2022

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) Why green chemistry prefers the use of catalyst instead of reagents?

(b) What do you mean by biocatalyst? Give one example.

(c) Arrange the following solvents in the increasing order of greenness :
Ethanol, chloroform, tetrahydrofuran, water.

(d) What is the starting material used in the green synthesis of adipic acid?

(e) Write one source each of ultrasonic sound (US) and infrasonic sound (IS).

(f) What is the basis of formation of ionic liquid?

(g) State the second principle of green chemistry.

(h) What are the necessary conditions for a molecule to be microwave active?

(i) What is commonly used solvent in cleaning industry?

(j) What is the frequency range for sonochemical reactions?

(k) Give two important uses of Sc-CO_2 as solvent.

(l) Mention one medicinal use of morphine.

2. (a) What is a phase transfer catalyst? Discuss the role of PTC in nucleophilic substitution reaction. Cite one reaction.

(b) Why are most of Diels-Alder reactions faster in water than in methanol? 3+2

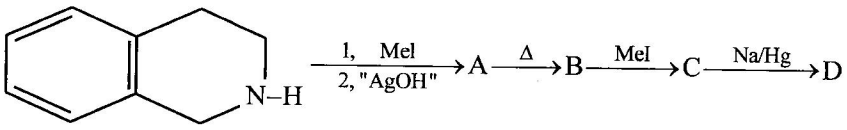
3. (a) How do you detect the presence of the followings in citral :

(i) Aldehyde group

(ii) Presence of double bond and their exact position

(iii) The hydrolysis product with aqueous potassium carbonate solution.

(b) Write down all the products (A → D) involved in the following transformations : 3+2



4. (a) Discuss the mechanism of thiamine catalysed benzoin condensation. What are the advantages of the green approach of synthesis?

(b) Give example of one green reagent along with structure which can be used in Fridel-Craft reaction instead of anhydrous $AlCl_3$. 3+2

5. (a) Give outlines of conventional and green synthesis of catechol. What are the advantages of the green method over the conventional one?

(b) How green chemistry works in sustainable development? 3+2

6. (a) Discuss in brief about biochemical and enzymatic method for the Baeyer–Villiger oxidation reaction.

(b) How combinatorial chemistry be beneficial in the context of green chemistry? 3+2

7. (a) Compare and contrast between the conventional method and any one green method of Claisen rearrangement.

(b) What are the utilities of PEG as a solvent in green synthesis? 3+2

8. (a) Discuss in brief any *one* green method of the following reactions :

(i) Michael reaction

(ii) Knoevenagel reaction

(iii) Cannizzaro reaction.

(b) Mention the reaction conditions for oxidation of toluene under microwave irradiation (MWI). Write the reaction and compare with conventional process. 3+2

9. (a) How microwave improves the yield of elimination product in 'Hofmann elimation' reaction? Explain with an example.

(b) What is hotspot in microwave irradiation? 3+2

10. (a) What is 'hydrophobic effect'? How it helps to get the activation energy necessary for the substrate molecules to react?

(b) What are micelles? 3+2

11. (a) Give one example of aldol condensation reaction carried out in a solventless benign way. Mention the substrate, reagents and conditions of the reaction.

(b) How acetanilide can be prepared *via* Beckmenn rearrangement following an environmentally benign procedure? 3+2

12. (a) Write down the product of the reaction when acrylonitrile is treated with benzaldehyde in a green way. Mention the name of the reaction, catalyst used and conditions needed for the reaction.

(b) Give an example of an oxidation catalyst. Write down one reaction showing its application. 3+2

13. (a) Why is carbon dioxide used as a supercritical fluid? Give two important uses of Sc-CO_2 as solvent.

(b) Why is an ionic liquid called a designer solvent? 3+2