

Problem Set 7. EDTA Titrations.
Chem 2222. Summer 2008.

Please complete examples and exercises in Chapter 15 before attempting these problems.

1. Write the main reactions and the end point reaction for the water hardness titration with EDTA. Assume a typical hard water sample (include the two primary cations responsible for water hardness).
2. Draw the structure of the free and metal forms of the indicator Calmagite used for the EDTA titration of calcium plus magnesium. This is called a _____ type indicator.
3. At pH 12, magnesium hydroxide is insoluble and does not react with EDTA. The titration of a hard water sample at pH 12 thus yields results for calcium only.
 - a. A 200-mL sample of tap water requires 48.2 mL of 0.01046 M EDTA for titration at pH 10. Report the total hardness of the water sample as parts-per-million CaCO_3 (mol wt = 100.1 g/mol).
 - b. A 250-mL sample of the same tap water was adjusted to pH 12 and titrated with the same standard EDTA using calcein indicator, requiring 38.0 mL to reach the endpoint. Calculate the individual molar concentrations of Ca^{2+} and Mg^{2+} in the tap water.
4. Calculate pCu in the titration of 20.0 mL of 0.0100 M CuSO_4 with 0.0100 M EDTA at pH 8.00 after addition of 10, 20, and 30.0 mL of EDTA. Use equilibrium data given in Skoog et al. Using these results to identify specific points, sketch the titration curve pCu vs volume EDTA.

Answers. (Points assigned)

1. (2) See text or lecture notes.
2. (2) See text or lecture notes for structure. Metallochromic.
3. (8) a) 252 ppm CaCO_3
b) 0.00159 M Ca^{2+} , 0.0000931 M Mg^{2+}
4. (6) pCu = 2.48 at 10 mL
pCu = 9.42 at 20 mL
pCu = 16.23 at 30 mL