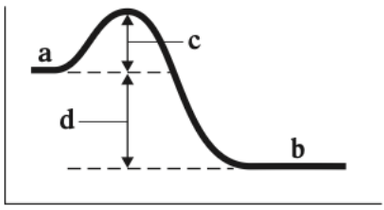
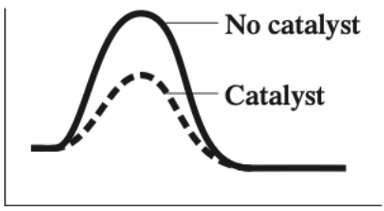
Chapter 9 **9.1** (a) $X + YZ \longrightarrow Y + XZ$ (b) $X + Y \longrightarrow XY$ **9.3** (a) single-replacement (b) decomposition (c) double-replacement (d) combination **9.5** (a) combination, single-replacement, combustion (b) decomposition, single-replacement (c) combination, decomposition, single-replacement, double-replacement, combustion (d) combination, decomposition, single-replacement, double-replacement, combustion **9.7** (a) +2 (b) +6 (c) 0 (d) +5 **9.9** (a) +3 (b) +4 (c) +6 (d) +6 (e) +6 (f) +6 (g) +6 (h) +5 **9.11** (a) +3P, −1F (b) +1Na, −2O, +1H (c) +1Na, +6S, −2O (d) +4C, −2O **9.13** (a) redox (b) nonredox (c) redox (d) redox **9.15** (a) H_2 oxidized, N_2 reduced (b) KI oxidized, Cl_2 reduced (c) Fe oxidized, Sb_2O_3 reduced (d) H_2SO_3 oxidized, HNO_3 reduced **9.17** (a) N_2 oxidizing agent, H_2 reducing agent (b) Cl_2 oxidizing agent, KI reducing agent (c) Sb_2O_3 oxidizing agent, Fe reducing agent (d) HNO_3 oxidizing agent, H_2SO_3 reducing agent **9.19** molecular collisions, activation energy, and collision orientation **9.21** total kinetic energy of colliding reactants; collision orientation **9.23** (a) exothermic (b) endothermic (c) endothermic (d) exothermic **9.25** (a) exothermic (b) released

9.27



9.29 (a) As temperature increases, so does the number of collisions per second. (b) A catalyst lowers the activation energy. **9.31** The concentration of O_2 has increased from 21% to 100%. **9.33** (a) increase (b) decrease (c) increase (d) decrease

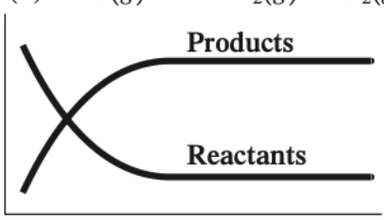
9.35



9.37 (a) 1 (b) 3 (c) 4 (d) 3 **9.39** rate of forward reaction = rate of reverse reaction

9.41 (a) $N_2(g) + O_2(g) \longrightarrow 2NO(g)$
(b) $2NO(g) \longrightarrow N_2(g) + O_2(g)$

9.43



9.45 Yes, the concentrations of molecules in diagrams III and IV are the same. **9.47** Diagrams II and IV; diagram III cannot be produced from the original mixture.

9.49 (a) $K_{eq} = \dfrac{[NO_2]^2}{[N_2O_4]}$ (b) $K_{eq} = \dfrac{[Cl_2][CO]}{[COCl_2]}$

(c) $K_{eq} = \dfrac{[CH_4][H_2S]^2}{[CS_2][H_2]^4}$ (d) $K_{eq} = \dfrac{[SO_3]^2}{[O_2][SO_2]^2}$

9.51 (a) $K_{eq} = [SO_3]$ (b) $K_{eq} = \dfrac{1}{[Cl_2]}$

(c) $K_{eq} = \dfrac{[NaCl]^2}{[Na_2SO_4][BaCl_2]}$ (d) $K_{eq} = [O_2]$

9.53 4.8×10^{-5} **9.55** (a) more products than reactants (b) essentially all reactants (c) significant amounts of both reactants and products (d) significant amounts of both reactants and products **9.57** diagram IV **9.59** diagram IV **9.61** (a) right (b) left (c) left (d) right **9.63** (a) left (b) left (c) left (d) left **9.65** (a) left (b) no effect (c) right (d) no effect **9.67** endothermic reaction **9.69** (a) redox, single replacement (b) redox, combustion (c) redox, decomposition (d) nonredox, double replacement **9.70** (a) redox (b) redox (c) redox (d) can't classify **9.71** (a) gain (b) reduction (c) decrease (d) increase **9.72** (a) gains (b) loses (c) loses (d) gains **9.73** (a) decrease (b) increase (c) increase (d) decrease **9.74** (a) no (b) no (c) yes (d) no

9.75 $CS_2(g) + 4H_2(g) \rightleftharpoons CH_4(g) + 2H_2S(g)$

9.76 (a) yes (b) yes (c) no (d) yes **9.77** (a) no effect (b) right (c) right (d) right **9.78** c **9.79** c **9.80** a **9.81** b **9.82** c **9.83** b **9.84** c **9.85** d **9.86** b **9.87** d