Ch. 11 PS#1 CALVIN

p. 542 #1, 8, 9, 11-16, 29, 43, 67, 79, 81, 104

1) a) Water evaporates faster than the solution (vapor pressure lowering)

b) Solution reaches equilibrium (due to lower VP does not evaporate completely).

c) No, in the air and in the 2nd beaker

d) Yes, eventually is constant once equilibrium is reached.

8) 2L → 1L

↘ 1.5L, more pressure due to less air above the pop so more carbonated

9) $M = \frac{n}{L}$ ← changes w/ temp

$molal = \frac{n}{kg}$ ← does not change w/ temp. so use with BPE/FPD

11) $M = \frac{n}{L}$ $\quad \frac{585\,g\,C_3H_7OH \;|\; 1\,mol\,C_3H_7OH}{60.09\,g\,C_3H_7OH} = \boxed{9.74\,M}$

$1.00\,L$

12) $\frac{0.250\,L \;|\; 0.100\,mol \;|\; 134.00\,g}{L \;|\; mol} = \boxed{3.35\,g\,Na_2C_2O_4}$

13) $M_1V_1 = M_2V_2$

$V_1 = \frac{M_2V_2}{M_1} = \frac{(0.040\,M)(1.00\,L)}{(0.25\,M)} = 0.16\,L = \boxed{160\,mL}$

14) $1.28\ g\ CaCl_2 \left| \frac{1\ mol\ CaCl_2}{110.98\ g\ CaCl_2} \right| \left| \frac{1\ L}{0.580\ mol\ CaCl_2} \right| \left| \frac{1000\ mL}{1\ L} \right| = \boxed{19.9\ mL}$

15) Na_2CO_3

$0.0700\ L \left| \frac{3.0\ mol}{1\ L} \right| = 0.21\ mol\ Na_2CO_3$

$$Na_2CO_{3(s)} \xrightarrow{H_2O} 2Na^+_{(aq)} + CO_3^{2-}{}_{(aq)}$$

$0.42\ mol$

$NaHCO_3$

$0.0300\ L \left| \frac{1.0\ mol}{L} \right| = 0.030\ mol\ NaHCO_3$

$$NaHCO_{3\,(s)} \xrightarrow{H_2O} Na^+_{(aq)} + HCO_3^-{}_{(aq)}$$

$0.030\ mol$

$$M_{Na^+} = \frac{0.42\ mol + 0.030\ mol}{0.0700\ L + 0.030\ L} = \boxed{4.5\ M\ Na^+}$$

16) a) $HNO_{3\,(s)} \xrightarrow{H_2O} H^+_{(aq)} + NO_3^-{}_{(aq)}$

b) $Na_2SO_{4\,(s)} \xrightarrow{H_2O} 2Na^+_{(aq)} + SO_4^{2-}{}_{(aq)}$

c) $Al(NO_3)_{3\,(s)} \xrightarrow{H_2O} Al^{3+}_{(aq)} + 3NO_3^-{}_{(aq)}$

d) $SrBr_{2\,(s)} \xrightarrow{H_2O} Sr^{2+}_{(aq)} + 2Br^-_{(aq)}$

e) $KClO_{4\,(s)} \xrightarrow{H_2O} K^+_{(aq)} + ClO_4^-{}_{(aq)}$

f) $NH_4Br_{(s)} \xrightarrow{H_2O} NH_4^+{}_{(aq)} + Br^-_{(aq)}$

g) $NH_4NO_{3(s)} \xrightarrow{H_2O} NH_4^+{}_{(aq)} + NO_3^-{}_{(aq)}$

h) $CuSO_{4\,(s)} \xrightarrow{H_2O} Cu^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)}$

i) $NaOH_{(s)} \xrightarrow{H_2O} Na^+_{(aq)} + OH^-_{(aq)}$

29)

$$D = \frac{m}{V} = \frac{10.0\,g\,H_3PO_4 + 100.\,g\,H_2O}{104\,mL} = 1.06\ g/mL$$

$$\frac{10.0\,g\,H_3PO_4}{} \left| \frac{1\ mol\ H_3PO_4}{97.99\,g\,H_3PO_4} \right. = 0.102\ mol\ H_3PO_4$$

$$\frac{100.\,g\,H_2O}{} \left| \frac{1\ mol\ H_2O}{18.02\,g\,H_2O} \right. = 5.55\ mol\ H_2O$$

$$\text{mole fraction } H_3PO_4 = \frac{0.102\ mol\ H_3PO_4}{(0.102 + 5.55)\ mol} = 0.0180$$

$$\chi_{H_2O} = 1.000 - 0.0180 = \boxed{0.9820}$$

$$M = \frac{0.102\ mol}{0.104\,L} = \boxed{0.981\ M}$$

$$\text{molal.} = \frac{0.102\ mol}{0.100\,Kg} = \boxed{1.02\ \text{molal.}}$$

43) a) CCl_4 b) H_2O c) H_2O d) CCl_4 e) H_2O f) H_2O

g) CCl_4

67) $\Delta t_F = K_f \cdot (\text{molal.})$ $\quad (\text{molal}) = \frac{\Delta t_F}{K_f} = \frac{(1.50\,^\circ C)}{(1.86\,^\circ C/\text{molal})} = 0.806\ \text{molal.}$

$$\frac{0.200\,Kg}{1\,Kg} \left| \frac{0.806\ mol}{1\ mol} \right. \left| \frac{92.09\,g}{} \right. = \boxed{14.8\,g\ C_3H_8O_7}$$

79) $Na_3PO_{4(s)} \xrightarrow{H_2O} 3Na^+_{(aq)} + PO_4^{3-}_{(aq)}$ $i = 4.0$ $4 \times 0.10 = 0.040$

$CaBr_{2(s)} \xrightarrow{H_2O} Ca^{2+}_{(aq)} + 2Br^-_{(aq)}$ $i = 3.0$ $3 \times 0.026 = 0.060$

$KCl_{(s)} \xrightarrow{H_2O} K^+_{(aq)} + Cl^-_{(aq)}$ $i = 2.0$ $2 \times 0.020 = 0.040$

HF 0.020

a) $Na_3PO_4 \rightsquigarrow 0.040$

$KCl \rightsquigarrow 0.040$

b) 0.020 molal. HF

c) $CaBr_2$

81) a) $\dfrac{5.0\,g\,NaCl \;/\; 1\,mol}{0.025\,kg \;/\; 58.44\,g} = 3.4$ molal $\quad NaCl_{(s)} \xrightarrow{H_2O} Na^+_{(aq)} + Cl^-_{(aq)}$ $i = 2.0$

$\Delta t_f = i\,K_f \cdot molal. = (2.0)(1.86\,^\circ C/molal.)(3.4\,molal) = 13\,^\circ C$

$T_F = \boxed{-13\,^\circ C}$

$\Delta t_b = i\,K_b \cdot molal = (2.0)(0.51\,^\circ C/molal.)(3.4\,molal.) = 3.5\,^\circ C$

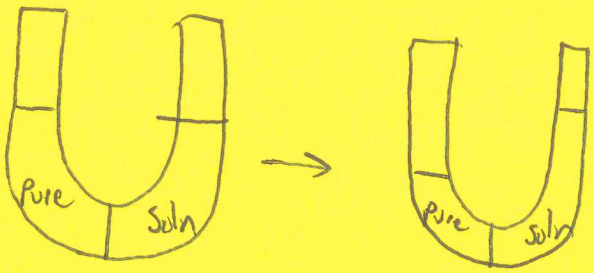
$T_b = \boxed{103.5\,^\circ C}$

b) $\dfrac{2.0\,g\,Al(NO_3)_3 \;/\; 1\,mol}{0.015\,kg \;/\; 213.01\,g} = 0.63$ molal. $\quad Al(NO_3)_{3(s)} \xrightarrow{H_2O} Al^{3+}_{(aq)} + 3NO_3^-{}_{(aq)}$ $i = 4.0$

$\Delta t_f = i \cdot K_f \cdot molal = (4.0)(1.86\,^\circ C/molal)(0.63\,molal) = 4.7\,^\circ C$ $T_F = \boxed{-4.7\,^\circ C}$

$\Delta t_b = i \cdot K_b \cdot molal. = (4.0)(0.51\,^\circ C/molal.)(0.63\,molal.) = 1.3\,^\circ C$ $T_F = \boxed{101.3\,^\circ C}$

104) a)



b) No change