**2021/TDC/CBCS/ODD/**
**CHMDSE-503T/296**

**TDC (CBCS) Odd Semester Exam., 2021**
**held in March, 2022**

# 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* from the following as directed : 1×15=15

**1.** What is green chemistry?

**2.** Green chemistry focuses on a process that reduces the use and generation of _____.

( Fill in the blank )

**3.** Which act for the first time dealt with prevention of formation of pollutants?

**4.** Green syntheses were developed for existing products by using starting material that use _____ rather than petrochemicals.

( Fill in the blank )

**5.** State any two of the listed twelve principles of green chemistry.

**6.** State the principle that talks about atom economy in the listed twelve principles of green chemistry.

**7.** A raw material of feedstock should be _____ rather than depleting wherever technically and economically practicable.

( Fill in the blank )

**8.** Which of the following is not a principle of green chemistry?

*(a)* Green solvent and auxiliaries

*(b)* Use of renewable feedstock

*(c)* Hazardous chemical synthesis

*(d)* Design for energy efficiency

( Choose the correct answer )





**9.** Which of the following is a green solvent used for bleaching cloths?

*(a)* Hydrogen peroxide

*(b)* Tetrachloroethene

*(c)* Benzene

*(d)* Toluene

( Choose the correct answer )

**10.** Benzene, a _____ substance, is an important industrial solvent used in the production of pharmaceuticals, plastics and dyes.

*(a)* odorless

*(b)* non-flammable

*(c)* biodegradable

*(d)* carcinogenic

( Choose the correct answer )

**11.** A desirable green solvent should be

*(a)* costly

*(b)* toxic

*(c)* readily available

*(d)* synthetic

( Choose the correct answer )

**12.** We must use feedstock derived from annually renewable resources or from

*(a)* chemicals

*(b)* organic compounds

*(c)* abundant waste

*(d)* plants

( Choose the correct answer )

**13.** How are energy requirements for chemical synthesis met in green chemistry?

**14.** How does a catalyst help to keep the energy requirement to a minimum?

**15.** Why are microwaves considered more efficient source of heating than conventional steam?

**16.** What is the frequency range of microwave?

**17.** Write the frequency range of ultrasound used in chemical synthesis.

**18.** Name the device by which electrical energy can be converted into sound energy.





**19.** What is formed when elemental tellurium is reduced?

**20.** Write the name and structure of the reagent that can be selectively used to methylate-active methylene compounds.

## SECTION—B

Answer any *five* from the following questions : 2×5=10

**21.** How can the goals of green chemistry be achieved?

**22.** Write any two novel green innovations that have been implemented by the industries.

**23.** Give one example each of a *(a)* chemo-selective and *(b)* regioselective reaction.

**24.** Carry out the cycloaddition of 1,3-butadiene and ethene, and also calculate the percentage atom economy of the reaction.

**25.** Write a few uses of chlorofluorocarbons and also discuss how it adversely affects the environment.

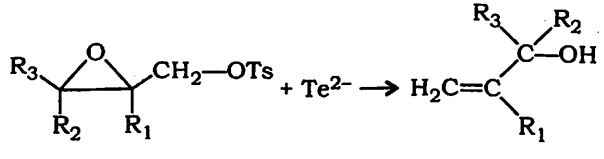
**26.** What do you mean by dry ice? What happens when dry ice is placed at room temperature and pressure?

**27.** Write a green method for the synthesis of benzyl bromide from toluene that gives 100% yield.

**28.** Carry out the hydrolysis of benzamide by a green method. How is this method superior to usual hydrolysis?

**29.** How can you carry out esterification of carboxylic acids at ambient temperature? What are the advantages of this process?

**30.** Write the mechanism of the following reaction :








SECTION—C

Answer any *five* from the following questions : 5×5=25

**31.** *(a)* Write the mechanism of depletion of ozone layer by $NO_x$ (oxides of nitrogen). 3

*(b)* Why is Bhopal Disaster considered most tragic in the history of mankind? 2

**32.** Write a note on 'metathesis method' in organic synthesis.

**33.** Which of the following four types of reactions is environmentally preferable? Explain with reasons and example :

*(a)* Substitution reaction

*(b)* Elimination reaction

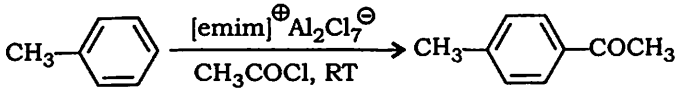
*(c)* Addition reaction

*(d)* Rearrangement reaction

**34.** *(a)* "Wherever practicable synthetic methodologies should be designed to use and generate substances that possess little or no toxicity to human health and the environment." Justify the statement. 3

(b) "Chemical products should be designed to preserve efficacy of function while reducing toxicity." Explain. 2

**35.** (a) The following Friedel-Crafts acylation is carried out in ionic liquid :




(97%–98% yield)

Write advantages of this reaction over conventional method. 2½

(b) Write a few features of ionic liquids as green solvents. 2½

**36.** Explain 'supercritical carbon dioxide' state by a phase diagram. Why is supercritical carbon dioxide considered as green solvent? 3+2=5

**37.** Carry out the synthesis of the following compounds by green method and mention the advantages of these methods over conventional methods of synthesis : 2½×2=5

(a) Paracetamol

(b) *p*-cresol (4-hydroxytoluene)



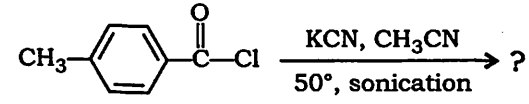


**38.** (a) Give an example of a decarboxylation reaction under microwave irradiation. Write how this method is superior to the conventional method of decarboxylation. 2½

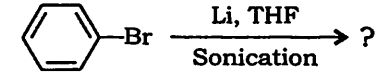
(b) Convert *p*-cresylacetate ($CH_3 \cdot C_6H_4 \cdot OCOCH_3$) into 2-hydroxy-5-methyl-acetophenone using microwave irradiation. What are the advantages of this method? 2½

**39.** (a) Write the advantages of using tellurium in chemical synthesis. 2

(b) Predict the product(s) of the following ultrasound-assisted reactions : 1×3=3

(i) 


(ii) 


(iii) 

**40.** *(a)* What are the limitations of conventional methylations of active methylene groups? How can active methylene compounds be selectively methylated by green method? Illustrate with an example. 1+2=3

*(b)* How can nitration of an arene be carried out in presence of clayan? Give an example. 2

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