SECOND SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, APRIL 2022

(CBCSS)

Polymer Chemistry

PCH 2C 08—POLYMER TECHNIQUES

(2019 Admission onwards)

Time : Three Hours   Maximum : 30 Weightage

General Instructions

1. *In cases where choices are provided, students can attend* **all** *questions in each section.*

2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*

3. *The instruction if any, to attend a minimum number of questions from each sub section / sub part / sub division may be ignored.*

4. *There will be an overall ceiling for each Section / Part that is equivalent to the maximum weightage of the Section / Part.*

Part A

Answer any **eight** *questions.*
Each question carries a weightage of 1

1. Why to use additives in plastics ?

2. What is the purpose of antistatic agent ?

3. What is the function of extruder screw ?

4. Explain Barus effect

5. Explain shark skin effect.

6. Give the advantages of hot melt adhesives.

7. How does polymer coating prevent corrosion ?

8. What are the reasons for making polymer blends ?

9. How does a compatibilizer work ?

10. What is a coupling agent in composites ?

11. What are polymer composites ?

12. What do you mean by carbon fibre reinforced polymer ?

<div align="right">(8 × 1 = 8 weightage)</div>

Part B

Answer any **four** *questions.*
Each question carries a weightage of 3.

13. What is the role of filler in rubber industry ? Give examples.

14. Explain the process of extrusion.

15. Write a note on rubber injection moulding and its advantages.

16. Explain the mechanism of adhesion.

17. What is pressure-sensitive adhesive material ? Explain with example.

18. What are the advantages of using polymer blends ?

19. Explain the term reinforcement. How boron fibers acts as a reinforcement fiber.

<div align="right">(4 × 3 = 12 weightage)</div>

Part C

Answer any **two** *questions.*
Each question carries a weightage of 5.

20. Write a note on compounding and explain about the mixing machines used in compounding.

21. Write a note on the methods of determining miscibility of polymer blends.

22. Briefly explain about any four types of adhesives.

23. How polymer composites are classified and mention its advantages.

<div align="right">(2 × 5 = 10 weightage)</div>

SECOND SEMESTER M.Sc. DEGREE [REGULAR/SUPPLEMENTARY] EXAMINATION, APRIL 2022

(CBCSS)

Polymer Chemistry

PCH 2C 07—PHYSICAL CHEMISTRY—I

(2019 Admission onwards)

Time : Three Hours   Maximum : 30 Weightage

General Instructions

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Section A

Answer any **eight** *questions.*
Each question carries a weight of 1.

1. Define Nearnst heat theorem.

2. Derive Gibb's-Duhem equation.

3. Explain the significance of phenomenological co-efficient.

4. What is Seebeck effect ?

5. Explain Raoult's law.

6. State and explain third law of thermodynamics.

7. Define ionic mobility, flow it is related to equivalent conductance of an electrolyte?

8. What is meant by metal deposition over voltage ?

9. Explain nuclear fusion reactions with examples.

10. Define the term osmotic co-efficient.

Turn over

11. What are the advantages of dropping mercury electrode ?

12. What is aqualuminescence ?

<div align="right">(8 × 1 = 8 weightage)</div>

Section B

*Answer any **four** questions.*
Each question carries a weight of 3.

13. Using the method of Jacobians show that :

$$\left(\partial H/\partial V\right)_T = -\frac{1}{K} + T\left(\partial P/\partial T\right)_V.$$

14. Explain the determination of osmotic pressure from thermodynamic considerations.

15. State and prove Prigogine's principle of minimum entropy production.

16. Explain the term concentration polarization.

17. Discuss the principle and applications of polarographic analysis.

18. Discuss the principle and applications of Fricke dosimeter.

19. Write short note on photonuclear and thermonuclear reactions.

<div align="right">(4 × 3 = 12 weightage)</div>

Section C

*Answer any **two** questions.*
Each question carries a weight of 5.

20. What are partial molar quantities ? Discuss the methods for the determination of partial molar quantities.

21. Discuss the various methods to test the validity of Deby-Huckel limiting law.

22. Write short notes on :

    (a) Nuclear binding energy and stability rules.

    (b) Interaction of radiation with matter.

23. Discuss the determination of absolute entropies of solids, liquids and gases.

<div align="right">(2 × 5 = 10 weightage)</div>

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SECOND SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, APRIL 2022

(CBCSS)

Polymer Chemistry

PCH 2C 06—ORGANIC CHEMISTRY—II

(2019 Admission onwards)

Time : Three Hours

Maximum : 30 Weightage

General Instructions

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Section A

*Answer any **eight** questions.*
Each question carries a weight of 1.

1. Predict the steriochemically formed product of the following reaction :

2. What is a Carbene ?

Turn over
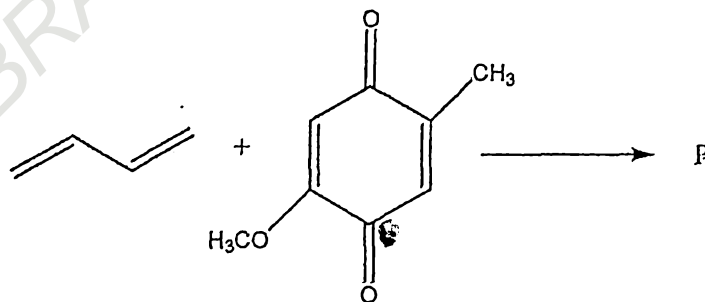
3. Draw the IR Spectrum of the compound, $CH_3CH_2CH_2\overset{\overset{\displaystyle O}{\|}}{C}NH_2$. Show the major (characteristic) three peaks.
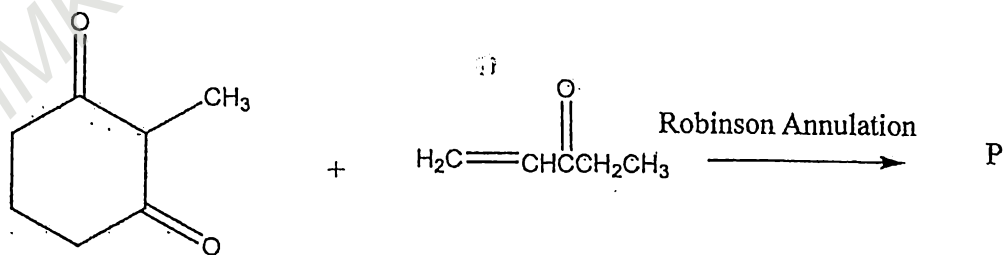
4. Calculate the λ_{max} for the following compound :
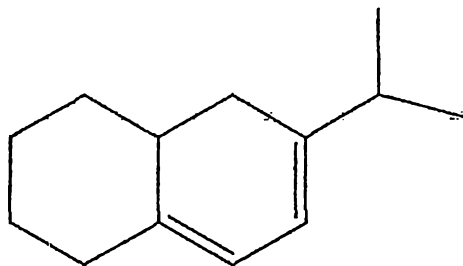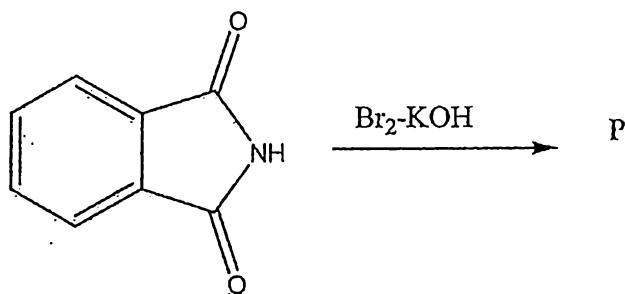

5. What do you mean by diasterotopic protons ?

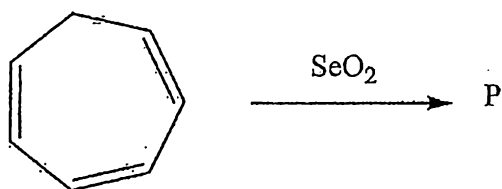6. How many peaks do you expect in a ^{13}C decoupled spectrum of the following compound :
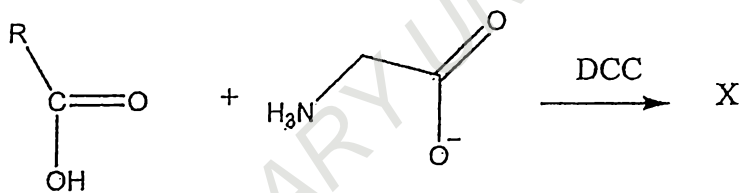

7. Write the product, P in the following reaction :

$+$ $H_2C\!=\!CHCCH_2CH_3$ $\xrightarrow{\text{Robinson Annulation}}$ P
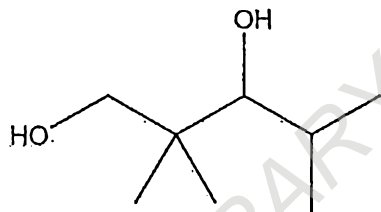
8. What is the product, P in the following reaction ?

Br$_2$-KOH $\longrightarrow$ P

9. Write the product, P in the following reaction :

SeO$_2$ $\longrightarrow$ P

10. Write the product, X in the following reaction :

+ H$_3$N ... O$^-$ DCC $\longrightarrow$ X

11. Name the reagents 1 and 2 in the following reaction :

1.
2. $\longrightarrow$ CH$_2$Ph
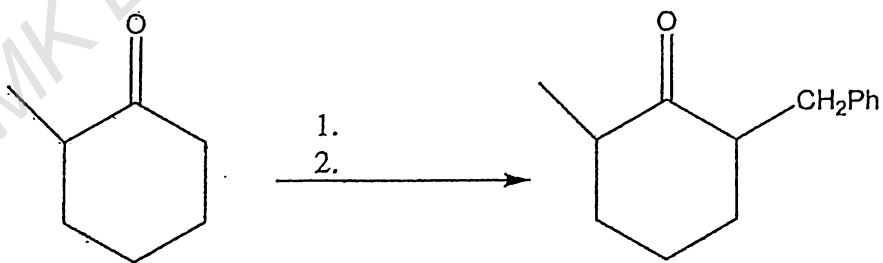
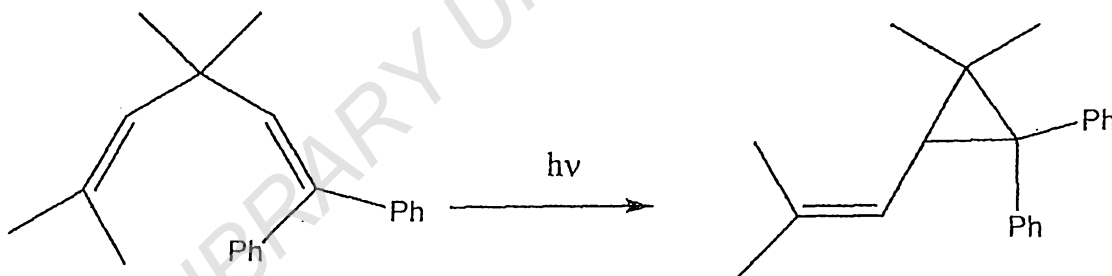12. Write the product, P in the following reaction :
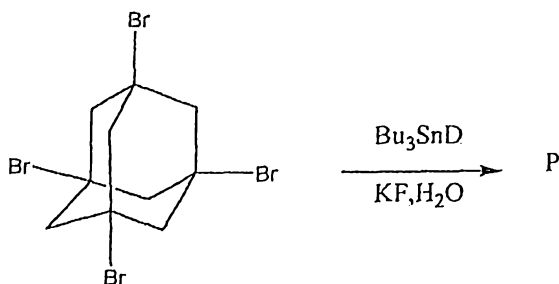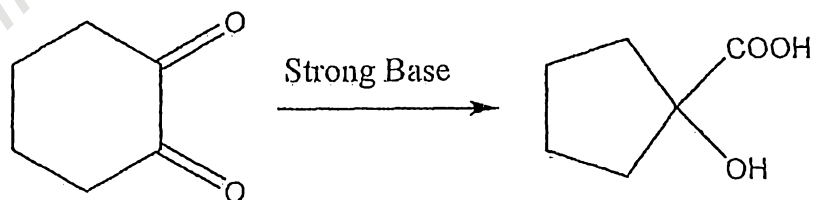
(8 × 1 = 8 weightage)

Section B

Answer any **four** *questions.*
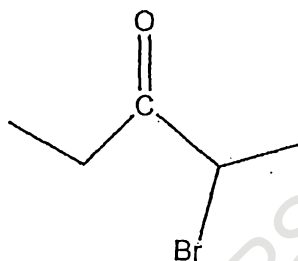*Each question carries a weight of 3.*

13. Explain the Woodward-Hoffmann rules for cycloaddition.

14. Explain the reason for the formation of product in the following reaction :

15. Explain the mechanism of the following reaction :

16. (a) Expalin *The McLafferty* rearrangement ; (b) What will be the fragmentation product of primary carboxylic acid due to *The McLafferty* rearrangement ?

17. Explain Spin decoupling with an example.

18. Write the scheme for the synthesis of : (a) Cytosin starting from malondialdehyde acetal ; and (b) Thymine starting from thiourea.

19. Explain the Favorski reaction with mechanism in the compound :
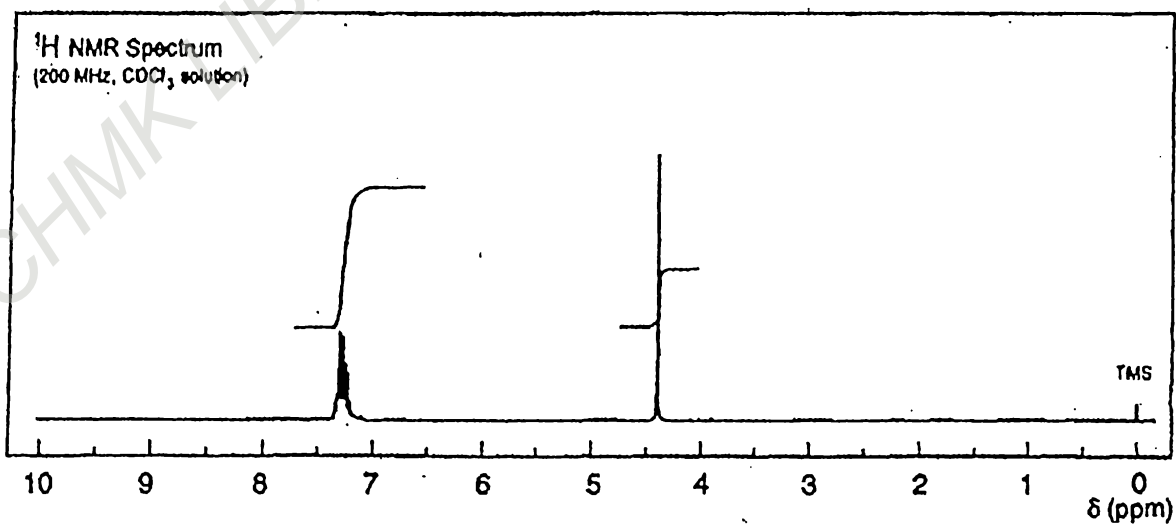

(4 × 3 = 12 weightage)

Section C

Answer any **two** *questions.*
Each question carries a weight of 5.

20. Explain the cycloadditions, [2 + 2] based on FMO and formulate the rules for photochemical and thermal reactions.

21. Explain the general methods for the detection of radical intermediates.

22. Predict the structure of the compound from the given spectral details (on Page 6).

23. Explain the synthetic applications of trimethyl silyl iodide.

(2 × 5 = 10 weightage)

Spectra for Q.No.22

IR Spectrum
(liquid film)

ν (cm⁻¹)

4000 3000 2000 1600 1200 800

Mass Spectrum

% of base peak

91

M⁺
170/172

C_7H_7Br

m/e

40 80 120 160 200 240 280

UV spectrum

0.917 mg / 10 mls
path length : 0.20 cm
solvent : hexane

absorbance

0.0 0.5 1.0 1.5

λ (nm)

200 250 300 350

¹³C NMR Spectrum
(50.0 MHz, CDCl₃ solution)

expansion

140 130 ppm

DEPT CH₃↓ CH₂↑ CH↓

expansion

140 130 ppm

proton decoupled

solvent

δ (ppm)

200 160 120 80 40 0

¹H NMR Spectrum
(200 MHz, CDCl₃ solution)

TMS

δ (ppm)

10 9 8 7 6 5 4 3 2 1 0

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Name.....................................

Reg. No..............................

SECOND SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, APRIL 2022

(CBCSS)

Polymer Chemistry

PCH 2C 05—THEORETICAL CHEMISTRY—II

(2019 Admission onwards)

Time : Three Hours

Maximum : 30 Weightage

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Section A

*Answer any **eight** questions.*

Each question carries a weight of 1.

1. Show that molecule having only one S_n axis is optically inactive.

2. What is direct product representation ?

3. Construct the reducible representation to find out the vibrations of ammonia molecule using normal co-ordinate analysis.

4. Define transition moment integral.

5. When is an integral said to vanish?

6. State GOT theorem

7. Explain standard reduction formula

8. The first line in the rotation spectrum of CO appears at 3.8 cm^{-1}. Calculate the rotational constant and hence the C-O bond length.

Turn over

9. The vibrational frequency of HCl is 2990 cm^{-1}. Find the force constant.

10. Define Beer- Lamberts law. The transmittance of an aqueous solution of $KMnO_4$ is 1 % for a 10^{-3} molar solution in a 1 cm. cell. What is the absorbance and the molar absorption co-efficient.

11. What are the advantages of FTNMR ?

12. What is laser Raman spectroscopy ?

(8 × 1 = 8 weightage)

Section B

Answer any **four** *questions.*

Each question carries a weight of 3.

13. Find out the matrix representations for all the symmetry elements in C_{3v} point group.

14. Construct the character table for C_{3v} point group.

15. Explain the complementarity of IR and Raman Vibrations using the concepts of group theory.

16. Perform a vibrational analysis of H_2O using internal co-ordinate method.

17. Explain McLafferty rearrangement and retro Diels Alder reaction with suitable examples.

18. Interpret the terms dissociation and predissociation with the help of proper diagrams.

19. Explain the factors affecting the chemical shift and coupling constant in NMR spectroscopy

(4 × 3 = 12 weightage)

Section C

Answer any **two** *questions.*

Each question carries a weightage of 5.

20. Construct a nine dimensional matrix representation for the point group to which SO_2 belongs.

21. Discuss the normal mode analysis of trans N_2F_2 for vibrational motion.

22. Explain the basic principle, hyperfine interactions and applications of Mossbauer spectroscopy.

23. Write an essay on the theory, instrumentation and applications of ESR spectroscopy.

(2 × 5 = 10 weightage)