

1. Please draw a figure to describe the stratification of a lake (10%), and discuss how thermal stratification of a body of water may affect its chemistry (10%)
2. Calcium chloride is quite soluble, whereas the solubility product of calcium fluoride, CaF_2 , is only 3.9×10^{-11} . A waste stream of $1.00 \times 10^{-3} \text{ M HCl}$ is injected into a formation of limestone, CaCO_3 , where it comes into equilibrium. Give the chemical reaction that occurs and calculate the hardness and alkalinity of the water at equilibrium. Do the same for waste stream of $1.00 \times 10^{-3} \text{ M HF}$? (20%)
3. Please use chemical reaction equations to explain how the NO_x and CFC to destroy the stratospheric ozone layer? (15%)
4. What is the rationale for classifying most acid rain as a secondary pollutant? (15%)
5. Balance the following equations: (30%, 6% for each)
 - a. Oxidation of I^- to I_2 and reduction of MnO_2 to Mn^{2+}
 - b. Oxidation of $\text{S}_2\text{O}_3^{2-}$ to SO_4^{2-} and reduction of Cl_2 to Cl^-
 - c. Oxidation of NH_4^+ to NO_3^- and reduction of O_2 to H_2O
 - d. Oxidation of CH_3COO^- to CO_2 and reduction of Cr_2O_7^- to Cr^{3+}
 - e. Oxidation of $\text{C}_6\text{H}_{12}\text{O}_6$ to CO_2 and reduction of NO_3^- to N_2