

- N. B.
- (i) Question No 1 is **compulsory**.
  - (ii) Attempt **any four** from remaining six.
  - (iii) Figures to the **right** indicate full marks.
  - (iv) All questions carry equal marks.
  - (v) Atomic weights: H=1, C=12, N=14, O=16, Na=23, Mg=24, S=32, Cl=35.5, Ca=40.

Q.1. Attempt any **Five** from the following

15

- a. Why is the Hot lime Soda process preferred over the Cold lime soda process?
- b. What are nano materials? Mention two reasons why properties of materials differ at the nano scale.
- c. Distinguish between conventional and non-conventional energy sources.
- d. What is the repeat unit structure of natural rubber? State any two drawbacks of natural rubber.
- e. What are plain carbon steels? What are their drawbacks?
- f. Find the acid value of a used lubricating oil sample whose 10 ml required 5 ml of N/50 KOH during titration. (Density of oil=0.91 g/cc). State whether the oil is suitable for lubrication or not.
- g. Explain the principle involved in production of hydropower. List any two advantages and disadvantages of hydropower generation.

Q.2

- a. Explain with a neat diagram, the Zeolite process of water softening including the following points  
(i) principle (ii) process (iii) softening and regeneration reactions (iv) advantages & limitations 6
- b. Explain structure, properties and uses of fullerenes 5
- c. 2.5 g of a blended oil was saponified using excess alcoholic KOH solution (0.5N). After refluxing for two hours, the mixture was titrated against 0.5N HCl solution. The burette reading was found to be 24 ml. The blank titration required 40 ml of the same HCl solution. Find the saponification value of the oil. If the oil used for blending has saponification value of 191, calculate percentage oil in the blend. 4

Q.3

- a. Calculate lime (95% pure) and soda (90% pure) required for softening one million litres of water containing the following constituents:  
 $\text{Ca}(\text{HCO}_3)_2=81\text{mg/l}$ ,  $\text{Mg}(\text{HCO}_3)_2=73\text{mg/l}$ ,  $\text{CaSO}_4=68\text{mg/l}$ ,  $\text{MgCl}_2=95\text{mg/l}$ ,  $\text{Mg}(\text{NO}_3)_2=14.8\text{mg/l}$ ,  $\text{H}_2\text{SO}_4=14.7\text{mg/l}$  6
- b. In what situations are solid lubricants used? Explain structure, properties and uses of any one solid lubricant. 5
- c. What are the functions of the following constituents in the compounding of plastics  
(i) Fillers (ii) Plasticizers 4

Q.4

- a. Write preparation properties and uses of any **two** of the following 6
  - (i) Polymethyl methacrylate (PMMA)
  - (ii) Urea formaldehyde
  - (iii) Buna-S

- b. An exhausted Zeolite softener was regenerated by passing 300 litres of NaCl solution having a strength of 150 g per litre of NaCl. If the hardness of water sample was 480 ppm, calculate the total volume of water softened by this softener. 5
- c. Explain special effects of the following metals on properties of alloy steels 4
- i. Chromium
  - (ii) Nickel
  - (iii) Cobalt
  - (iv) Tungsten

Q. 5.

- a. What are carbon nanotubes? Describe production of single walled carbon nano tube by LASER method. 6
- b. Using phase rule, find the number of degrees of freedom (F) in the following systems at equilibrium. 5
- i. In the water system, when  
Ice (s)  $\rightleftharpoons$  water (l)  $\rightleftharpoons$  water vapour (g)
  - ii. A gaseous mixture of Nitrogen and Hydrogen
- c. Write a note on nickel-hydrogen batteries. 4

Q.6.

- a. What is meant by fabrication of plastics? Explain Compression moulding with the help of a neat diagram. 6
- b. Explain application of Gibbs Phase Rule to one component system- water system. 5
- c. Describe the working of solar heating system using Flat Plate collector. 4

Q. 7.

- a. Write a short note on any **one** of the following 5
- i. Haecelites
  - (ii) Hydrogen as fuel
  - (iii) Reverse Osmosis
- b. Explain Boundary lubrication. 5
- c. Define glass transition temperature of polymer. What factors influence its value. 5