

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.*

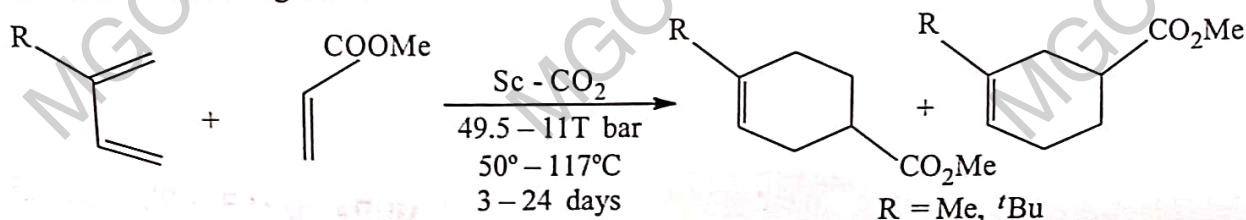
Answer *question no. 1* and *any eight* questions from the rest (*question nos. 2 to 13*).

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  $\text{AlCl}_3$ .
  - (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. 1×10
- (b) 'Atom economy' of rearrangement and addition reactions is always 100%. Explain with one example of each. 3+2
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

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5. (a) Discuss briefly for the green methods of the following reactions :
- Fries rearrangement
  - 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.
- Oxidation of toluene
  - 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 :



What is the role of Sc - CO<sub>2</sub> 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