

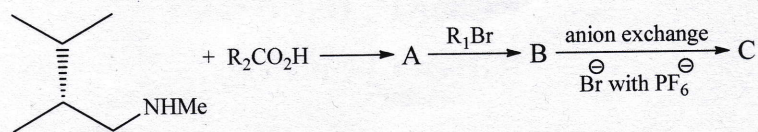
**B.Sc. 6th Semester (Honours) Examination, 2023 (CBCS)****Subject : Chemistry****Course : DSE-3****(Green Chemistry)****Time: 2 Hours****Full Marks: 40***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.***1. Answer any five questions:****2×5=10**

- (a) List two important differences between 'Conventional heating' and 'Microwave heating'.
- (b) What is 'Eutrophication'? How does it affect the ecosystem?
- (c) Calculate the atom economy of the following reaction:
- $$\text{HOCH}_2\text{CHOHCH}_2\text{OH} + \text{H}_2 \xrightarrow[200^\circ\text{C}, 200 \text{ psi}]{\text{CuCrO}_4} \text{CH}_3\text{CHOHCH}_2\text{OH}$$
- (d) Mention two characteristics of water that makes it a benign solvent.
- (e) Write two advantages of use of supercritical carbon dioxide 'scCO<sub>2</sub>' as a solvent in extraction process in food industry.
- (f) Elucidate the working definition of 'Green Chemistry'.
- (g) Why are ionic liquids called designer solvents?
- (h) Identify the non-ionising radiation among the following:  
X-rays,  $\gamma$ -rays, MW, UV-Visible and justify your choice.

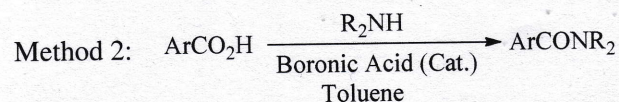
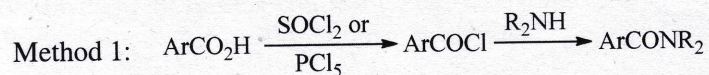
**2. Answer any two questions:****5×2=10**

- (a) (i) Provide two arguments in favour of the statement— "Oxidation of cyclohexanol/cyclohexanone to adipic acid by concentrated nitric acid is not considered a green synthesis".
- (ii) Suggest a suitable green alternative route to the above transformation. **3+2**
- (b) (i) In the successful synthesis of an ionic liquid (IL) what are the two important factors that should be maintained?

- (ii) Complete the synthesis of the following ionic liquid by providing the structures of the missing compounds. 2+3



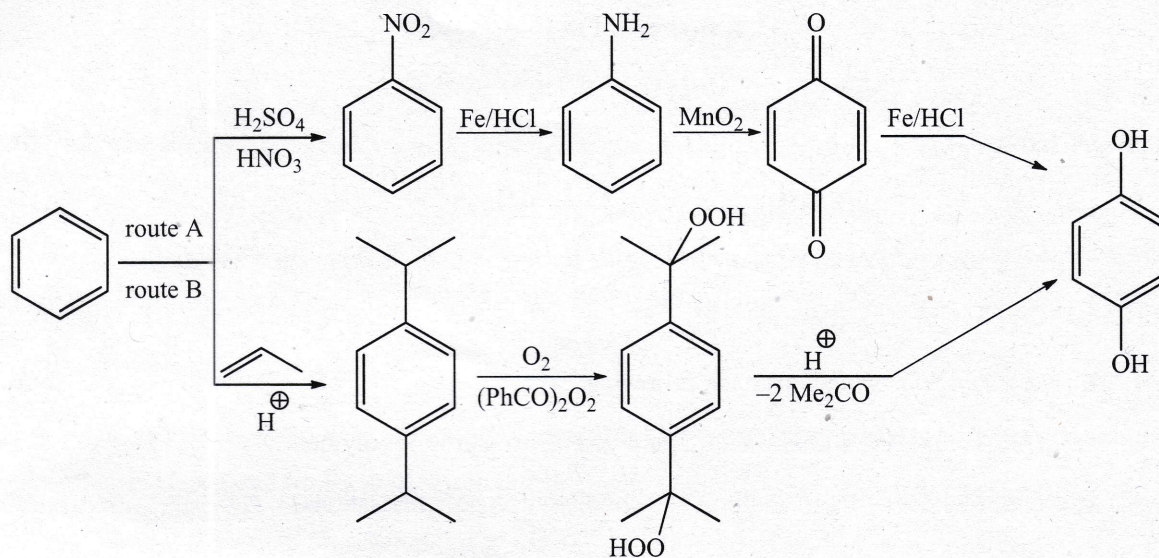
- (c) (i) Two methods of synthesis of following secondary amide are given below:



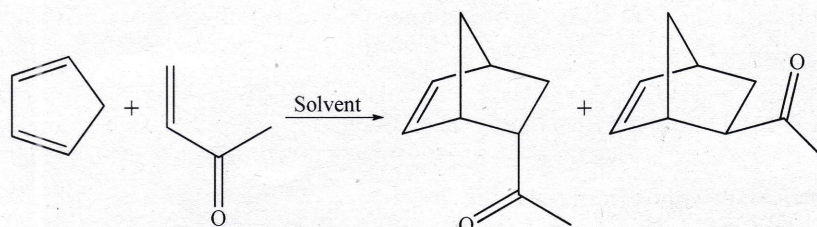
Which method is greener and why? Which principle of green chemistry do your choice satisfy?

- (ii) Name the chemical responsible for 'Bhopal Gas Tragedy' in 1984? (1+2+1)+1
- (d) (i) List two points to prove polylactic acid (PLA) is a green polymer.
- (ii) How can the monomer of PLA be generated? In which category of polymer does PLA fall into? 2+(2+1)
3. Answer *any two* questions: 10×2=20
- (a) (i) Draw the pyramid that represents the waste management hierarchy indicating options to manage waste. Which is the most preferred option and why?
- (ii) What is the relationship between Risk and Hazard? Explain the factors on which risk depends to justify the relation.
- (iii) Give correct abbreviation of any two of the following: (2+1+2)+(1+2)+(1+1)  
CCS, ISD, EMY
- (b) (i) Explain the following terms giving one example in each case (*any three*):  
(a) VOC (b) Toxic Chemical  
(c) Green Solvent (d) Non-biodegradable polymer
- (ii) What is cavitation? How does ultrasound vibration lead to acoustic cavitation? (2×3)+(2+2)
- (c) (i) Define E-Factor. Name the scientist who used this term first. Mention the basic difference between 'E-Factor' and 'Atom Economy'.

- (ii) Consider the synthesis of hydroquinone by two routes as depicted below. In which case do you expect E-Factor is substantially less? And why?



- (iii) Name the tool that is used to assess potential environmental impacts and sustainability of products and process. Name the different domains of such assessment.  
(1+1+2)+(1+2)+(1+2)
- (d) (i) Consider the following Diels Alder reaction.



Solvent	<i>endo:exo</i>
EtOH	8.5
H <sub>2</sub> O	21.4

Comment with proper justification why greater *endo* selectivity is observed in water. Why most Diels-Alder reaction is reasonable faster in water than methanol?

- (ii) What is bio-diesel? How can benzoin condensation be carried out without the use of cyanides?
- (iii) Suggest an environmentally safer alternative reagent to bromine. (3+2)+(2+2)+1