

Solution and Answer Guide

Solution and Answer Guide: Skoog et al., *Fundamentals of Analytical Chemistry*, 10e,
© 2022, 978-0-357-45039-0, Chapter 9: Solving Equilibrium Problems for Complex Systems

Chapter 9

- 9-1.** Demonstrate how the sulfide ion concentration is related to the hydronium ion concentration of a solution that is kept saturated with hydrogen sulfide.

Solution:

The overall dissociation constant for H_2S is

$$\frac{[\text{H}_3\text{O}^+]^2[\text{S}^{2-}]}{[\text{H}_2\text{S}]} = K_1K_2$$

In a solution saturated with the gas, $[\text{H}_2\text{S}]$ is constant, therefore

$$[\text{S}^{2-}] = \frac{[\text{H}_2\text{S}]}{[\text{H}_3\text{O}^+]^2} K_1K_2 \text{ or } [\text{S}^{2-}] = \frac{K}{[\text{H}_3\text{O}^+]^2}$$

- *9-2.** Why are simplifying assumptions in equilibrium problems restricted to relationships that are sums or differences?

Answer:

To simplify equilibrium calculations, we sometimes assume that the concentrations of one or more species are negligible and can be approximated as 0.00 M. In a sum or difference assuming a concentration is 0.00 M leads to an appropriate result. In contrast, if we were to simplify an equilibrium constant expression by assuming one or more concentrations are zero, we would be multiplying or dividing by 0.00, which would render the expression meaningless.

- 9-3.** In the margin note on page 215, we suggest that the term *mass-balance equation* may be something of a misnomer. Using a specific chemical system, discuss mass balance and show that mass balance and concentration balance are equivalent.

Answer:

Let us take the case of 0.100 M acetic acid (HOAc). We usually write the mass balance as a concentration balance. That is

$$C_{\text{HOAc}} = 0.100 = [\text{HOAc}] + [\text{OAc}^-]$$

Since the concentrations are moles/L, we can write

$$\text{Initial moles HOAc/L} = \text{equilibrium moles HOAc/L} + \text{equilibrium moles OAc}^-/\text{L}$$

*Answers and solutions are provided in the Student Solutions Manual for questions and problems marked with an asterisk.

Skoog Spectroscopy Answer Guide

Padhraic Smyth



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