## 13.6 End-of-Chapter Material

ADDITIONAL EXERCISES

1. What is the relationship between the K_{sp} expressions for a chemical reaction and its reverse chemical reaction?

2. What is the relationship between the K_w value for H_2O and its reverse chemical reaction?

3. For the equilibrium

$$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g) + 60 \text{ kJ}$$

   list four stresses that serve to increase the amount of PCl_5.

4. For the equilibrium

$$N_2O_4 + 57 \text{ kJ} \rightleftharpoons 2NO_2$$

   list four stresses that serve to increase the amount of NO_2.

5. Does a very large K_{eq} favor the reactants or the products? Explain your answer.

6. Is the K_{eq} for reactions that favor reactants large or small? Explain your answer.

7. Show that $K_a \times K_b = K_w$ by determining the expressions for these two reactions and multiplying them together.

$$HX(aq) \rightleftarrows H+(aq) + X–(aq)$$

$$X–(aq) + H_2O(\ell) \rightleftarrows HX(aq) + OH–(aq)$$
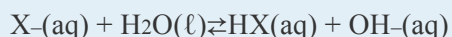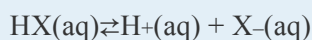
8. Is the conjugate base of a strong acid weak or strong? Explain your answer.

9. What is the solubility in moles per liter of AgCl? Use data from http://catalog.flatworldknowledge.com/bookhub/reader/2273 - ball-ch13_s05_s03_t01.

11. What is the solubility in moles per liter of $Ca(OH)_2$? Use data from http://catalog.flatworldknowledge.com/bookhub/reader/2273 - ball-ch13_s05_s03_t01.

13. Under what conditions is $K_{eq} = K_P$?

15. Under what conditions is $K_{eq} > K_P$ when the temperature is 298 K?

17. What is the pH of a saturated solution of $Mg(OH)_2$? Use data from http://catalog.flatworldknowledge.com/bookhub/reader/2273 - ball-ch13_s05_s03_t01.

19. What are the pH and the pOH of a saturated solution of $Fe(OH)_3$? The K_{sp} of $Fe(OH)_3$ is 2.8×10^{-39}.

21. For a salt that has the general formula MX, an ICE chart shows that the K_{sp} is equal to x^2, where x is the concentration of the cation. What is the appropriate formula for the K_{sp} of a salt that has a general formula of MX_2?

22. Referring to Exercise 15, what is the appropriate formula for the K_{sp} of a salt that has a general formula of M_2X_3 if the concentration of the cation is defined as $2x$, rather than x?

23. Consider a saturated solution of $PbBr_2(s)$. If $[Pb^{2+}]$ is 1.33×10^{-5} M, find each of the following.

    a. $[Br^-]$
    b. the K_{sp} of $PbBr_2(s)$

24. Consider a saturated solution of $Pb_3(PO_4)_2(s)$. If $[Pb^{2+}]$ is 7.34×10^{-14} M, find each of the following.

    a. $[PO_4^{3-}]$
    b. the K_{sp} of $Pb_3(PO_4)_2(s)$

ANSWERS

1. They are reciprocals of each other.

3. increase the pressure; decrease the temperature; add PCl_3; add Cl_2; remove PCl_5

5. favor products because the numerator of the ratio for the K_{eq} is larger than the denominator

7. $K_a \times K_b = \dfrac{[H^+]\cancel{[X^-]}}{\cancel{[HX]}} \times \dfrac{\cancel{[HX]}[OH^-]}{\cancel{[X^-]}} = [H^+][OH^-] = K_w$

9. 1.3×10^{-5} mol/L

11. *$K_{eq} = K_P$ when the number of moles of gas on both sides of the reaction is the same.*

13. 10.35

15. $4x^3$

17. a. 2.66×10^{-5} M

    b. 9.41×10^{-15}