



- Notes :
1. All questions carry equal marks.
 2. Assume suitable data wherever necessary.
 3. Diagrams and Chemical equation should be given wherever necessary.
 4. Discuss the reaction, mechanism wherever necessary.

1. a) Calculate amount of lime and soda required for 40000 litres of water containing $\text{CaCO}_3 = 18.5$ ppm, $\text{MgCO}_3 = 4.2$ ppm, $\text{CaSO}_4 = 3.4$ ppm, $\text{MgCl}_2 = 8.9$ ppm, $\text{MgSO}_4 = 7.2$ ppm, $\text{SiO}_2 = 3.9$ ppm, $\text{NaCl}_2 = 3.1$ ppm Dissolved $\text{CO}_2 = 12$ ppm, purity of lime and soda is 79 and 97% respectively. **6**
 b) Calculate total, carbonate and non carbonate hardness. **3**
 c) An exhausted zeolite softener was regenerated by passing 95% ltr. of strength 1.4% NaCl. How many litres of water having hardness 460 ppm can be softened using this softener. **4**
 d) Explain reverse osmosis? **3**

OR

2. a) Explain ion exchange process with principle, advantage and limitation? **6**
 b) Explain scale and sludge formation with its prevention? **4**
 c) Explain phosphate conditioning with respect to principle, advantage and limitation? **6**
3. a) Explain the corrosion prevention with respect to design and material selection? **6**
 b) Explain in detail polymer electrode membrane? **4**
 c) Explain differential aeration theory? **6**

OR

4. a) Explain pilling bedworth rule? **4**
 b) Explain anodic protection method for controlling corrosion? **6**
 c) Explain electrochemical corrosion mechanism? **6**

5. Coal sample C = 81%, H = 9%, N = 1.4%, moisture-1%, O-6.4% rest ash is burnt. Calculate
- a) Total oxygen required. 3
 - b) Minimum vol. of air required in m³ at N.T.P. per 50 kg of fuel burnt. 3
 - c) Percentage composition of dry flue gas if 25% excess air is used. 6
 - d) Explain octane and cetane number? 4

OR

6. a) Describe Bomb calorimeter? 8
- b) Calculate GCV and NCV of coal sample having C = 82%, H₂ = 8%, O₂ = 5%, S = 2.5%, N₂ = 1.4% and ash = 2%. 4
- c) Explain Fischer tropesch process? 4
7. a) Explain principle of green chemistry? 10
- b) Explain principle and concept of carbon credit and goal of green chemistry? 6

OR

8. a) Explain traditional and green pathways of
- a) Adipic acid 4
 - b) Polycarbonate 4
 - c) Indigo dye 4
- b) Explain efficiency parameters and need of green chemistry? 4
9. a) Explain free radical and step growth polymerization reaction and mechanism? 8
- b) Explain average molecular weight concept? 4
- c) Differentiate T_m and T_g? 4

OR

10. Write short note on:
- a) Polycarbonate 4
 - b) Polyhydroxyburate 4
 - c) Polyhydroxyvalante 4
 - d) Vulcanization by sulphur 4
