

- N.B. (1) Question No. 1 is compulsory.
 (2) From remaining six questions attempt any four.
 (3) Figures to the right indicate full marks.
 (4) All questions carry equal marks.

1. Attempt any five from the following :— 15
 - (a) What do you mean by hardness of water ? Distinguish between alkaline and non-alkaline hardness of water.
 - (b) What is co-polymerization ? Explain with the help of suitable example.
 - (c) Explain the structure, properties and uses of fullerene.
 - (d) What are blended oils ? How are they superior to vegetable and mineral oils ?
 - (e) Name the different renewable and non-renewable sources of energy. Distinguish between conventional and non-conventional energy.
 - (f) Explain the term "glass transition temperature". What is its significance ?
 - (g) Give the demerits of phase rule.

2. (a) Write the synthesis, properties and uses of any two of the following :— 6
 - (i) Polythene
 - (ii) Buna-S
 - (iii) Buna-N
- (b) What is fuel cell ? Explain the principle and working of hydrogen-oxygen fuel cell. 5
- (c) 800 liters of raw water was softened by zeolite softener. After it got exhausted required 40 liters of NaCl solution containing 110 gm per liter of NaCl for its regeneration. Calculate the hardness of water. 4

3. (a) State and explain phase rule. Discuss the application of phase rule to one component water system. 7
- (b) Explain any two of the following terms :— 4
 - (i) Crystallinity of polymer
 - (ii) Tacticity
 - (iii) Viscoelasticity.
- (c) 3 gm of liquid lubricant was saponified with potassium hydroxide solution. After saponification the mixture was titrated against 0.5 N HCL solution. The burette reading was found to be 12 ml. If blank titration burette reading was 36 ml, calculate the saponification number of the lubricant. 4

4. (a) What are (i) SWCNT and (ii) MWCNT ? Describe the production of SWCNT by LASER method. 6
- (b) Calculate lime (90%) pure and soda (95%) pure required for softening of 20000 liters of water containing following impurities :— 5
 - (i) $\text{Ca}(\text{HCO}_3)_2 = 81 \text{ mg per litre}$
 - (ii) $\text{MgCO}_3 = 42 \text{ mg per litre}$
 - (iii) $\text{NaAlO}_2 = 4.1 \text{ mg per litre}$
 - (iv) $\text{HCl} = 3.65 \text{ mg per litre}$
 - (v) $\text{Ca}(\text{NO}_3)_2 = 82 \text{ mg per litre}$
 - (vi) $\text{NaCl} = 4.5 \text{ mg per litre}$

(At Wt. Ca = 40, H = 1, C = 12, O = 16, Mg = 24, Na = 23, Al = 27, Cl = 35.5, N = 14)
- (c) What is polymerization ? Explain condensation polymerization with the help of an example. 4

5. (a) Explain the theory of Lime-soda process with reference to the different functions of lime and soda. 5
- (b) What are lubricants.? Explain the mechanism of thin film lubrication in detail. 4
- (c) Write short notes on any **two** the following :— 6
- (i) Nanocones
 - (ii) Haeckelites
 - (iii) Alkaline batteries.
6. (a) Explain vulcanization giving examples. Distinguish between vulcanized and non-vulcanized rubber. 4
- (b) What are alloys steels ? What are the effects of following alloying elements on alloy steels :— 5
- (i) Nickel
 - (ii) Chromium
 - (iii) Cobalt
 - (iv) Tungsten.
- (c) Give the composition of biogas. Describe the method for production of biogas from animal waste. 6
7. (a) What is meant by fabrication of plastics ? Name different methods of fabrications. Explain transfer moulding with the help of a neat diagram. 6
- (b) Explain any **two** of the following properties of lubricants :— 6
- (i) Flash point and fire point temperature
 - (ii) Cloud point and pour point temperature
 - (iii) Saponification number.
- (c) Explain the terms —
- (i) B.O.D.
 - (ii) C.O.D.

What is their significance ?