

7-18. Write the charge balance for a solution containing H^+ , OH^- , Ca^{2+} , HCO_3^- , CO_3^{2-} , $\text{Ca}(\text{HCO}_3)^+$, $\text{Ca}(\text{OH})^+$, K^+ , and ClO_4^- .

7-20. Write the charge balance for an aqueous solution of arsenic acid, H_3AsO_4 , in which the acid can dissociate to H_2AsO_4^- , HAsO_4^{2-} , and AsO_4^{3-} . Look up the structure of arsenic acid in Appendix G and write the structure of HAsO_4^{2-} .

7-21. (a) Write the charge and mass balances for a solution made by dissolving MgBr_2 to give Mg^{2+} , Br^- , MgBr^+ , and MgOH^+ .

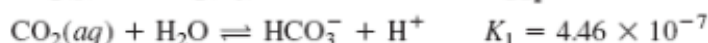
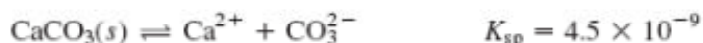
(b) Modify the mass balance if the solution was made by dissolving 0.2 mol MgBr_2 in 1 L.

7-24. Consider the dissolution of the compound X_2Y_3 , which gives $\text{X}_2\text{Y}_2^{2+}$, X_2Y^{4+} , $\text{X}_2\text{Y}_3(\text{aq})$, and Y^{2-} . Use the mass balance to find an expression for $[\text{Y}^{2-}]$ in terms of the other concentrations. Simplify your answer as much as possible.

7-27. (a) Following the example of $\text{Mg}(\text{OH})_2$ in Section 7-5, write the equations needed to find the solubility of $\text{Ca}(\text{OH})_2$. Include activity coefficients where appropriate. Equilibrium constants are in Appendixes F and I.

(b) Neglecting activity coefficients, compute the concentrations of all species and compute the solubility of $\text{Ca}(\text{OH})_2$ in g/L.

7-30. *Heterogeneous equilibria and calcite solubility.* If river water in Box 7-2 is saturated with calcite (CaCO_3), $[\text{Ca}^{2+}]$ is governed by the following equilibria:



(a) From these reactions, find the equilibrium constant for the reaction



(b) The mass balance for Reaction A is $[\text{HCO}_3^-] = 2[\text{Ca}^{2+}]$. Find $[\text{Ca}^{2+}]$ (in mol/L and in mg/L) in equilibrium with atmospheric CO_2 if $P_{\text{CO}_2} = 3.8 \times 10^{-4}$ bar. Locate this point on the line in Box 7-2.

(c) The concentration of Ca^{2+} in the Don River is 80 mg/L. What effective P_{CO_2} is in equilibrium with this much Ca^{2+} ? How can the river have this much CO_2 ?