Total number of printed pages–6

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 ? 1½+1½=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. 1½+1½=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.

$$A + B \xrightarrow[\text{in Benzene, 90°C}]{\text{3hr reflux}} C + D$$

(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