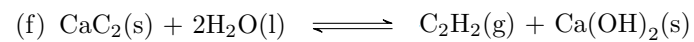
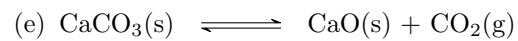
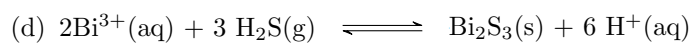
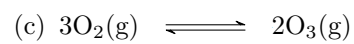
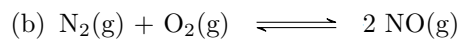
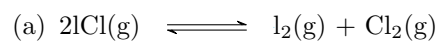
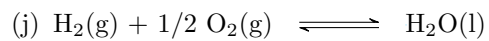
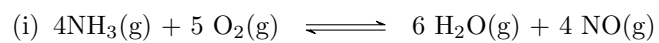
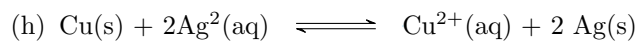
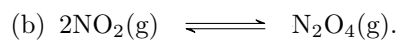


31. Write the equilibrium expressions for the following.



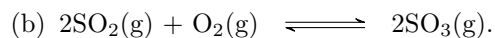
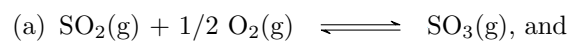


32. Write the K_{eq} expression for:



Examine the relationship between the K_{eq} expressions for equations (a) and (b) of this question. If $K_{\text{eq}} = 10.0$ for equation (a), what would be the value of K_{eq} for equation (b)?

33. Write the K_{eq} expression for:



Examine the which exists between the K_{eq} expressions for equations (a) and (b) of this question. If $K_{\text{eq}} = 3$ for equation (a), what would be the value of K_{eq} for equation (b)?

34. Which way will the equilibrium $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{Ca}^{2+}(\text{aq}) + 2 \text{HCO}_3^{-}(\text{aq}) + 40 \text{ kJ}$ shift if

(a) more $\text{CO}_2(\text{g})$ is added?

(b) more $\text{CaCO}_3(\text{s})$ is added?

(c) $\text{Ca}^{2+}(\text{aq})$ is removed?

(d) heat is added?

35. Rearrange the following equations to solve in terms of the concentrations indicated in bold.

(a) $K_{\text{eq}} = [\mathbf{H_3O^+}] [\text{F}^-] / [\text{HF}]$

(b) $K_{\text{eq}} = [\text{H}_3\text{O}^+][\text{F}^-] / [\mathbf{HF}]$

(c) $K_{\text{eq}} = [\mathbf{NO_2}]^2 / [\text{NO}]^2[\text{O}_2]$

(d) $K_{\text{eq}} = [\text{NO}_2]^2 / [\mathbf{NO}]^2 [\text{O}_2]$

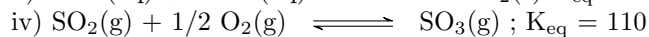
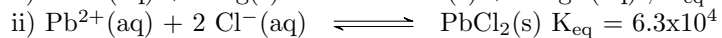
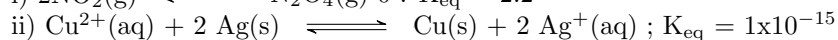
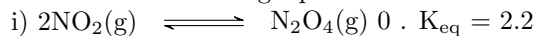
(e) $K_{\text{eq}} = [\text{NH}_3]^2 / [\text{N}_2] [\mathbf{H_2}]^3$

(f) $K_{\text{eq}} = [\text{N}_2\text{O}_4] / [\mathbf{NO_2}]^2$

(g) $K_{\text{eq}} = [\mathbf{NH_3}]^2 / [\text{N}_2][\text{H}_2]^3$

$$(h) K_{eq} = [PCl_3]^4 / [P_4] [Cl_2]^6$$

36. Consider the following equilibria.



(a) Which equilibrium favours products to the greatest extent?

(b) Which equilibrium favours reactants to the greatest extent?

37. In the reaction $A + B \rightleftharpoons C + D + 100 \text{ kJ}$, what happens to the value of K_{eq} if the temperature is INCREASED?

38. If the value of K_{eq} DECREASES when the temperature DECREASES, is the reaction EXOTHERMIC or ENDOTHERMIC?

39. In the reaction $P + Q + 150 \text{ kJ} \rightleftharpoons R + S$, what happens to the value of K_{eq} if the temperature is DECREASED?

40. In the reaction $W + X + 100 \text{ kJ} \rightleftharpoons Y + Z$, what happens to the Value of K_{eq} if the $[X]$ is INCREASED?
41. If the value of K_{eq} INCREASES when the temperature DECREASES, is the reaction EXOTHERMIC or ENDOTHERMIC?
42. In Exercises 21-23, describe the effect on K_{eq} of the changes indicated. Write INC for increase, DEC for decrease and NC for no change.
43. In Exercise 23, assume that the bold species Sn(s) instead of $\text{CO}_2(\text{g})$. Now redo the Exercise, describing the effect on the species in bold and the value of K_{eq} when the changes indicated occur.
44. In the equilibrium $\text{KCl(s)} + 17 \text{ kJ} \rightleftharpoons \text{K}^+(\text{aq}) + \text{Cl}^-(\text{aq})$, which way will the equilibrium shift and what is the effect on the value of K_{eq} when (i) more $\text{K}^+(\text{aq})$ is added? (i) the temperature is decreased? (ii) more KCl(s) is added?

45. An equilibrium $A(aq) + 2 B(q) \rightleftharpoons 2 C(aq) + 2 D(aq)$ has $K_{eq} = 0.25$ at $100^{\circ}C$ and $K_{eq} = 0.15$ at $200^{\circ}C$. State whether the forward reaction is endothermic or exothermic and explain why.

46. Examine the following graphs for the equilibrium $3O_2 \rightleftharpoons 2O_3$.
Is the equilibrium endothermic or exothermic, as written? Explain.