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14 (CHM-2) CH 205

2018

CHEMISTRY

Paper : CH-205

(Green Chemistry)

Full Marks : 40

Time : Two hours

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

Part A

1×4=4

1. Among the choices given below, the option not related to the Twelve Principles of Green Chemistry is :

- (a) Cleaning of waste
- (b) Use of catalysts
- (c) Recycling
- (d) Reduce less solvents.

Contd.

2. Which of the following statements is incorrect?

- (a) Catalysts increase the reaction rate.
- (b) All catalysts cause lowering of the activation energy.
- (c) Catalysts do not affect the reaction mechanism.
- (d) Catalysts are not consumed during the reaction.

3. Green Chemistry is mostly applicable to _____ of a chemical product.

- (a) Synthesis
- (b) Purification
- (c) Life cycle
- (d) Disposal.

4. Among the statements given below, the incorrect statement is :

- (a) Aeration of waste water removes odour.
- (b) Purging waste water with air causes the suspended particles to coagulate.
- (c) Aeration of waste water leads to oxidation of dissolved $Fe(II)$ ions.
- (d) Waste water can be aerated to prevent coagulation and flocculation of suspended particles.

Part B

Answer any nine questions : $4 \times 9 = 36$

5. Give an example of a reaction with 100% atom economy and a reaction with < 50% atom economy. 2+2

6. What is the relationship between risk and hazard? Explain the difference between the two terms using appropriate examples. 2+2

7. Give two advantages of using hydrogen as a fuel. What would best method of hydrogen production and why? Give one example of such a method. 2+1+1

8. Elaborate the advantages of use of heterogeneous catalyst to meet the requirement of green chemistry. What are the factors that control the properties of a heterogeneous catalyst? 2+2

9. Using a schematic diagram, briefly explain the mechanism of heterogeneous oxygen evolution reaction. 4

10. "Food crops can indeed be used to produce energy (e.g. biodiesel from vegetable oil), materials (e.g. polylactic acid from corn) and chemicals (e.g. polyols from wheat)." However, it is widely recognized that waste and lignocellulosic materials are better renewable sources of fuel, materials and chemicals. Elaborate on the idea of effective utilization of biomass as a renewable source of fuel, materials and chemicals. 4

11. State and explain what platform molecules are. Suggest how glycerol can be obtained as a large-volume bio-based platform chemical and mention a few value-added products to which glycerol may be transformed. 4

12. Phenol can be synthesised from benzene via sulfonation and subsequent hydrolysis. Write the important steps of this synthesis. Propose a greener synthesis of phenol which does not involve sulphuric acid. 2+2

13. Explain what sustainable development means. Discuss how issues of sustainability may be addressed by practicing green chemistry. 2+2

14. For the synthesis of adipic acid, a very important industrial chemical, the following routes, A and B, are known. While the former is industrially practiced, the latter — called Draths-Frost synthesis — was developed in 1994. Rationalise the two synthetic routes and comment on green chemistry advantages of the route B. 4

