

## Practice Problems for Exam 3

These problems are given to you as extra practice. The key to studying for this exam is, however, to review the notes and homework! You should understand the notes, including being able to describe/use any graphs, and understand the *concepts* behind the homework. There will be several “mathematical” problems; they are mostly similar to the homework. These problems only represent a fraction of the topics covered and do not completely represent the problems on the exam.

1. Sketch the phase diagram of I<sub>2</sub> given the following data: triple point, 113 °C and 0.12 atm; critical point, 512 °C and 116 atm; normal melting point, 114 °C; normal boiling point, 184 °C; and density of liquid > density of solid.
2. Given the following table of data for ethanol/water at 25 °C determine whether the solution is ideal, shows positive deviations from Raoult’s Law or shows negative deviations from Raoult’s Law. If the solution shows deviations, describe the forces responsible for the deviation.

$x_{\text{ethanol}}$	$P_{\text{ethanol}} / \text{torr}$	$P_{\text{water}} / \text{torr}$
0.00	0.00	23.78
0.10	17.65	21.70
0.50	36.86	17.29
0.90	53.45	5.38
1.00	59.20	0.00

3. Show that  $a_{\pm} = a_{\pm}^2 = m^2 \gamma_{\pm}^2$  for CuSO<sub>4</sub>.
4. Find  $\Delta_r G^\circ(T)$  and  $K_p(T)$  at 25 °C for  $\text{CO}(g) + 3\text{H}_2(g) \rightarrow \text{CH}_4(g) + \text{H}_2\text{O}(g)$ . What does the size of  $K_p(T)$  tell you about the reaction?
5. The value of  $K_p$  for a gas-phase reaction doubles when the temperature is increased from 300 K to 400 K at a fixed pressure. What is the sign of  $\Delta_r H^\circ(T)$  for this reaction? What is the value?
6. What is the pH for a solution 0.100 M HClO<sub>2</sub> ( $K_a = 1.12 \times 10^{-2}$ ) at equilibrium? Compare this problem to the one completed in class. What does the size of  $K_a$  tell you about acid strength?