

**School of Chemistry and Biochemistry, TIET, Patiala**  
**UCB008–Applied Chemistry**  
**Tutorial Sheet (Water Treatment and Analysis-I)**

1. Soap's molecular composition is "sodium salt of long chain fatty acid". However, when salts of calcium or magnesium are present in water, its cleansing action is reduced. Why?
2. Why hardness of water is expressed in equivalents of calcium carbonate?
3. 100 ml of water sample required 4 mL of N/50  $\text{H}_2\text{SO}_4$  for neutralization of phenolphthalein end point. Another 16 mL of the same was needed for further titration to the methyl orange end point. Determine the type of alkalinity and amount of alkalinity.
4. 100 ml of a sample of hard water neutralize exactly 12 ml of 0.12 N HCl using methyl orange as indicator. What kind of hardness is present? Express the same in terms of equivalent of  $\text{CaCO}_3$ .
5. 0.5 g of  $\text{CaCO}_3$  was dissolved in dil. HCl and diluted to 500 ml. Then, 100 ml of this solution required 90 ml of EDTA solution for titration. Also, 100 ml of a water sample required 36 ml of the same EDTA solution for titration. After boiling, titration of 100 ml of same water sample required 18 ml of EDTA. Calculate total, permanent and temporary hardness.
6. 50 mL of a water sample consumed 15 mL of 0.01 M EDTA before boiling and 5 mL of the same EDTA after boiling. Calculate total, permanent and temporary hardness of water sample.
7. Calculate the temporary and permanent hardness of a sample of water containing:  $\text{Mg}(\text{HCO}_3)_2 = 7.3 \text{ mg/L}$ ;  $\text{Ca}(\text{HCO}_3)_2 = 16.2 \text{ mg/L}$ ;  $\text{MgCl}_2 = 9.5 \text{ mg/L}$ ;  $\text{CaSO}_4 = 13.6 \text{ mg/L}$ .
8. Draw a flow chart diagram for the analysis of hard water using EDTA and EBT. Specify the role of colours in the flow chat diagram.
9. Write structure and full name of EDTA and EBT.
10. Write structures of phenolphthalein and methyl orange indicators.
11. Write various units of hardness and what is the relationship among them.
12. Convert 50 ppm of  $\text{CaCO}_3$  into mg/L, degree Clarke and degree French.
13. Convert 70,000 °Clarke into ppm and °French.

(At. wt. Ca = 40; Mg = 24; Cl = 35.5; S = 32)