Name...

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

FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2021

(CBCSS)

Polymer Chemistry

PCH 1C 04—POLYMER CHEMISTRY

(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.*

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Section A

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

1. Identify the polymers which are denoted by the recycling codes '4' & '6'.

2. Give examples for the polymers which are formed by nucleophilic substitution reaction.

3. What do you meant by Alfrey-Price treatment ?

4. Write down the expression for weight average molecular mass.

5. What do you meant by redox initiation ?

6. Give examples for speciality plastics.

7. What do you meant by step growth polymerisation.

8. What do you meant by aging of polymers ?

9. What are condensation polymers ?

10. What is the propagation step in vinyl polymerisation ?

Turn over

11. What are Zeigler Natta catalysts ?

12. What are block copolymers ?

(8 × 1 = 8 weightage)

Section B

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

13. Briefly discuss about kinetics of stepwise polymerisation.

14. How the configuration of monomers in vinyl polymer takes place ?

15. Write down the mechanism of anionic polymerisation.

16. How will you calculate statistical fluctuation of instantaneous co-polymer composition.

17. What are the types of polymerisation in homogeneous systems ?

18. What are biodegradable polymers ?

19. How will you distinguish thermoplastics from thermosets ?

(4 × 3 = 12 weightage)

Section C

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

20. (A) Briefly discuss about the kinetics of vinyl radical polymerisation.

(B) What are the effects of temperature and pressure on chain polymerisation ?

21. (A) How polymers react with : (1) polyolefines, (2) polyenes (3) aromatic pendant groups.

(B) Discuss about crosslinking reactions ?

22. (A) How will you classify polymers on the basis of different factors ?

(B) Comment about the stereochemistry and conformational analysis of polymers.

23. (A) What are the types of polymer degradation ?

(B) Write down the kinetics of polymer degradation.

(2 × 5 = 10 weightage)

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(Pages : 3)

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FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2021

(CBCSS)

Polymer Chemistry

PCH 1C 03—ORGANIC CHEMISTRY—I

(2019 Admission onwards)

Time : Three Hours

Maximum : 30 Weightage

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SectionA

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

1. Draw the stereo chemical structure of exo-2-methyl [2.2.1] heptane.

2. Explain the optical activity of helical molecules.

3. Triphenyl amine and N, N dimethyl aniline are both tertiary amines, but the former is insoluble in HCl but the latter is soluble. Justify.

4. Write the IUPAC name of the following compound (in terms of E and Z notations).
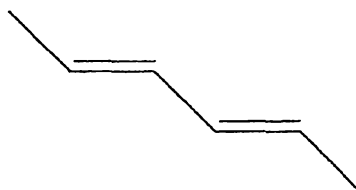
Turn over

5. Write the R and S notation of second and third carbon atoms following compound :

$$CH_3$$
$$H—\!\!\!\!\!\!\!-OH$$
$$H—\!\!\!\!\!\!\!-OH$$
$$CH_3$$
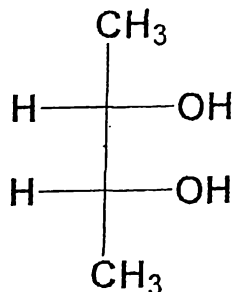
6. Write the structural formula of trans-1,3 dichlorocyclohexane.

7. What is cram's rule ?

8. What is bond angle strain ?

9. Draw the structure of first Molecular Orbital (ψ_1) of benzene molecule.

10. What is a prochiral centre ?

11. Draw all the diastereomers and enantiomers of the following molecule :

$$CHO$$
$$H—\!\!\!\!\!\!\!-OH$$
$$H—\!\!\!\!\!\!\!-OH$$
$$CH_3$$
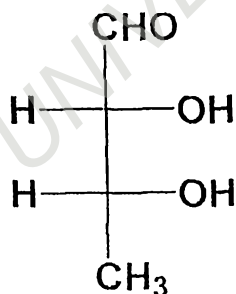
12. Arrange the following carbo cations as their order of stability.

$(CH_3)_2\, CHCH_2\, {}^+CH_2$, $CH_3\, {}^+CH\, CH\, (CH_3)_2$, $CH_3\, {}^+C(CH_3)\, CH_2\, CH_3$.

(8 × 1 = 8 weightage)

Section B

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

13. Discuss the geometrical isomerism of di-substituted cyclohexane molecule.

14. Describe the structure and reactions of carbanions.

15. Describe neighboring group participation.

16. Draw the Newman's formulae of all possible confirmations-of cyclohexane and 1, 4 dichloro cyclohexane.

17. Explain the stereochemistry of S_N1 and S_N2 mechanisms.

18. Briefly discuss the method for separation of racemic mixtures into chiral compounds.

19. Explain clemmenson and wolf-kishner reduction with suitable reaction.

(4 × 3 = 12 weightage)

Section C

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

20. Explain E_1 and E_2 eliminations with suitable examples

21. Give the mechanism and evidence for aromatic electrophilic substitution with two specific examples.

22. Write an essay on inter and intra molecular hydrogen bonding.

23. Explain the reaction mechanism of i) Mannich reaction ; and ii) Knoevenagel reaction.

(2 × 5 = 10 weightage)

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Polymer Chemistry

PCH 1C 02—INORGANIC CHEMISTRY—I

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Section A

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

1. What is the styx number of B2H6 ?

2. What is a super acid ?

3. Define Bravais lattice.

4. Does the spin system (high spin v. low spin) of a molecule play a role in Jahn-Teller effects.

5. An element exists as hexagonal close packed structure as well as cubic close packed structure. In which case the element would have higher density ?

6. What are the two methods bring conductivity to semiconductors ?

7. What is the chelate effect ?

8. Cite any two applications of Ellingham diagram.

Turn over

9. Of $[Ni(en)^3]2^+$, $[Ni(EDTA)]2^-$, and $[Ni(NH_3)^6]2^+$ which would you expect to have the largest and smallest Kf value ? Explain.

10. What is term symbols and what do they represent in Russell-Saunders coupling scheme ?

11. What are isopoly and heteropoly anions ?

12. In what respect Latimer and Frost diagrams differs from Pourbaix diagrams ?

(8 × 1 = 8 weightage)

Section B

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

13. Write about Fermi level in intrinsic semiconductors.

14. Discuss the consequences of lanthanide contraction.

15. What are the factors that affect the stability of coordination compounds ?

16. Give any two methods of preparation of borazine.

17. Differentiate high spin and low spin complexes.

18. What are Borides ? Comment on their properties.

19. Write Hume-Rothery rules for the formation of alloys.

(4 × 3 = 12 weightage)

Section C

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

20. (i) Give a note on the structure of diborane.

    (ii) How crystals generate unique XRD patterns.

21. It a solid "A+B-" has a structure similar to NaCl Consider the radius of anion, as 250 p.m. Find the ideal radius of the cation in the structure. Is it possible to fit a cation C+ of radius 180 p.m. in the tetrahedral site of the structure "A+B-" ? Explain your answer.

22. What is Crystal Field Theory and Ligand Field Theory ?

23. Discuss the classification of silicates based on structure.

(2 × 5 = 10 weightage)

FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2021

(CBCSS)

Polymer Chemistry

PCH 1C 01—THEORETICAL CHEMISTRY—I

(2019 Admission onwards)

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Section- A

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

1. Explain the term well behaved wave function. Examine whether $Y = \sin x$ is a well behaved wave function.

2. Find the spectroscopic term symbol for the ground state of H and He.

3. Calculate the no. of photons emitted by 150W yellow lamp in 2s. λ of yellow light = 555 nm.

4. Write the Slater determinantal wave function for lithium atom.

5. Show that the energy density for Planck distribution of black body radiation has units of energy per unit volume.

6. Write down the Hamiltonian operator of hydrogen molecule and explain the terms.

7. Write down the expression for the angular part of $d_{x_2 - y_2}$ orbital.

8. Explain Hermitian operator with examples.

Turn over

9. What is Pauli's antisymmetry principle ?

10. State Born-Oppenheimer approximation.

11. Write down the del squared operator in spherical polar coordinates.

12. Define spherical harmonics. Write one example.

$(8 \times 1 = 8 \text{ weightage})$

Section B

Answer any **four** *questions.*

Each question carries a weight of 3.

13. Explain the Stefan-Boltzmann law and Weins displacement law and derive Planck's approximation applicable to black body radiation.

14. State variation theorem and explain the variation method.

15. What is the angular momentum of a non-planar rigid rotor ? Apply this and explain the Zeeman effect.

16. What is associated Legendre polynomial ? Give its form.

17. Give the MO and VB approximation for the ground state of H_2 molecule and compare them.

18. Find the ground state energy of He atom by first order perturbation method.

19. Briefly explain basic principles of HF method to find energy of many electron atoms.

$(4 \times 3 = 12 \text{ weightage})$

Section C

Answer any **two** *questions.*

Each question carries a weight of 5.

20. Apply Schrödinger wave equation for H atom. Transform it into spherical polar coordinates. Separate the variables. Solve the θ equation.

21. What is rigid rotator model ? Set up the Schrödinger equation for a rigid rotator.

22. Obtain the allowed eigen states and energies of a particle constrained to move with in the boundaries of a three dimensional box. Explain how the degeneracy arises.

23. Briefly explain the perturbation method. Find the ground state energy of a particle with slanted bottom.

$(2 \times 5 = 10 \text{ weightage})$