



- Notes :
1. All questions carry equal marks.
 2. Due credit will be given to neatness and adequate dimensions.
 3. Assume suitable data wherever necessary.
 4. Diagrams and Chemical equation should be given wherever necessary.
 5. Illustrate your answers wherever necessary with the help of neat sketches.
 6. Discuss the reaction, mechanism wherever necessary.
 7. Use of non-programmable calculator is permitted.

1. $\text{CaCO}_3 = 75 \text{ ppm}$, $\text{Mg}(\text{HCO}_3)_2 = 73 \text{ ppm}$, $\text{CaCl}_2 = 166.5 \text{ ppm}$,
 $\text{MgCl}_2 = 190 \text{ ppm}$, $\text{MgSO}_4 = 30 \text{ ppm}$. Dissolved $\text{CO}_2 =$
- Calculate: 3
- i) Temporary & Permanent Hardness.
 - ii) Theoretical quantities of lime (90% pure) & soda (95% pure) required to soften 1,00,000 litres of water using sodium aluminate as a coagulant at the rate of 8.2 ppm. Cost per 100 kg of lime & soda are Rs. 50/- & Rs. 2000/- resp. 9
 - iii) If 10,000 litres of same hard water is passed through zeolite softener requires 100 litres NaCl solution for complete regeneration. Find concentration of NaCl solution used to regenerate exhausted zeolite bed. 4

OR

2. a) Explain: 4
- i) Calgon conditioning
 - ii) Phosphate conditioning
- b) Explain Reverse Osmosis method of purification of water. 4
- c) What are zeolites? How do they function in removing the hardness of water? What are the limitations of zeolite process and regeneration of zeolite bed. 8
3. a) Write in detail the mechanism of Dry Corrosion. 6
- b) Write short note on: 8
- i) Waterline corrosion
 - ii) Stress corrosion

- c) Define wet corrosion. 2

OR

4. a) Discuss the advantages and limitations of fuel cell. 3

- b) Describe Nickel Cadmium Cell. 4

- c) Write short note on: 9

i) Pitting Corrosion

ii) Anodic protection

iii) Importance of proper material selection and design to fight corrosion.

5. a) A gaseous fuel has the following composition by volume:- 14

$\text{CH}_4 = 36\%$, $\text{H}_2 = 44\%$, $\text{O}_2 = 2\%$, $\text{CO} = 6\%$,

$\text{N}_2 = 3\%$, $\text{C}_2\text{H}_2 = 4\%$, $\text{CO}_2 = 2\%$ and moisture = 3% is burnt in furnace.

Calculate:

i) Minimum weight of air required for combustion of gas.

ii) % composition (by volume) of flue gases, if 40% excess air is supplied.

iii) Air : Fuel ratio

- b) Define: 2

i) HCV

ii) LCV

OR

6. a) During the determination of calorific value of a gaseous fuel by Boy's calorimeter the following results were recorded. Volume of gaseous fuel burnt at NTP = 0.093m^3 wt. of water used for cooling combustion products = 31 kg. 4

Wt. of steam condensed = 0.03 kg

Temp. of inlet water = 26.2°C

Temp. of outlet water = 36.3°C

Calculate GCV & NCV of the fuel.

- b) Write short notes on – 4

i) Biodiesel

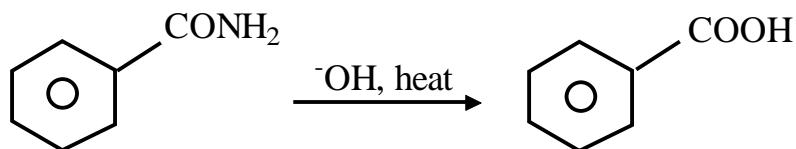
ii) Anti – knocking agents

- c) Describe the construction & working of Bomb calorimeter. 8

7. a) Define: Green Chemistry. 2

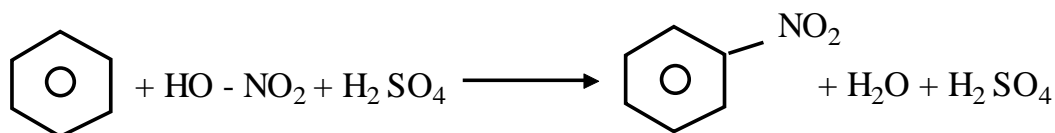
- b) Discuss the goals of Green Chemistry. 6

- c) Discuss principle & concept of carbon credit. 5
- d) 2 gm of benzamide on alkaline hydrolysis forms 1.75 gm benzoic acid product. Calculate yield. 3



OR

8. a) Discuss Green pathways for manufacture of 8
- i) Adipic acid
- ii) Poly carbonates.
- b) What are the efficiency parameters of green chemistry. 4
- c) Calculate atom economy and environmental load factor (E) for the following reaction. 4



9. a) Distinguish between thermosetting and thermoplastic polymer. 6
- b) Discuss step growth polymerization? 4
- c) Explain Kevlar and FRP with respect to their properties and applications. 6

OR

10. a) Discuss free radical mechanism of polymerization. 4
- b) Write notes on: 8
- i) Tm & Tg
- ii) Epoxy resin
- c) Explain significance of Average Molecular crystallinity in Polymers. 4
