TDC (CBCS) Odd Semester Exam., 2020
held in March, 2021

CHEMISTRY

(5th Semester)

Course No. : CHMDSE–503T

(Green Chemistry)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *fifteen* as directed : 1×15=15

1. Green chemistry is also called as

(a) life chemistry

(b) environmental chemistry

(c) organic chemistry

(d) sustainable chemistry

(Choose the correct option)

2. Green chemistry applies across the _____ of a chemical product like design, manufacture and use.

   (a) life cycle

   (b) properties

   (c) uses

   (d) efficiency

(Choose the correct option)

3. Green chemistry reduces risk by

   (a) minimizing the use of all chemicals

   (b) reducing the hazard inherent in a chemical product or process

   (c) inventing technologies that will clean up toxic sites

   (d) developing recycled products

(Choose the correct option)

4. Green chemistry is more expensive than traditional chemistry.

(Write True or False)

5. Green chemistry aims to

   (a) design chemical products and processes that maximize profits

   (b) design chemical products and processes that work most efficiently

(c) design safer chemical products and processes that reduce or eliminate the use or generation of hazardous substance

(d) utilize non-renewable energy

(Choose the correct option)

6. Risk = Hazard × _____

(Fill in the blank)

7. It is better to _____ waste than to treat or clean up waste after it is formed.

(Fill in the blank)

8. Write the expression for percentage yield of a reaction.

9. Give an example of a 100% atom economical reaction.

10. Which of the following is not one of the twelve principles of green chemistry?

(a) Less hazardous chemical synthesis

(b) Maximization of atom economy

(c) Using high temperature to speed up reactions

(d) Use of renewable feedstocks

(Choose the correct option)

11. The principle of green chemistry includes the eliminating _____ treatments.

(a) harmful

(b) costly

(c) hard

(d) easy

(Choose the correct option)

12. Write the expression for percentage atom economy.

13. What do you mean by auxiliary substance?

14. What is meant by green solvent?

15. What hazardous substances are discharged in the environment from coal-based power generating units?

16. How can the requirement of energy be kept to a minimum in a reaction?

17. In green synthesis by avoiding harmful by-products, which of the following catalysts is used?

(a) Benzene

(b) Cyclohexane

(c) Adipic acid

(d) Tungsten

(Choose the correct option)

18. Which of the following is an excellent 'green' solvent as well as greenhouse gas?

(a) Methanol

(b) CFCs

(c) Carbon monoxide

(d) Carbon dioxide

(Choose the correct option)

19. What is sonochemistry?

20. Why are microwaves considered as a more efficient source of heating than conventional steam?

21. Give an example of renewable starting material.

22. What is formed when a mixture of benzoic acid and propan-1-ol is heated in a microwave oven for six minutes in presence of catalytic amount of conc. H_2SO_4?

23. Name the green solvent used in Diels-Alder reaction.

24. Green chemistry synthesis could also involve which of the following?

(a) High temperature

(b) Dichloromethane

(c) Fossil fuel

(d) Microwaves

(Choose the correct option)

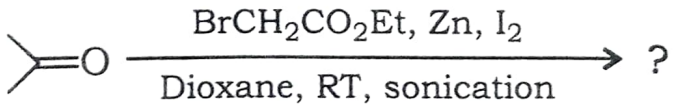
25. Chemically what is clayan?

26. Write the oxidation state of the primary reduced form of elemental tellurium.

27. Write the formula of rongalite.

28. Write the structural formula of diphenyl carbonate.

29. Predict the product :



30. Give the range of ultrasound used in sonochemistry.

SECTION—B

Answer any *five* questions : 2×5=10

31. What do you mean by green chemistry?

32. What is the need for green chemistry?

33. How can atom economy of a reaction be improved?

34. Why is it important to carry out a synthesis in which generation of waste is minimum or absent?

35. What characteristics of supercritical carbon dioxide gives it unique properties of a solvent?

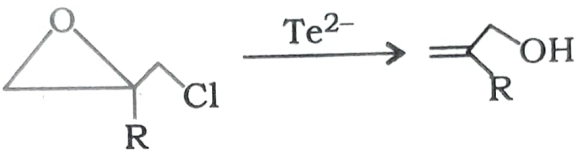
36. Write the characteristic features possessed by ionic liquids as green solvent.

37. Write the reactions involved in obtaining furfural from biomass.

38. Write the reactions involved in the green synthesis of catechol using biocatalyst.

39. Describe Cannizzaro reaction under sonication.

40. Propose a mechanism for the following reaction :



SECTION—C

Answer *any* **five** questions

41. *(a)* What are the goals in green chemistry? 3

(b) Write the limitations in the pursuit of the 'goals of green chemistry'. 2

42. *(a)* Discuss any two environmental incidents that mobilized public opinions towards awareness of environmental issues. 3

(b) How does green chemistry help creating a sustainable development? 2

(Continued)

43. *(a)* Ethyltrimethyl ammonium hydroxide (obtained from ethyltrimethyl ammonium iodide), on heating, forms ethene. Write the reaction and analyze the percentage atom economy of the reaction. 3

(b) Yield is different from atom economy. Explain. 2

44. *(a)* Write a short note on 'waste minimization'. 3

(b) What other aspects, in addition to atom economy, should be considered for evaluating a particular reaction to be called a green reaction? 2

45. *(a)* Give one example of each of the following : 1×2=2

(i) Green feedstock

(ii) Green reagent

(b) What is the role of solvent in a chemical reaction? How is this role fulfilled in a solventless reaction? Explain advantages of solventless syntheses with the help of an example. 3

46. *(a)* What are ionic liquids? Give two examples. Why are they otherwise called as 'designer solvents'? 3

(b) There has been lot of concerns for auxiliary substances that are used in achieving separations. Explain. 2

47. Outline the conventional and green syntheses of ibuprofen. Write the advantages in green method. 5

48. *(a)* Give one example of microwave assisted reaction in water involving Hofmann elimination. 2

(b) How can toluene be oxidized in microwave conditions? How is it advantageous over conventional method? 2+1=3

49. *(a)* How can toluene be brominated by green reaction that follows free radical mechanism? What are the advantages of this method? 2

(b) Give one example each that illustrates the following properties of clayan : 3

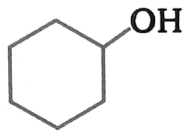
(i) Oxidative property

(ii) Deprotecting reagent

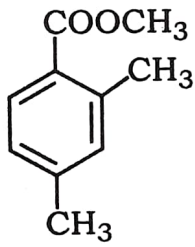
(Continued)

50. *(a)* Give an example of reduction of carbon-carbon double bonds in an α, β-unsaturated carbonyl compounds under sonication. How is it superior to conventional method? 1+1=2

(b) Predict the products of the following reactions : 1×3=3

(i) 

$\xrightarrow[\text{RT,))))}]{KMnO_4, \text{ hexane}}$?

(ii) 

$\xrightarrow[))))\text{, 1 hr}]{NaOH, H_2O}$?

(iii) 

$\xrightarrow[))))]{KCNS/H_2O/PTC}$?

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