p. 643

CALVIN

#10, 13, 14, 17, 18, 20, 21, 22, 23, 25, 29, 39

$$1N_2 + 3H_2 \rightarrow 2NH_3$$

10) a) Red ~ NH_3, Green ~ H_2, Blue ~ N_2

b) · H_2 decreases more than N_2 (3:1 ratio)
· plots increase/decrease as RXN proceeds

c) once they all plateau they are at equilibrium

13) K much greater than 1 ($K >> 1$) means large concentrations of products; this RXN is a good source of products

14) K much less than 1 ($K << 1$) means large concentrations of reactants; this RXN is a poor source of products

17) K + K_p are equilibrium constants (K is mol/L); (K_p is atm) — generally

Q is reaction quotient, Q is exactly the same as K or K_p but instead of equil. concentrations, uses initial concentrations

Q = K then @ equil. (or if $Q_p = K_p$)

18) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$ $\quad K = \dfrac{[HI]^2}{[H_2][I_2]}$

1) different K expressions
2) 1st $K = K_p$ 2nd $K \neq K_p$

$H_{2(g)} + I_{2(s)} \rightleftharpoons 2HI_{(g)}$ $\quad K = \dfrac{[HI]^2}{[H_2]}$

3) change volume effects only RXN 1

20) a) TRUE ONLY if solids + liquids do ~~so~~ False (solids + liquids don't affect equil.)

b) K is constant unless temp. changes

c) False, depends if endo- or exo-thermic

d) False since depends on moles of gases on each side

e) TRUE

21) a) $K = \frac{[NO]^2}{[N_2][O_2]}$ b) $K = \frac{[NO_2]^2}{[N_2O_4]}$ c) $K = \frac{[SiCl_4][H_2]^2}{[SiH_4][Cl_2]^2}$

d) $K = \frac{[PCl_3]^2[Br_2]^3}{[PBr_3]^2[Cl_2]}$

22) a) $K_p = \frac{(P^2_{NO})}{(P_{N_2})(P_{O_2})}$ b) $K_p = \frac{(P^2_{NO_2})}{(P_{N_2O_4})}$ c) $K_p = \frac{(P_{SiCl_4})(P_{H_2})^2}{(P_{SiH_4})(P^2_{Cl_2})}$

d) $K_p = \frac{P^2_{PCl_3} \times P^3_{Br_2}}{P^2_{PBr_3} \times P^3_{Cl_2}}$

23) IN CLASS

25) $2NO_{(g)} + 2H_2{}_{(g)} \rightleftharpoons N_{2(g)} + 2H_2O_{(g)}$ $\quad K = \dfrac{[N_2][H_2O]^2}{[NO]^2[H_2]^2}$

$$K = \frac{(5.3\times10^{-2})(2.9\times10^{-3})^2}{(8.1\times10^{-3})(4.1\times10^{-5})^2} = \boxed{4.0\times10^{6}}$$

29) $K_p = \dfrac{P_{NO}^2 \times P_{O_2}}{P_{NO_2}^2} = \dfrac{(6.5\times10^{-5})^2(4.5\times10^{-5})}{(0.55)^2} = \boxed{6.3\times10^{-13}}$

39) $H_2O_{(g)} + Cl_2O_{(g)} \rightleftharpoons 2HOCl_{(g)}$ $\quad K = \dfrac{[HOCl]^2}{[H_2O][Cl_2O]} = 0.0900$

$Q = K$ (equil.) $\quad Q > K$, shift left $\quad Q < K$, shift right

a) $Q = \dfrac{[HOCl]_0^2}{[H_2O]_0[Cl_2O]_0} = \dfrac{\left(\frac{1.0\,mol}{1.0\,L}\right)^2}{\left(\frac{0.10\,mol}{1.0\,L}\right)\left(\frac{0.10\,mol}{1.0\,L}\right)} = 1.0\times10^{2}$

$Q > K$ shift left

b) $Q = \dfrac{\left(\frac{0.084\,mol}{2.0\,L}\right)^2}{\left(\frac{0.98\,mol}{2.0\,L}\right)\left(\frac{0.080\,mol}{2.0\,L}\right)} = 0.090 = K$, @ equil.

c) $Q = \dfrac{\left(\frac{0.25\,mol}{3.0\,L}\right)^2}{\left(\frac{0.56\,mol}{3.0\,L}\right)\left(\frac{0.0010\,mol}{3.0\,L}\right)} = 110$ $\quad Q > K$, shift left