School of Chemistry and Biochemistry, TIET, Patiala UCB008–Applied Chemistry (Session: 1819ODDSEM) Tutorial Sheet (Water Treatment and Analysis-II)

- 1. How many grams of MgCl₂ dissolved per litre will give hardness of 76 ppm?
- 2. A water sample contains 168 mg of MgCO₃ per litre. Calculate hardness of the sample in ppm and in grains/gallon.
- 3. What role does "coagulants" play in lime soda process to remove hardness? Give examples of coagulants.
- 4. Calculate the quantity of lime and soda required for softening 50,000 litres of water containing the following salts per litre: $Ca(HCO_3)_2 = 8.1 \text{ mg}$; $Mg(HCO_3)_2 = 7.5 \text{ mg}$; $CaSO_4 = 13.6 \text{ mg}$; $MgSO_4 = 12.0 \text{ mg}$; $MgCl_2 = 2.0 \text{ mg}$ and NaCl = 4.7 mg.
- 5. A sample of water on analysis gave the following results: $Ca^{2+} = 30 \text{ mg/L}$; $Mg^{2+} = 18 \text{ mg/L}$; $K^+ = 19.5 \text{ mg/L}$; $CO_2 = 11 \text{ mg/L}$; $HCO_3^- = 122 \text{ mg/L}$; $CI^- = 35.5 \text{ mg/L}$; $SO_4^{2-} = 48 \text{ mg/L}$. Calculate total hardness and alkalinity present in water sample.
- 6. The carbonate alkalinity of water sample was found to be 75 ppm CaCO₃ equivalent. After carrying out lime treatment, the alkalinity of water was found to increase to 300 ppm CaCO₃ equivalent. Calculate the excess amount of Ca(OH)₂ present in water after lime treatment. Express it in terms of mg/L of Ca(OH)₂.
- 7. Why calgon conditioning is better than phosphate conditioning?
- 8. Why water softened by zeolite process is unfit for use in boilers?
- 9. The hardness of 25,000 litres of a sample of water was removed by passing it through a zeolite softener. The softener then required 100 litres of NaCl solution, containing 125 gm/L of NaCl for regeneration. Calculate the hardness of the sample of water.
- 10. A zeolite bed was exhausted after completely removing the total hardness of 10,000 L of hard water. The zeolite bed was regenerated using 8 L of NaCl containing 150 gm/L of NaCl. Calculate the hardness of water.
- 11. After treating 10,000 L of water by ion exchanger, the cationic resin required 200 L of 0.1 N HCl and anionic resin required 200 L of 0.1 N NaOH solutions. Find the hardness of the water sample.
- 12. In demineralization process, water is usually first passed through the cation-exchanger and then through anion-exchanger. Why?
- 13. Why is demineralization process preferred over zeolite process for softening of water for use in boilers?
- 14. Name the important discovery that has helped using the principle of reverse osmosis for the purification of water on commercial scale.
- 15. Why commercial RO technique as available today is not recommended by environmental agencies?

(At. wt. Ca = 40; Mg = 24; Cl = 35.5; S = 32; Na = 23; K = 39)