CM 3230 Fall 2015
Quiz 7a

Name _____

Circle the correct answers, each question is worth 20 points. (Bonus of 20 if all 6 are correct).

1. A binary liquid mixture of A and B containing 0.1 mole fraction of A is in equilibrium with a gas mixture of A and B containing 0.25 mole fraction of A. At a system pressure of 2 bar and temperature $T = 280\ K$, the liquid fugacity of pure components are $f_A^{liq} = 1.2\ bar$ while the vapor phase behaves as an ideal gas. If the Henry's constant for A is $\mathcal{H}_A = 8\ bars$, then the Henry's law activity coefficient of A is closest (to within 2%)

   a) $\gamma_A^H = 0.625$
   b) $\gamma_A^H = 0.815$
   c) $\gamma_A^H = 1.00$
   d) $\gamma_A^H = 1.25$
   e) None of the above

2. For a liquid mixture containing components a and b at temperature $T = 320\ K$, the liquid fugacity of pure b was found to be $f_b^{liq} = 1.2\ bar$. Based on Van Laar model for g^E, we

$$RT \ln \gamma_b = B\left(\frac{Ax_a}{Ax_a + Bx_b}\right)^2$$

   with $A = 1.302\ kJ/mol$ and $B = 2.253\ kJ/mol$. Then the Henry's law constant for b is closest to (within $\pm 2\%$)
   a) $\mathcal{H}_B = 0.45\ bar$
   b) $\mathcal{H}_B = 0.80\ bar$
   c) $\mathcal{H}_B = 1.25\ bar$
   d) $\mathcal{H}_B = 2.80\ bar$
   e) None of the above

3. The partial molar volume of A at $T = 400\ K$ and $P = 15\ bar$, in a gas mixture of 0.3 mole fraction A and the rest B, was found to be

$$\bar{V}_A = (1 - kP)\left(\frac{RT}{P}\right)$$

   where $k = -0.01\ bar^{-1}$. Then the fugacity is closet to (within $\pm 2\%$)

   a) $\hat{f}_A^{vap} = 5.228\ bar$
   b) $\hat{f}_A^{vap} = 7.014\ bar$
   c) $\hat{f}_A^{vap} = 10.00\ bar$
   d) $\hat{f}_A^{vap} = 12.50\ bar$
   e) None of the above

4. Plots of $\ln(\gamma)$ and/or $\ln(\gamma^{\mathcal{H}})$ for binary liquid mixture of A and B are shown in Figure 1.

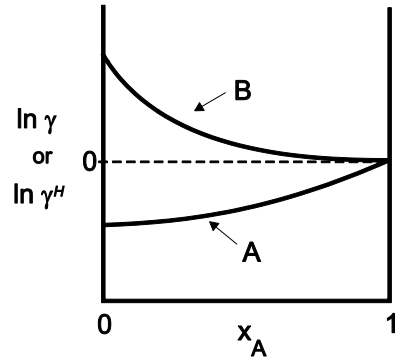

Figure 1. Ln of Activity Coefficients.

The two plots shown are based (referenced) on

a) Lewis-Randall model for A and Henry's model for B
b) Lewis-Randall model for B and Henry's model for A
c) Lewis-Randall model for A and Lewis-Randall model for B
d) Henry's model for A and Henry's model for B
e) None of the above

5. The excess enthalpy for the mixture for a mixture of 10 moles of A and 20 moles of B at $T = 420K$ is given by $H^E = -10\ kJ$. Then the enthalpy of mixing is closest to (within $\pm 2\%$)

a) $\Delta h_{mix} = +0.10 \frac{kJ}{mol}$
b) $\Delta h_{mix} = -0.33 \frac{kJ}{mol}$
c) $\Delta h_{mix} = -4.00 \frac{kJ}{mol}$
d) $\Delta h_{mix} = -10.0 \frac{kJ}{mol}$
e) None of the above

6. A binary gas mixture contains A and B in equilibrium with a liquid mixture containing A and B. If the fugacity coefficients of A and B were found to be $\hat{\phi}_A = 1.1$ and $\hat{\phi}_B = 0.8$, while the fugacities at the liquid phase were determined to be $\hat{f}_A^{liq} = 2\ bars$ and $\hat{f}_B^{liq} = 5\ bars$, the system pressure is closest to (within $\pm$ 2%)

a) $P_{sys} = 2.021\ bars$
b) $P_{sys} = 2.916\ bars$
c) $P_{sys} = 3.684\ bars$
d) $P_{sys} = 4.220\ bars$
e) None of the above