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**3 SEM PG (CBCS) CHM GE 305**

**2024**

(December)

**CHEMISTRY**

Paper : GE-305

**(Green and Sustainable Chemistry)**

Full Marks : 60

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

**UNIT-I**

(Marks : 5)

1. Fill in the blanks : 1×3=3
- (i) Chernobyl disaster was caused by \_\_\_\_.
- (ii) The term "Green Chemistry" was introduced by \_\_\_\_.
- (iii) The greenest solvent for any reaction is \_\_\_\_.

Contd.

2. 'Green chemistry' is synonymous with 'Sustainability'. Justify this statement. 2

### UNIT-II

(Marks : 25)

3. Answer the multiple choice questions :  
1×5=5

(i) Ultrasound-assisted reactions generally occurs in the range of :

- (a) 20 Hz to 20 kHz
- (b) Less than 20 Hz
- (c) 20 kHz to 10 GHz
- (d) More than 10 GHz

(ii) Biodiesel is an example of which of the 12 Principles of Green Chemistry ?

- (a) Waste prevention
- (b) Use of renewable feedstocks
- (c) Use of catalysis
- (d) Safer solvents

(iii) Bio-polymers exemplify Green Chemistry Principle 10, which is —

- (a) Catalysis
- (b) Prevent waste
- (c) Benign solvents & auxiliaries
- (d) Design for degradation

(iv) \_\_\_\_\_, or VOCs, have been replaced and were banned in some paints.

- (a) Versatile Organic Chemicals
- (b) Volatile Organic Compounds
- (c) Volatile Organic Components
- (d) Versatile Odorless Components

(v) Green chemists reduce risk by —

- (a) Minimizing the use of all chemicals
- (b) Inventing technologies that will clean up toxic sites
- (c) Reducing the hazard inherent in a chemical product or process
- (d) Developing recycled products

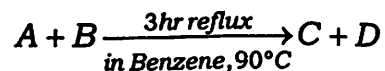
4. Answer **any four** of the following questions :

3×4=12

- (i) Discuss *any three* basic principles of green chemistry.
- (ii) Elaborate *any three* barriers in the implementation of green chemistry.
- (iii) Waste generation in any chemical process is related to green chemistry — Explain the term related to such measurement. How can this term be calculated?  $1\frac{1}{2}+1\frac{1}{2}=3$
- (iv) Write a note on 'microwave synthesis as a greener alternative'.
- (v) Solvents play a crucial role in green chemistry principles. Elaborate *any four* green solvents with examples.  $1\frac{1}{2}+1\frac{1}{2}=3$

5. Answer the following questions : 4×2=8

- (i) Mention *four* ways to make the following reaction green, where C is the desired product.



- (ii) The cracking of 14.2 g of decane ( $C_{10}H_{22}$ ) produces 2.8 g of ethane ( $C_2H_4$ ) as the desired product with the production of octane ( $C_8H_{18}$ ) as a by-product. Calculate the percentage (%) yield and atom economy of the reaction. 2+2=4

### UNIT-III

(Marks : 25)

6. Answer **any five** of the following questions :

5×5=25

- (a) What are the advantages of green synthesis? How can adipic acid be synthesized using green method? 2+3=5
- (b) Explain, why microwave is considered a green technique? Briefly discuss the various microwave-assisted chemical reactions. 2+3=5
- (c) Write down the conventional and green synthesis of disodium iminodiacetate (DSIDA). 3+2=5
- (d) What is paracetamol? How to synthesize paracetamol by conventional and green method? Justify your answer. 1+2+2=5

- (e) "Use of ultrasound is considered as a green technique in chemical synthesis" — Explain this statement with the help of examples. 5
- (f) What are the advantages and disadvantages of using water as a solvent in chemical transformations? 3+2=5
- (g) What are the factors that have to be considered while designing a green alternative reagent for synthesis? Comment on the use of a green reagent for chemical transformation. 2+3=5

#### UNIT-IV

(Marks : 5)

7. What is Biomimetic multifunctional reagent? Discuss the various advantages of Biomimetic multifunctional reagents in organic synthesis. 2+3=5

Or

Write short notes on **any two** the following :  
2½×2=5

- (i) Oxidation reagents and catalysis
- (ii) Combinatorial green chemistry
- (iii) Proliferation of solventless reactions