B.Sc. 6th Semester (Honours) Examination, 2021 (CBCS)

Subject: Chemistry

Paper: DSE-3

(Green Chemistry)

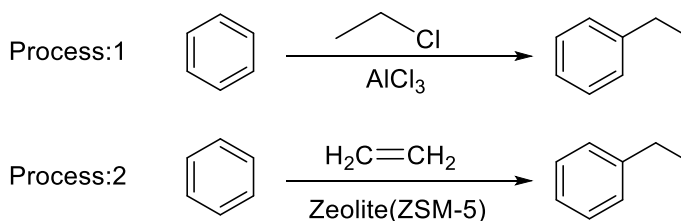**Time: 2 Hours**   **Full Marks: 40**

Candidates are required to give answers in their own words as far as practicable

*Answer **any eight** questions from the following:*   **8 × 5 = 40**

1. State two basic differences between E-factor and atom economy? What change in calculation of E-factors do you expect for the synthesis of bulk chemicals to fine chemicals? Why?

2. Mention two reasons why green chemistry is also called sustainable chemistry? Calculate the atom economy for olefination of cyclohexanone by Wittig method. [Given, At. Wt: P = 31]

3. Discuss the advantages of any two alternatives to the VOCs. (Volatile Organic Solvents). Mention the names of organic solvents that are benign to the environment.

4. Does the direct interaction of ultrasound waves responsible for bringing about chemical change of organic starting materials? Justify your answer in light of cavitation theory.

5. Why CO_2 is commonly used as supercritical fluid? Name a few other supercritical fluids. What are the drawbacks of using $ScCO_2$?

6. Why do we call ionic liquids as 'designer solvent'? Give two examples of organic reactions in ionic liquids.

7. What is bio-diesel? How benzoin condensation can be carried out without the use of cyanides?

8. Two methods of synthesis of ethyl benzene are depicted below:

   Process:1   [benzene] $\xrightarrow[\text{AlCl}_3]{\text{CH}_3\text{CH}_2\text{Cl}}$ [ethylbenzene]

   Process:2   [benzene] $\xrightarrow[\text{Zeolite(ZSM-5)}]{\text{H}_2\text{C}=\text{CH}_2}$ [ethylbenzene]

   Which process according to you is greener than the other? Mention at least three ways in support of your choice.

9. "At high temperature water becomes more like organic solvent"— do you agree with the statement? Justify your answer with at least two reasons.

10. Discuss the advantages and disadvantages of PLA in polymer industry.

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(Polymer Chemistry Theory)

Time: 2 Hours   **Full Marks: 40**

Figures in the margin indicate full marks

Candidates are required to give their answers in their own wards as far as practicable.

Answer any *eight* questions from the following: 8×5=40

1. Discuss the mechanical properties of elastomers and fibers on the basis of intermolecular forces existing in them. Give example of each type with their molecular structures.

2. What is polydispersity index? What is its usual value for synthetic polymer? Find the condition under which $\bar{M}_w = \bar{M}_n$. What does the condition signify?

3. Describe what is meant by primary, secondary and tertiary structures of a polymer. Draw the syndiatactic configuration of polypropelene.

4. i) What is glass transition temperature (T_g)? Between a rubber and a fiber which has the lowest T_g and why?
   ii) Write down the Carothers' equation mentioning the terms therein.

5. In a polymerization reaction hexamethylenediamine reacts with adipic acid in equimolar concentration to form nylon 6,6. Calculate the molecular weight nylon 6,6 when the conversion is 90%. (Given the weight of repeating unit of nylon 6,6 is 226).

6. i) What is conducting polymer? Give example and the use of conducting polymers.

ii) High melting temperatures are desirable in case of polyamides and polyesters. – Justify.

7. Discuss the viscosity method for the determination of molecular weight of a polymer. What type of molecular weight is obtained from this method?

8. i) Describe how the interactions between solvent (both good and poor) and polymer would affect the behaviour of polymer solution (in terms of ideality, viscosity etc).
   ii) Write down the expression of Gibbs free energy of mixing of n_1 moles of solvent and n_2 moles of polymer with their volume fractions Φ_1 and Φ_2 respectively at temperature T.

9. Derive the rate expression in terms of the extent of reaction for the step growth polymerization between a diacid and a diol in presence of catalyst. Interpret the result graphically.

10. Write the monomers and chemical reaction for the preparation of Buna-S. What does the name Buna-S stand for? Mention its use. In which class of polymers (according to properties) does it belong?