Annexure-1

Numerical on Estimation of Hardness by EDTA Method

Problem-1: 1.0 gm of $CaCO_3$ was dissolved in dil. HCl and diluted to 1000 ml. 25 ml of this solution required 25 ml of EDTA solution for titration. 50 ml of sample hard water required 45 ml of EDTA solution. In another titration 50 ml of same hard water on boiling, cooling and filtering etc. required 20 ml of EDTA solution using eriochrome blact-T as indicator, calculate total, temporary and permanent hardness of water sample in different units.

Problem-2: 0.5 gm of CaCO3 was dissolved in dil. HCl and diluted to 500 ml. 50 ml of this solution required 48 ml of EDTA solution for titration. 50 ml of sample hard water required 15 ml of EDTA solution for titration. Calculate total hardness of water sample.

Problem-3: 0.28 gm of CaCO3 was dissolved in dil. HCl and the solution diluted to one litre. 100 ml of this solution required 28 ml of EDTA solution, while 100 ml of sample hard water required 33 ml of EDTA. On the other hand 100 ml of the boiled water sample when titrated against EDTA consumed 10 ml of . Calculate total, temporary and permanent hardness of water sample in different units.

Problem-4: Calculate the hardness of a water sample, whose 20 ml required 30 ml EDTA. 10 ml of standard calcium chloride solution, whose strength is equivalent to 300 mg of $CaCO_3$ per 200 ml required 20 ml of the same EDTA solution.

Problem-5: A standard hard water contains 1000 mg of $CaCO_3$ per liter. 50 ml of this required 50 ml of EDTA solution, 50 ml of sample water required 40 ml of EDTA solution. The sample after boiling required 20 ml EDTA solution. Calculate the temporary and permanent hardness of the given sample of water, in different units.

Annexure-2

Numerical on Alkalinity

Problem-1: A water sample is alkaline to both phenolphthalein as well as methyl orange. 200 ml of water sample on titration with N/50 HCl required 9.4 ml of acid to phenolphthalein end point. When a few drops methyl orange are added to the same solution and titration further continued, the yellow colour of the solution just turned red after addition of another 21 ml of the acid solution. Elucidate on the type and extend of alkalinity present in the water.

Problem-2: A water sample is alkaline to both phenolphthalein as well as methyl orange. 200 ml of water sample on titration with N/25 HCl required 5 ml of acid to phenolphthalein end point. When a few drops methyl orange are added to the same solution and titration further

continued, the yellow colour of the solution just turned red after addition of another 12 ml of the acid solution. Calculate the type and extend of alkalinity present in the water.

Problem-3: A sample of water was alkaline to both phenolphthalein and methyl orange. 500 ml of water sample require 29 ml of N/50 H_2SO_4 for phenolphthalein end point and 58 ml of the acid to methyl orange end point on separate titration. Determine the type and extend of alkalinity present in the water.

Problem-4: 100 ml of a water sample required 5 ml of N/10 acid solution for titration while using phenolphthalein as indicator. 100 ml of the sample of water was again taken and methyl orange was used as indicator when 15 ml of the same acid solution was required for neutralization. Determine the type and extend of alkalinity present in the water.

Problem-5: 50 ml of a sample of water requied 5 ml of N/50 H_2SO_4 using methyl orange as indicator but did not give any colouration with phenolphthalein. What type of alkalinity is present? Express the same in ppm.

Problem-6: 200 ml of water sample on titration with N/50 H_2SO_4 using phenolphthalein as indicator, gave the end point when 10 ml of acid were run down. Another lot of 200 ml of the sample also required 10 ml of the acid to obtain methyl orange end point. What type of alkalinity is present and what is its magnitude?

Problem-7: A sample of water was alkaline to both phenolphthalein and methyl orange. 100 ml of this water sample required 12.4 ml of N/50 HCl for phenolphthalein end point and 15.2 ml of the acid to methyl orange end point. Determine the type and extent of alkalinity present.