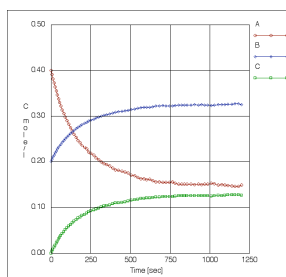
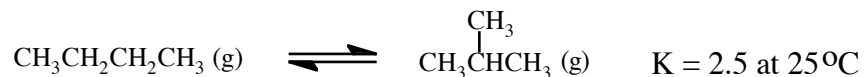


Chemistry 116
General Chemistry II



Equilibrium Calculation
Practice Problems

- 1) The equilibrium constant for the solubility reaction of calcium carbonate is 8.7×10^{-9} at 25°C . Calculate the equilibrium concentrations of the calcium and carbonate ions at 25°C .
- 2) The equilibrium constant for the solubility reaction of iron (III) hydroxide is 2.0×10^{-39} at 25°C . Calculate the equilibrium concentration of the iron(III) ion in water where $[\text{OH}^-] = 1.0 \times 10^{-7} \text{ M}$ at 25°C .
- 3) The equilibrium constant for the solubility reaction of lead fluoride is 3.7×10^{-8} at 25°C . Calculate the equilibrium concentrations of the Pb^{+2} and F^- ions at 25°C .
- 4) The two isomers butane and 2-methylpropane can equilibrate according to the following equation:



If butane is put in a container at a partial pressure of 1860 mm Hg at 25°C with a catalyst and allowed to equilibrate by this reaction, what will be the equilibrium partial pressures of the two gases?

- 5) A solution is prepared by dissolving 5.6×10^{-4} moles of bromocresol green indicator in 1 L of water. The indicator reacts with water according to the following chemical equation:



Set up an equilibrium table and calculate $[\text{Hbg}]$, $[\text{OH}^-]$ and $[\text{bg}^-]$ when the solution reaches equilibrium.

- 6) A solution is prepared by dissolving 1.6×10^{-3} moles of phenolphthalein indicator in 1 L of water plus ethanol. The indicator reacts with the water according to the following chemical equation:



Set up an equilibrium table and calculate $[\text{Hphth}]$, $[\text{H}_3\text{O}^+]$ and $[\text{phth}^-]$ when the solution reaches equilibrium.

- 7) A reaction with $\Delta H^\circ = -64.0$ kJ/ mole has $K = 1.00 \times 10^{-8}$ at 25.0 °C. What would be the value of K at 0.00 °C?
- 8) A reaction with $\Delta H^\circ = 618.0$ kJ/ mole has $K = 1.00 \times 10^{-60}$ at 25.0 °C. What would be the value of K at 500.0 °C?

ANSWERS

- 1) $[\text{Ca}^{+2}] = [\text{CO}_3^{-2}] = 9.3 \times 10^{-5}$ M 2) $[\text{Fe}^{+3}] = 2.0 \times 10^{-18}$ M
- 3) $[\text{Pb}^{+2}] = 2.1 \times 10^{-3}$ M $[\text{F}^-] = 4.2 \times 10^{-3}$ M
- 4) $P_{\text{but}} = 0.70$ atm (530 mm Hg), $P_{2\text{mp}} = 1.75$ atm (1330 mm Hg)
- 5) $[\text{Hbg}] = [\text{OH}^-] = 5.3 \times 10^{-7}$ M, $[\text{bg}^-] = 5.595 \times 10^{-4}$ M (extra sig figs shown)
- 6) $[\text{phth}^-] = [\text{H}_3\text{O}^+] = 8.0 \times 10^{-7}$ M, $[\text{Hphth}] = 1.5992 \times 10^{-3}$ M (extra sig figs)
- 7) $K = 1.06 \times 10^{-7}$ 8) 3.20×10^6