

2023

CHEMISTRY — HONOURS

Paper : DSE-A-3

(Green Chemistry and Chemistry of Natural Products)

Full Marks : 50

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*Answer **question no. 1** and **any eight** questions from the rest (**question nos. 2 to 13**).

1. Answer **any ten** questions : 1×10
- (a) Give example of one green reagent that can be used in Friedel-Crafts reaction instead of anhydrous AlCl_3 .
 - (b) What is PEG? Write its general formula.
 - (c) Write one medical importance of nicotine.
 - (d) Give one example of biodegradable polymer.
 - (e) Name two carcinogenic solvents.
 - (f) What is meant by hydrophobic effect?
 - (g) Why is waste prevention better than waste clean up?
 - (h) Write down the names of two alternative energy sources other than thermal energy used in chemical reactions.
 - (i) What are the methods by which ultrasonic waves are generated?
 - (j) Mention one limitation in the pursuit of goal of green chemistry.
 - (k) Give one example of ionic liquid.
 - (l) What is isoprene rule?
2. (a) Give one example of decarboxylation reaction using MWI. Write down the green context of the reaction. 3+2
- (b) 'Atom economy' of rearrangement and addition reactions is always 100%. Explain with one example of each.
3. (a) Outline the synthesis of hygrine alkaloid.
- (b) Why does green chemistry prefer the use of catalyst instead of stoichiometric reagents? 3+2
4. (a) Discuss the green synthesis of adipic acid, mentioning all the steps involved.
- (b) What are the advantages of green method over the conventional one? 3+2

Please Turn Over

5. (a) Discuss briefly for the green methods of the following reactions :
 (i) Fries rearrangement
 (ii) Benzoin condensation.
 (b) How a lactone can be synthesised *via* Bayer-Villiger oxidation method following an environmentally benign procedure? 3+2
6. (a) Write down the following reactions using MWI (microwave irradiation) and also mention the conditions of the reactions.
 (i) Oxidation of toluene
 (ii) Conversion of methyl benzoate to benzoic acid.
 (b) Write down the green context of the above reactions [stated in Q. 6(a)]. 3+2
7. (a) Consider the following reaction :
- $$\text{R-CH=CH}_2 + \text{CH}_2=\text{CH-COOMe} \xrightarrow[\substack{49.5-11\text{T bar} \\ 50^\circ-117^\circ\text{C} \\ 3-24 \text{ days}}]{\text{Sc-CO}_2} \text{R-cyclohexene-CO}_2\text{Me (cis)} + \text{R-cyclohexene-CO}_2\text{Me (trans)}$$

$$\text{R} = \text{Me, } ^t\text{Bu}$$
- What is the role of Sc - CO₂ in the above reaction? How is its use advantageous over the conventional solvent?
- (b) Give an example of an organic reaction where PEG acts as a phase transfer catalyst. 3+2
8. (a) Mention three advantages of solvent-free synthesis over conventional methods.
 (b) Give one example each of two solid support syntheses. 3+2
9. (a) Give any one green approach of aldol condensation. Mention one important advantage of this method over classical method.
 (b) What are the limitations of MW heating? 3+2
10. (a) What are the emerging areas on which the future trends of green chemistry depends?
 (b) Mention four disadvantages of the common oxidation processes. 3+2
11. (a) What is biomimetic synthesis?
 (b) Which oxidation catalyst is used for the green oxidation of alcohol to carbonyl compounds? Write down the reaction. 3+2
12. (a) Write the disadvantages of the conventional method of the Beckmann rearrangement. Elaborate one example about the green approach of the reaction.
 (b) Mention the advantages of using ultrasonics in the medical field over other techniques. 3+2
13. (a) How can the functional nature of oxygen present in an alkaloid chemistry be detected?
 (b) Write down the medical importances one for each of quinine and cocaine. 3+2