Point values are shown in brackets. Show your work. Explain any assumptions that you make. You are encouraged to discuss the course material outside of class and are permitted to work together on problem sets; however, you are expected to turn in your own work. Unless explicitly asked to calculate activity coefficients, assume that the activity coefficients for solutes are one.

1. [20] Look at example 4.5c in Water Chemistry.
   a) Using OCl⁻ as the reference species for the HOCl/OCl⁻ group, show that the proton condition and TOTH approaches yield equivalent equations.
   b) Solve for the pH and overall equilibrium speciation of the system given in example 4.5c.


3. [20] Problem 6 in Chapter 4 of Water Chemistry. Use graphical solution methods to help solve parts b and c (you may give your answers for pH to only one decimal place).

4. [20] Problem 13a-c in Chapter 4 of Water Chemistry. For part (b) you can use either the proton condition or the TOTH equation constructed with a Tableau. Hint: for parts (a) and (c) note which species can be considered negligible at the specified pH values.

5. [10] Problem 2 in Chapter 7 of Water Chemistry.

6. [20] Problem 8a-c in Chapter 7 of Water Chemistry. Although Ca(OH)₂ is not a strong base, no Ca(OH)₆(aq) persists in solution, although CaOH⁻ is present. For parts (a) and (b), draw logC-pH diagrams and use them to help solve for the pH. For part (b), give the pH and the total dissolved sulfur (i.e., you do not need to list the full equilibrium speciation). You do not need to write full Tableaux for these problems and can start by using the charge balance equation.