

B.Sc. 6th Semester (Honours) Examination, 2024 (CBCS)**Subject : Chemistry****Course : DSE-3****(Polymer Chemistry)****Time: 2 Hours****Full Marks: 40***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.***1. Answer any five questions:****2×5=10**

- (a) State and illustrate the criterion of a molecule to be a monomer of a polymer.
- (b) Write the name and structure of the monomer of PVC.
- (c) Polymer are also called as molecular colloids.— Comment.
- (d) Define polydispersity of a polymer sample. Comment on its unit.
- (e) Arrange number-average, weight-average and viscosity-average molar masses of polymers in increasing order.
- (f) Predict the values of reactivity ratios r_A and r_B of two monomers A and B respectively, so that they can form perfectly alternate copolymers.
- (g) Write down the structure of polypyrrole. What is the speciality of this polymer?
- (h) What is degree of polymerisation? Give an example of inorganic polymer.

2. Answer any two questions:**5×2=10**

- (a) Derive carothers' equation relating average functionality, extent of reaction and degree of polymerization. Deduce its form for a bifunctional system. What is the usefulness of this equation? 3+1+1
- (b) Differentiate between addition and condensation polymers. Give an example of each type of these polymers. 3+2
- (c) Classify polymers on the basis of tacticity. Give one example each of thermoplastic and thermosetting plastic. 3+2
- (d) (i) Write two unique properties and two uses of Bakelite.
- (ii) Why are the numbers '6, 6' and '6' used in the names of the polymers nylon 6, 6 and nylon 6 respectively? 3+2

3. Answer any two questions:

10×2=20

- (a) (i) What is glass transition temperature (T_g)? What is the effect of branching of polymer backbone on T_g ?
 (ii) A linear amorphous polymer has a T_g of 10°C . At 27°C it has a melt viscosity of 4×10^8 Poise. Estimate its viscosity at 50°C .
 (iii) Discuss the osmotic pressure method to determine the molar masses of polymers.
 (iv) Define the term 'average functionality'. (1+1)+4+3+1
- (b) (i) Write down the expressions for number-average molar mass and weight-average molar mass of polymers. Prove that $\overline{M}_w \geq \overline{M}_n$. When is $\overline{M}_w = \overline{M}_n$?
 (ii) Find the expression for $\overline{M}_w \times \overline{M}_n$. What is the name of this product?
 (iii) Write down Mark-Houwink-Sakurada equation. Which type of molar mass of polymers is determined with the help of this equation? (2+3+1)+(1+1)+(1+1)
- (c) (i) Briefly explain the two-stage solution process of polymers.
 (ii) 'Highly cross-linked polymers do not dissolve easily and absence of solubility necessarily implies cross-linking in polymers.' — Justify or criticise this statement.
 (iii) What are conducting polymers? Give two examples.
 (iv) What is the main difference between a homopolymer and a copolymer? Give an example of each. 2+2+(2+1)+(1+2)
- (d) (i) Derive the rate expression in terms of extent of reaction for the step-growth polymerisation between a dicarboxylic acid and a dihydric alcohol. Interpret the results graphically.
 (ii) Briefly discuss the intermolecular forces present in polymers.
 (iii) Determine the solubility parameter of a polymer having cohesive energy 43870 J mol^{-1} and molar volume $136 \text{ cm}^3 \text{ mol}^{-1}$.
 (iv) What is vulcanisation of rubber? 4+3+2+1

B.Sc. 6th Semester (Honours) Examination, 2024 (CBCS)

Subject : Chemistry

Course : DSE-3 (OR)

(Green Chemistry)

Time: 2 Hours

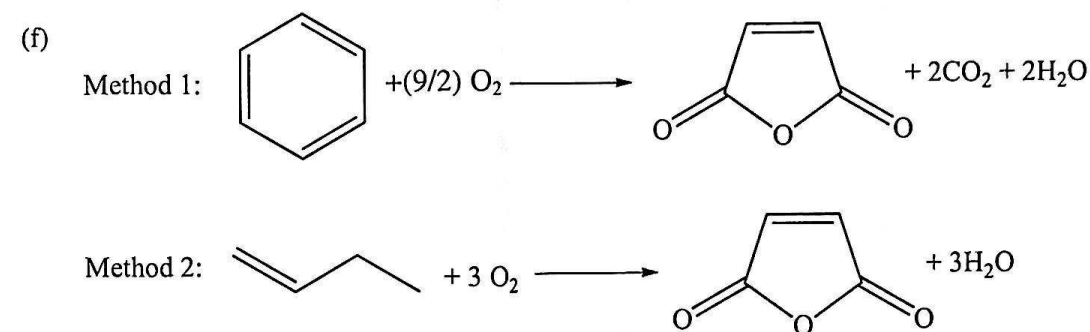
Full Marks: 40

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*

1. Answer any five questions:

2×5=10

- (a) Name the two dielectric properties on which microwave heating depends.
 (b) Mention two domains of Life Cycle Assessment (LCA).
 (c) What is the ideal value of Atom Economy (AE) and E-factor?
 (d) What are benign solvents? Give two examples.
 (e) Name two natural biopolymers.



Between the two methods shown above for the synthesis of maleic anhydride which one is suitable industrially and why?

- (g) What characteristics of fluorous solvent that make it a biphasic solvent and why?
- (h) Write the name of most preferable and least preferable stage, respectively of "The Waste Mangement Hierarchy".

2. Answer any two questions:

5×2=10

- (a) (i) How does MW produce heat in a dielectric material?
- (ii) Why has MW radiations established itself as a non-conventional energy source in the field of synthetic organic chemistry? Write any two reasons. 3+2
- (b) (i) What is cavitation? How many types of cavitation are there?
- (ii) How does 'cavitation theory' explain chemical reaction? 2+3
- (c) (i) Point out two drawbacks of ScCO_2 .
- (ii) Decaffeination of coffee beans by ScCO_2 is very popular and economically viable. — Why? 2+3
- (d) (i) Differentiate between Atom Economy and E-Factor.
- (ii) Considering two possible ways of making FeSO_4 :
- $$\text{Fe(s)} + \text{H}_2\text{SO}_4(\text{aq}) = \text{H}_2(\text{g}) + \text{FeSO}_4(\text{aq})$$
- $$\text{FeO(s)} + \text{H}_2\text{SO}_4(\text{aq}) = \text{FeSO}_4(\text{aq}) + \text{H}_2\text{O(aq)}$$
- Which process should be adopted as a green method and why? 2+(2+1)

3. Answer any two questions:

10×2=20

- (a) (i) "At high temperature water becomes more like organic solvent" — Do you agree with the statement? Justify your answer with at least two reasons.
- (ii) Mention two reasons why green chemistry is also called sustainable chemistry. Calculate the atom economy for olefination of cyclohexanone by Witting method.

[Given, At. Wt: P=31]

- (iii) Why is PLA considered as green polymer? Give an important property of PLA which makes it unique. (1+2)+(2+2)(2+1)

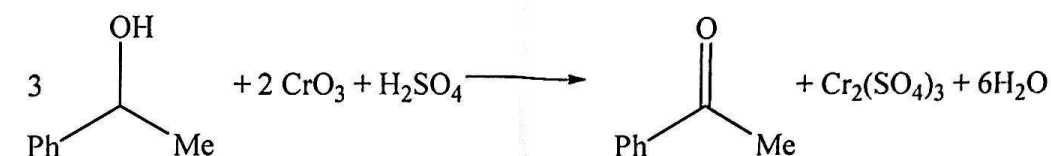
(b) (i) Explain the following terms giving one example in each case (any three):

- (I) Cradel to Grave
- (II) Eurotrophication
- (III) Environmental Quotient
- (IV) Non-biodegradable polymer

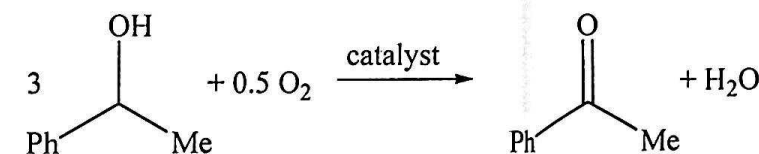
(ii) What are ionic liquids? Mention its two special features. (2×3)+(2+2)

- (c) (i) Acetophenone can be synthesized by the two different methods as given below. Calculate Atom Economy and E-Factor for both the methods to establish the fact that "catalytic reagents are superior than stoichiometric ones".

Method 1:



Method 2:



- (ii) Discuss any four principles of green chemistry. (3+3)+4
- (d) (i) What are the characteristics of a pigment that make it a 'Rightfit Pigment'? Give an example of 'Rightfit Pigment'.

- (ii) What is bio-diesel? Suggest a greener alternative to benzoin condensation with cyanides.
- (iii) The rate of oxidation of PhCH_2OH to PhCHO with O_2 gas in presence of cat ScCO_2 is accelerated by the addition of small amount of toluene. — Why?

(2+1)+(
