

Mahishadal Raj College
Internal Assessment
Sem-III

C7T: Organic Chemistry-III

2019-20 (07/09/2019)

F.M 10 2x5

1. Write the mechanism of decarboxylation of the β-keto acid $CH_3COCH_2CO_2H$ and hence explain the following stability order:

2. Propanoyl chloride readily decomposed by water, but benzoyl chloride reacts with water very slowly.

3. Compare the regioselectivity of the reactions of HBr with

(a) $CF_3CH{=}{=}CH_2$, (b) $BrCH{=}{=}CH_2$ and (c) $CH_3OCH == CHCH_3$.

4. Explain the following observation:

When p-tert-butyl-phenol is treated with dilute acid, a mixture of phenol and tert-butyl alcohol is obtained.

5. Discuss the principle of preparing thiophene-free benzene.

Mahishadal Raj College
Internal Assessment
Sem-V
C12T: Organic Chemistry – V
2019-20 (07/09/2019)

F.M 10 2x5

1. [2+2] Cycloaddition reaction is not a thermally favourable process— why?

2. Thermal [1, 5] – H shift is facile, but thermal [1, 3] – H shift is not observed. — Explain.

3. The mutarotation of D-glucose in an aprotic solvent does not occur in the presence of pyridine alone or cresol alone; when both cresol and pyridine are present together, the mutarotation of glucose takes place. Explain the observation with the mechanism.

4. Write the product's structure when 2-methylfuran is treated with DMF-$POCl_3$.

5. What happens when cis and trans isomers of 3-hydroxy cyclohexane carboxylic acids are heated separately?

Mahishadal Raj College
Internal Assessment
Sem-II
C4T: ORGANIC CHEMISTRY-II
2019-20 (12/03/2020)

F.M 10 2x5

1. Explain why the rotation of the C—C s-bond in ethane (CH_3—CH_3) is not completely free.

2. The gauche conformation of ethylene glycol is more stable than the anti-conformation. Offer an explanation.

3. Predict the products when $CHClBr_2$ and CHF_2Br are treated separately with the base t-BuOK.

4. Explain why 2,2-dichlorobutane does not form a Grignard reagent when treated with Mg in dry ether.

5. Large activation energy (Ea) and negative enthalpy change ($-\Delta H°$) of a reaction indicate that the reaction is

(a) fast and endothermic reaction
(b) fast and exothermic reaction
(c) slow and endothermic reaction
(d) slow and exothermic reaction

Mahishadal Raj College
Internal Assessment
Sem-IV

C10T: ORGANIC CHEMISTRY-IV

2019-20 (12/03/2020)

F.M 10 2x5

1. Diazonium salts are not generally separated in a solid state—Why?

2. What happens when (a) *o*-aminophenol and (b) *o*-phenylenediamine are separately diazotized?

3. Which of the following would show a greater chemical shift for the OH proton and why?

(a) The NMR spectrum of ethyl alcohol dissolved in dichloromethane

(b) The NMR spectrum of pure ethyl alcohol.

4. Define the term chemical shift. What difference in chemical shift values are expected for the protons of CH_3F, CH_3Cl and CH_3Br?

5. How would you distinguish between *o*- and *p*-fluorophenol by 1H-NMR spectroscopy?

Mahishadal Raj College
Internal Assessment
Sem-VI

SEC-4T: PESTICIDE CHEMISTRY

2019-20 (13/03/2020)

F.M 10 2x5

1. Outline two health impacts and two environmental impacts of using pesticides.

2. Write down the chemical structure of gammaxene. It is also known as HCH, elaborate on this acronym.

3. Draw the chemical structure of carbaryl. To which chemical class does this insecticide belong? Name another insecticide that belongs in this class.

4. Name two plant-based natural pesticides.

5. Write down two primary and two secondary benefits of using pesticides.

Mahishadal Raj College
Internal Assessment
Sem-VI

DSE-3T: GREEN CHEMISTRY

2019-20 (13/03/2020)

F.M 10 2x5

1. What is biomimetic design?

2. What is biomimicry and how is it used in science?

3. What is the difference between cradle to grave vs Cradle to Cradle?

4. How do carpets are recycled?

5. Which are surfactants?

Session 2020-2021

Mahishadal Raj College
Internal Assessment
Sem-1

C1T1: ORGANIC CHEMISTRY-I

2020-21 (21/09/2020)

F.M 10 2x5

1. Draw the orbital picture of singlet and triplet carbene and also comment on their bond angle.
2. The melting point of a dicarboxylic acid having even No. of carbon atoms is always higher than that of acids having odd No. of carbon atoms lying below or above the series –justify and comment.
3. Compare with reason the dipole moment values of acetonitrile and methyl isocyanide.
4. Show how cis-cyclooctene is defined as a meso compound under the original definition but not under our working definition.
5. What do you mean by fluxional molecule?

Mahishadal Raj College
Internal Assessment
Sem-III

C7T: Organic Chemistry-III

2020-21 (22/09/2020)

F.M 10 2x5

1. Reaction of $(CH_3)_3CH$ with Cl_2 forms two products: $(CH_3)_2CHCH_2Cl$ (63 %) and $(CH_3)_3CCl$ (37%). Why is the major product formed by cleavage of the stronger 1° C−H bond?
2. Calculate the percentage of ionic character of HF. Given that the dipole moment of HF is 1.91 D and its bond length is 0.92 Å.
3. What do you mean by push-pull or captodative ethylene?
4. Explain why phthalimide dissolves in alkali.
5. 2-Ethyl-3-methylcyclobuta-2-en-1-one exists exclusively in the keto form.Explain.

Mahishadal Raj College
Internal Assessment
Sem-V
C12T: Organic Chemistry – V
2020-21 (22/09/2020)

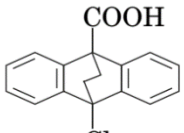
F.M 10 2x5

1. How can you prepare phenanthrene from naphthalene by Howarth synthesis?
2. What happens when cis- and trans-isomers of 3-hydroxy cyclohexane carboxylic acid are heated separately.
3. How can you prepare glycine by Strecker synthesis?
4. Trans-4-t-butyl cyclohexane carboxylic acid is more acidic than cis- isomer-explain.
5. Though the exo product is more stable, the Diels-Alder reaction between cyclopentadiene and acraldehyde gives the endo product. Explain.

Mahishadal Raj College
Internal Assessment
Sem-II
C4T: ORGANIC CHEMISTRY-II
2020-21 (09/03/2021)

F.M 10 2x5

1, The chloro acid I is a stronger acid than the acid without the chlorine, whereas the chloro acid II is a weaker acid than the corresponding acid with no chlorine. Explain



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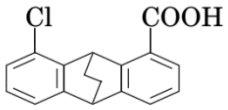


II

2. 18-crown-6 ether greatly increases the rates of reaction where KCN is used as the source of cyanide ion. Account for the empirical observation.
3. How will you prove whether a reaction is intramolecular or intermolecular?
4. Reaction rate of CH_3I with NaN_3 increases several folds with the change of solvent from methanol to DMP –Explain.
5. Explain the stereochemistry of the product with a suitable mechanism when threo diastereomer of PhCHMeCHMeOTs is treated with acetic acid in the presence of sodium acetate.

Mahishadal Raj College

Internal Assessment

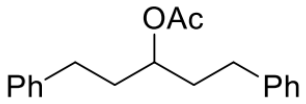
Sem-IV

C10T: ORGANIC CHEMISTRY-IV

2020-21 (09/03/2021)

F.M 10 2x5

1. Mention the type of halides which cannot be used to alkylate an amine.Give your reasoning.
2. Write down the products when a mixture of phenyl acetate and α-naphthyl-propanoate is heated with anhydrous $AlCl_3$. Explain.
3. Describe the synthesis of the following compound with proper retrosynthetic analysis.



4. Why is TMS used as a reference compound for 1H-NMR spectroscopy?
5. Distinguish vinyl acetate and methyl acrylate by IR spectroscopy.

Mahishadal Raj College

Internal Assessment

Sem-VI

DSE-3T: GREEN CHEMISTRY

2020-21 (09/03/2021)

F.M 10 2x5

1. Define Atom Economy with suitable example.
2. Show an example of Aldol condensation in solid phase.
3. Discuss Friedel-Crafts Alkylation using Ionic Liquids.
4. Explain an example of Michael Addition in aqueous medium.
5. Give an example of Dieckmann condensation under sonication.

Mahishadal Raj College
Internal Assessment
Sem-VI

DSE-4T: POLYMER CHEMISTRY

2020-21 (09/03/2021)

F.M 10 2x5

1. What is Polydispersity index?
2. Differentiate LDPE and HDPE.
3. Calculate the molecular weight of polyvinyl alcohol whose DP is 600. (DP= degree of polymerization).
4. What is free volume and how it affects Tg?
5. Explain the term – 'thermosetting polymers'.

Mahishadal Raj College
Internal Assessment
Sem-VI

SEC-4T: PESTICIDE CHEMISTRY

2020-21 (10/03/2021)

F.M 10 2x5

1. What are DDD and DDE?
2. Give an example of an organophosphate herbicide. Draw its chemical structure.
3. Name two inorganic pesticides.
4. Name two plant based natural pesticides.
5. Write down two primary and two secondary benefits of using pesticides.

Session 2021-2022

Mahishadal Raj College
Internal Assessment
Sem-1

C1T1: ORGANIC CHEMISTRY-I

2020-21 (14/09/2021)

F.M 10 2x5

1. Heat of combustion not heat of hydrogenation is more suitable for comparing stability of 1-butene, cis-2-butene. Trans-2-butene and iso butane explain.
2. What are electrophilic carbene and nucleophilic carbene? Give one example to each.
3. The radical anion of benzophenone is more stable than that of cyclohexanone. Explain.
4. 2-methylpyrrolidine boils at temperature higher than the boiling point of pyrrolidine— Why
5. Resorcinol has higher boiling point than 2-nitroresorcinol — Why?

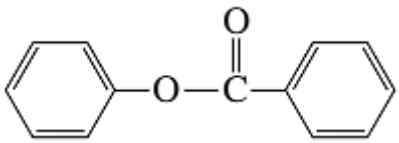
Mahishadal Raj College
Internal Assessment
Sem-III

C7T: Organic Chemistry-III

2021-22 (15/09/2021)

F.M 10 2x5

1. The formation of an acetal requires anhydrous acid, whereas aqueous acid undergoes ready hydrolysis. Explain.
2. Explain why primary or tertiary amines cannot be used to prepare enamines.
3, When 1,4-hexadien-3-ol is dissolved in H_2SO4, it is converted completely into 3,5-hexadien-2-ol. How do you account for this?
4. What products are obtained from the reaction of the following compound with one equivalent of Br_2, using $FeBr_3$ as a catalyst?

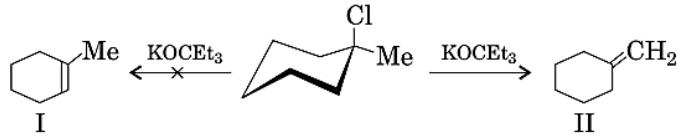


5. When phenol is treated with Br_2, a mixture of *ortho*-bromophenol and *para*-bromophenol is obtained. Design a synthesis that would convert phenol primarily to *ortho*-bromophenol.

Mahishadal Raj College
Internal Assessment
Sem-V
C12T: Organic Chemistry – V
2021-22 (15/09/2021)

F.M 10 2x5

1. Account for the fact that sucrose is a non-reducing sugar but reduces Fehling's solution after heating with dilute HCl.
2. Explain why it requires three moles of HIO4 for the oxidative cleavage of sucrose.
3. Explain the following observations:



I II

4. Draw the structure of an isomer of benzene hexachloride which does not undergo E2 dehydrochlorination and explain why it is unreactive.
5. 1-Methylisoquinoline condenses with benzaldehyde much readily than 3-methyl isoquinoline. Explain.

Total page – 1 UG/3rd SEM/CHEM/Honours/21

2021
B.Sc
3rd SEMESTER EXAMINATION
CHEMISTRY (HONOURS)
Internal Assessment
PAPER – C6T

FULL MARKS: 10

ANSWER ANY **FIVE** FROM THE FOLLOWING QUESTIONS

1. What is radioactive decay?
2. Write down the differences between chemical reactions and nuclear reactions.
3. What do you mean by half-life and average-life of a radioelement?
4. Write down the factors that affect the nuclear stability.
5. Predict the geometry of XeF_2 and XeF_4 with the help of VSEPR theory.
6. Bond angle of CH_4, NH_3 and H_2O are 109^o, 107^o and 104^o, respectively. Explain
7. What are the limitations of the VSEPR model?
8. Explain the structure of PCl_3F_2 with the help of Bent's rule

2021
B.Sc
5th SEMESTER EXAMINATION
CHEMISTRY (HONOURS)
Internal Assessment
PAPER – DSC2T

FULL MARKS: 10

ANSWER ANY **FIVE** FROM THE FOLLOWING QUESTIONS

1. Define precision and accuracy.

2. What is bathochromic shift? Give example.

3. What are systematic and random errors?

4. Write down the limitations of Beer's law.

5. Define spectral bandwidth (SBW) and natural bandwidth (NBW) of a compound.

6. Explain the terms void time and retention time for a column chromatography.

7. Write down the factors that affect the band broadening in column chromatography.

8. What are the advantages of using plasma sources of atomization?

Mahishadal Raj College
Internal Assessment
Semester: II * Subject: Inorganic Chemistry
Paper: C3T * Full marks: 10 * Time: 30 min

Answer any five (05) questions. 5 x 2

1. What do you mean by normal phase and reverse phase column chromatography?
2. Define mean and standard deviation in analytical techniques.
3. Write down the full forms GPC, GLC, CCC and HPLC associated with chromatography.
4. What are the informations can be obtained from a thermogram?
5. How solid sample is introduced in FTIR instrument?
6. Mention the limitations of Lambert-Beer's law.
7. Define chemical interference in atomic absorption spectroscopy.
8. What is the advantage of double beam over single beam in UV-Visible spectrometry?

Mahishadal Raj College
Internal Assessment
Sem-II

C4T: ORGANIC CHEMISTRY-II

2021-22 (29/03/2022)

F.M 10 2x5

1. Chiral trialkylammonium salts undergo racemisation in aqueous solution. Explain.

2. Symmetry affects the melting point of a compound but not the boiling point —Why?

3. Classify the following objects as to whether they are chiral or achiral.Give your reasoning.

(a) scissors, (b) knife, (c) shoe, (d) child's block,

4. A benzene solution of 2,4,6-tri-tert-butylphenoxy radical is decolorized in atmospheric oxygen in 30 min, whereas 2,6-di-tert-butyl-4-phenylphenoxy radical requires 8 hr. Explain.

5, **What is resolution? Explain why two enantiomers cannot be separated by usual techniques (physical means).**

Mahishadal Raj College
Internal Assessment
Sem-IV

C10T: ORGANIC CHEMISTRY-IV

2021-22 (29/03/2022)

F.M 10 2x5

1. The transition states of the Diels–Alder reaction and the Cope rearrangement are comparable. Why?

2. Predict the product (with R/S designation) for the following reaction and give your reasoning:

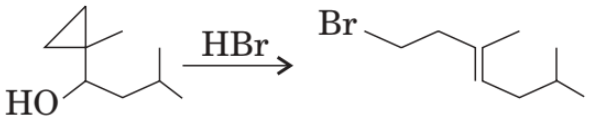
$$(S)\text{-PhMeCHCO}_2\text{Me} \xrightarrow{CF_3COOOH}$$

3. When an excess of hydrazoic acid is used during the Schmidt rearrangement involving a ketone, then a tetrazole derivative is obtained in good yield. Explain its formation by a suitable mechanism.

4. Mention the advantage and disadvantage of the Curtius rearrangement over the Hofmann

rearrangement.

5. Suggest a mechanism for the following reaction



Mahishadal Raj College

Internal Assessment

Sem-VI

DSE-3T: GREEN CHEMISTRY

2021-22 (29/03/2022)

F.M 10 2x5

1. what do you mean by the term ‘sustainable chemistery’

2. Mention two limitation of Green Chemistry.

3. Give on rxample of volatile carcinogenic halogenated sovent.

4. Define the term percent atom utilization and percent atom economy. .

5. write two disadvantage of super critical fluid.

Session 2022-2023

Mahishadal Raj College
Internal Assessment
Sem-1

C1T1: ORGANIC CHEMISTRY-I

2022-23 (20/09/2022)

F.M 10 2x5

1. How can you prove that cis- and trans-but-2-ene have the same constitutional structure but different configurational structures.

2. A molecule is superposable on its mirror-image structure. What could be the point group of that molecule?

3. Show that the enol form of ethyl aceto acetate may exist as different diastereomers. Indicate with reasons for the more stable of the diastereomers.

4. Justify the statement that S2 and I are equivalent operations.

5. Three students concluded that CH_4 has point groups Td, D_4h, and D_2h. What type of structure did they assume?

Mahishadal Raj College
Internal Assessment
Sem-III

C7T: Organic Chemistry-III

2022-23 (21/09/2022)

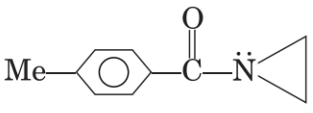
F.M 10 2x5

1. If anisole is allowed to sit in D_2O that contains a small amount of D_2SO_4, what products are formed?

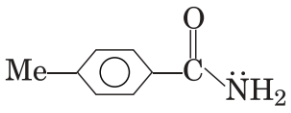
2. Why is 2-chloroanisole nitrated more rapidly than 2-chlorothioanisole under the same conditions?

3. When 1-octene is allowed to react with NBS in CCl4 in the presence of light, 1-bromooct-2-ene is obtained in 80 percent yield. Explain this observation.

4. The amide I undergoes alkaline hydrolysis at a rate much faster (105 times) than the amide II. Explain.

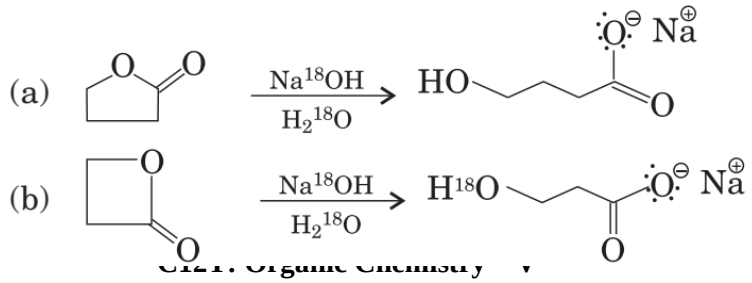


I



II

5. Explain the following observations:



CH21: Organic Chemistry - V

2022-23 (20/09/2022)

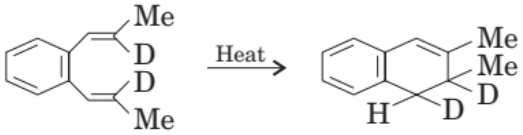
F.M 10 2x5

1. What happens when 1-methylisoquinoline is treated with benzaldehyde in the presence of alkali?

2. 1-Methylisoquinoline condenses with benzaldehyde much readily than 3-methylisoquinoline.

Explain.

3. Account for the following transformation and show the stereochemistry of the product:



Mahishadal Raj College

Internal Assessment

Semester: V * Subject: Analytical Methods in Chemistry

Paper: DSE-2T * Full marks: 10 * Time: 30 min

Answer any five (05) questions. 5 x 2

1. What do you mean by normal phase and reverse phase column chromatography?
2. Define mean and standard deviation in analytical techniques.
3. Write down the full forms GPC, GLC, CCC and HPLC associated with chromatography.
4. What are the informations can be obtained from a thermogram?
5. How solid sample is introduced in FTIR instrument?
6. Mention the limitations of Lambert-Beer's law.
7. Define chemical interference in atomic absorption spectroscopy.
8. What is the advantage of double beam over single beam in UV-Visible spectrometry?

MAHISHADAL RAJ COLLEGE

Chemistry General/Internal Assessment 2022

Subject: Polymer Chemistry

Semester: V Paper: DSE-1A

Marks: 10

Answer any five (05) from the following questions: 2 X 5 = 10

1. Define 'addition polymer' and 'condensation polymer'?
2. What are isotactic and syndiotactic polymers?
3. What is the difference between thermoplastic and thermosetting polymers?

4. What is ‘degree of polymerisation’ of a polymer.
5. What is you understand by the functionality of a monomers for polymer synthesis?
6. What are the differences between homopolymer and heteropolymer?
7. Give example of two natural and two synthetic polymer.

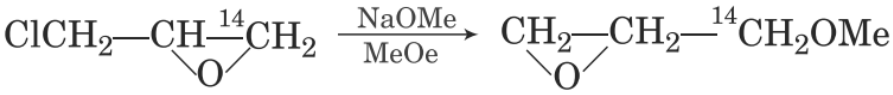
Mahishadal Raj College
Internal Assessment
Sem-II

C4T: ORGANIC CHEMISTRY-II

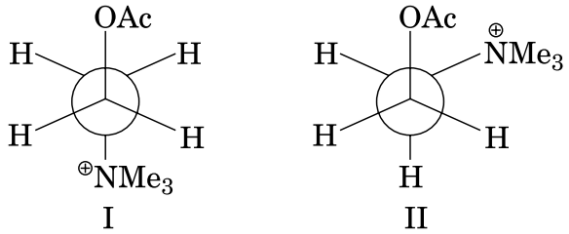
2022-23 (09/03/2023)

F.M 10 2x5

1. Predict the product and give the mechanism of the following reaction:

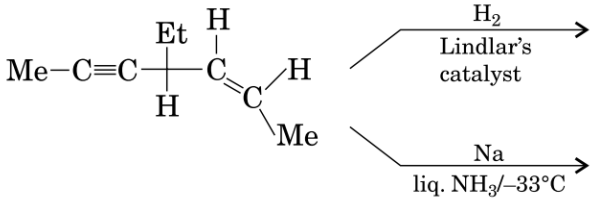


2. In between the two conformations (I and II) of acetylcholine which one is more stable and why?



3. Explain why 2,3-di-tert-butyl-1,3-butadiene exists nearly exclusively in s-trans conformation.

4. Which one of the following two reactions gives a product which is optically inactive? Give your reasoning.



5. In a given solution, a compound shows optical rotation of +300°. How will you prove that it

is dextrorotatory?

Mahishadal Raj College
Internal Assessment
Sem-IV

C10T: ORGANIC CHEMISTRY-IV

2022-23 (09/03/2023)

F.M 10 2x5

1. How can o-, m- and p-dinitrobenzene be distinguished by proton NMR spectroscopy?

2. How can IR spectroscopy be used to distinguish the members of the following pairs?

(a) 1-Hexyne and 3-hexyne

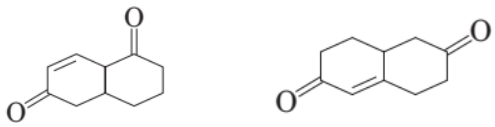
(b) cis-3-Hexene and trans-3-hexene

3. The IR spectrum of benzalacetone (PhCH= =CHCOCH$_3$) in CS_2 at room temperature shows

two separate bands for C= =O stretching vibration. Explain this observation.

4. Using disconnection approach, design a convenient synthesis for each of the following target

molecules:



5. (a) Explain why the following conditions are unsatisfactory for diazo coupling: (i) strong acid and (ii) strong base. (b) what conditions are used to disfavour coupling during diazotization of $ArNH_2$?

Mahishadal Raj College
Internal Assessment
Sem-VI

DSE-3T: GREEN CHEMISTRY

2022-23 (09/03/2023)

F.M 10 2x5

1. Mention two advantages of solvent free organic reaction.

2. Give one example of mchanochemical reaction.

3. What are the difference between catalysts and susceptors?

4. What is the source of micro irradiation?

5.define the molecular radiator.

MAHISHADAL RAJ COLLEGE

INTERNAL ASSESSMENT, 2022

DEPARTMENT OF CHEMISTRY

PHYSICAL CHEMISTRY/CHEMISTRY (H)/SIX SEMESTER

Full Marks 10 Time: 30 min

Answer any five questions.

1. Show that the rotational frequency is equal to

$$\frac{h}{4\pi^2 I}\sqrt{j(j+1)}$$

2. Draw and explain the typical diagram of potential energy of a diatomic molecule according to Morse potential expression. $V = D_{eq}\left[1 - exp\{a(r_{eq} - r)\}\right]^2$

3. Explain the terms: (a) overtone transitions (b) hot bands.

4. The rotational spectrum of HF has lines which are 41.9 cm^{-1} apart. Calculate the bond length in HF. (Given: At wt of H=1, F=19, N_A=6.023 x 10^{23} mol^{-1}). What will be the spacing between lines if DF was investigated (D=2). Assume the bond length to remain unaltered upon isotopic substitution.

5. What are 'Stokes' and 'anti-stokes' lines in Raman spectrum? Why 'Stokes' lines are more intense than 'anti-stokes' lines?

6. Explain why TMS is used as one of the internal references in the measurement of chemical shift of proton.

7. How many lines will be observed in the ESR spectrum of benzene anion radical. What will be their relative intensities?

Internal Examination 2022

Physical Chemistry

5th Sem Hons.

Mahishadal Raj College

Answer any 5 questions. 5x2=10

1. How many possible spin states are expected for the first excited state of He?
2. Evaluate ln(N!) for N=100 using a calculator, and compare the result to that obtained using following form of Stirling's approximation.

$$N! = \sqrt{2\pi N}\left(\frac{N}{e}\right)^N$$

3. What is the difference between a configuration and a microstate? Explain the term 'the most probable configuration'.
4. How would you expect the partition function to vary with temperature? For example, what should the value of a partition function be at 0 K?
5. Write down the differences between thermal de Broglie wavelength and de Broglie wavelength.
6. What is the canonical ensemble? What properties are held constant in this ensemble?

Internal Examination
Mahishadal Raj Collge
Physical Chemistry III (CC-8)

Full marks 10 Time 30 min

Answer any five questions from the following. All questions are carrying equal marks.

1. Find out the correct relationship between the boiling points of very dilute solution of $AlCl_3$ (T_1K) and of $CaCl_2$ (T_2K) having the same molecular concentration.
2. In which of the following pairs of solution will the values of the vant Hoff factor be the same?
   (a) $0.05\ M\ K_4[Fe(CN)_6]$ and $0.10\ M\ FeSO_4$
   (b) $0.10\ M\ K_4[Fe(CN)_6]$ and $0.05\ M\ FeSO_4$, $(NH_4)_2SO_4,\ 6H_2O$
   (c) $0.20\ M\ NaCl$ and $0.10\ M\ BaCl_2$
   (d) $0.05\ M\ FeSO_4$, $(NH_4)_2SO_4, 6H_2O$ and $0.02\ M\ KCl,\ MgCl_2,\ 6H_2O$
3. The values of observed and calculated molecular mass of silver nitrate in water are 92.64 and 170, respectively. Calculate the degree of dissociation.
4. Select and justify the incorrect statement(s).
   (a) The freezing of water is an endothermic process.
   (b) Addition of any substance lowers it freezing point.
   (c) At freezing point or below it, the freezing of both solute and solvents occurs.
   (d) In freezing $\Delta S_{solvent} < \Delta S_{solution}$
5. If 4 moles of a MX_2 salt in 1 kg of water raises the boiling point of water by 3.2 K, calculate the degree of dissociation of MX_2 in the solution. (for water, $K_b = 0.5\ K\ kg\ mol^{-1}$)
6. The vapour pressure of D_2O at 20^0C is 745 mm of Hg. When 15 g of a non-volatile compound is dissolved in 200 g of D_2O, pressure changes to 730 mm of Hg. Assuming the applicability of Roult's Law, calculate the molecular weight of the compound.

MAHISHADAL RAJ COLLEGE

INTERNAL ASSESSMENT I

2021

DEPARTMENT OF CHEMISTRY

GE3: Chemistry Generic

THIRD SEMESTER

Full Marks 10 Time: 30 min

1. True or false? –

(a) Every isolated system is closed.

(b) Energy completely converted from one form to another form.

(c) In endothermic reaction absolute enthalpy of the system increases.

(d) $C_p = C_v$ at absolute zero. +2

2. For each process state whether each of *q*, *w*, and *U* is positive, zero, or negative (from your intuition only). –

(*a*) Combustion of benzene in a sealed container with rigid, adiabatic walls.

(*b*) Combustion of benzene in a sealed container that is immersed in a water bath at 25°C and has rigid, thermally conducting walls.

+2+2

3. Match column 'a' with column 'b'.

a	b
0^{th} law of thermodynamics	Energy conservation
1^{st} law of thermodynamics	Thermal equilibrium
2^{nd} law of thermodynamics	Energy conversion ratio

+3

4. Evaluate for an ideal gas:

$$\left(\frac{\partial P}{\partial V}\right)_T \left(\frac{\partial V}{\partial T}\right)_P \left(\frac{\partial T}{\partial P}\right)_V = ?$$

+1

Internal Examination 2022
Physical Chemistry
3rd Sem Hons.
Mahishadal Raj College

Answer any 5 questions. 5x2=10

1. State and explain Fick's first law of diffusion.
2. Plot viscosity coefficient with temperature for a pure liquid and explain the graph.
3. A liquid of density 1.2 flows through a viscometer in 110 s. The same volume of water requires 60 s to pass. Calculate viscosity coefficient of the liquid. ($\eta_{water} = 0.01\ poise$)
4. Do you feel that fluoride ion in liq HF solvent will exhibit high conductance?
5. Plot Λ vs $\sqrt{C}$ for strong and weak electrolytes up to very high concentration.
6. The speed ratio of silver and nitrate ions in an aqueous solution of silver nitrate has been found to be 0.92. calculate the transport number of these two types of ions.
7. State and explain Walden's rule.
8. Calculate the fugacity of CO_2 at 2 atm and 300^0C. (For CO_2: $a = 3.6\ atm.L^2mol^{-1}$ and $b = 0.04\ Lmol^{-1}$)
9. Predict the nature of ΔG when (i) equal mole of hydrogen and oxygen gas are mixed; and (ii) equal mole of hydrogen and chlorine gas are mixed in presence of sunlight.
10. When nitrogen and hydrogen are mixed in 1:3 (v/v) proportion at 50 atm and 700^0C, the equilibrium concentration of ammonia is 25% by volume. Plot the amount of different gas with time till equilibrium.
11. Light of wavelength 552 nm or grater will not eject photo electrons from a potassium surface. What is the work function (in eV) of potassium?
12. Normalize the wave function $\varphi = \sin(\pi x/a)$ over the interval $0 \leq x \leq a$.
13. Is the following function is square integrable? $f(x) = \sin ax\ \ [-\pi, \pi]$

MAHISHADAL RAJ COLLEGE

INTERNAL ASSESSMENT 2022

DEPARTMENT OF CHEMISTRY

GE2: Chemistry Generic

Second Semester

Full Marks 10 Time: 30 min

Answer any five questions.

1. Apart from tetrahedral geometry, another possible geometry for CH_4 is square planar with the four H atoms at the corners of the square and the C atom at its centre. Explain why CH_4 is not square planar ?
2. Explain why BeH_2 molecule has a zero dipole moment although the Be–H bonds are polar.
3. Which out of NH_3 and NF_3 has higher dipole moment and why ?
4. Describe the shapes of sp and sp^3 hybrid orbitals.
5. Is there any change in the hybridization of B and N atoms as a result of the following reaction?

$$NH_3 + BF_3 \rightarrow NH_3.BF_3$$

6. Use molecular orbital theory to explain why the Be_2 molecule does not exist.
7. Describe the hybridisation in case of PCl_5. Why are the axial bonds longer as compared to equatorial bonds?
8. Define hydrogen bond. Is it weaker or stronger than the van der Waals forces?

Mahishadal Raj College

Internal Assessment – 2022

General Chemistry Sem – I Paper DSC-1A

FM – 10 Time 30 min.

Answer any five questions. (যে কোন 5 টি প্রশ্ন) 2×5

1. পরমাণুর বোর সংক্রান্ত বোরের তত্ত্বের দুটি ত্রুটি উল্লেখ কর।
2. হাইড্রোজেন পরমাণুতে একটি মাত্র ইলেকট্রন থাকা সত্ত্বেও এর বর্ণালিতে অনেকগুলি রেখা পাওয়া যায় কেন ?
3. VSEPR তত্ত্বের প্রয়োগে H_2O অণুর গঠন ব্যাখ্যা কর।
4. NH_3 এর স্থুটনাঙ্ক PH_3 অপেক্ষা বেশী কেন ?
5. নিচের অণু ও গুলির অস্থিরতা ব্যাখ্যা কর।

$CH_3-CH_2^{\oplus}$; $CH_3-\overset{\oplus}{C}H-CH_3$; $CH_3-\overset{\oplus}{\underset{CH_3}{\underset{|}{C}}}-CH_3$

6. নামকরণ কর (IUPAC)