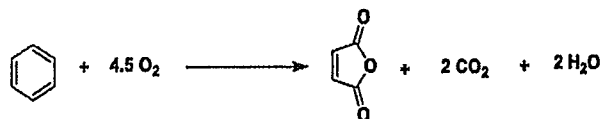


(C) Two possible routes to the production of maleic anhydride are discussed below:

(i) Benzene Oxidation



Benzene Oxygene

Maleic Anhydride

(ii) Butene Oxidation



Butene Oxygen

Maleic Anhydride

Calculate the reaction's atom efficiency and discuss the greenness of the two processes.

5

6. Write a short note on the following :

- (A) Asymmetric catalysis. 3
- (B) Biodiesel. 3
- (C) Real-time monitoring of any synthetic process. 3
- (D) Safer solvent. 3
- (E) Heterogeneous and homogenous catalysis. 3

[This question paper contains 4 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : 1506 I

Unique Paper Code : 2173542002

Name of the Paper : Green Chemistry

Name of the Course : Analytical Chemistry/
Industrial Chemistry

Semester : III/V

Time : 2 Hours Maximum Marks : 60

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
- (b) Simple calculator can be used
- (c) Attempt **four** questions.
- (d) Question No. 1 is compulsory.

1. (A) State **True** or **False**. 1×5=5

- (i) Green chemistry is sustainable.
- (ii) Ethyl lactate is an excellent green solvent.
- (iii) Is carbon dioxide a greenhouse gas?
- (iv) Ionic liquids have high VOCs.
- (v) Biocatalysts are environment-friendly.

(B) Fill in the blanks:

1×5=5

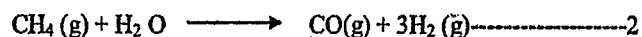
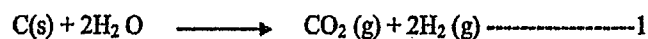
- (i) Rearrangement reactions atom economical
- (ii) Ionic liquids are not highly
- (iii) The Flixborough accident was due to a leak of
- (iv) Pyridine is a solvent
- (v) Ultrasound heating converts energy into
- (vi) Solvent is obtained from renewable resources

(C) Discuss any **two** of the following : 2.5×2=5

- (i) Application of biocatalysts.
- (ii) Protection and de-protection of functional groups.
- (iii) One example of a solid state reaction.
- (iv) Two industrial applications of ultrasound energy.

2. (A) Give an example of a less hazardous synthesis. Give the factors to be considered for less hazardous synthesis. 5

(B) Which is the better method of preparation of hydrogen based on the atom economy? 5



(C) Discuss the principle of prevention of waste. Draw the hierarchy triangle for prevention of waste. 5

3. (A) What is a supercritical fluid? Why is carbon dioxide the most widely used supercritical fluid? What is the main advantage of supercritical CO₂ as an extraction solvent? 5

(B) Discuss the importance and need of green chemistry. 5

(C) Give two reasons for developing antifoulant coatings. Differentiate between green antifoulant coating and conventional methods of coating. 5

4. (A) Ionic liquids are important replacements for solvents. Why explain? Give two examples of ionic liquids. 5

(B) Discuss green chemistry and sustainability 5

(C) Design Cradle to grave approach for the development of biodegradable plastics. 5

5. (A) Describe surfactants for carbon dioxide to replace the use of the ozone-depleting chemicals used in the dry cleaning of garments. 5

(B) Differentiate between microwave heating and conventional heating. Give two examples microwave-assisted synthesis. 5