Study Guide for Chapter 5+6

1) Definition for phase.

2) What is the number of phases in a) a gas mixture; b) an aqueous solution of NaCl, c) a metal alloy; d) a suspension of oil in water; e) an aqueous solution of NaCl and $MgCl_2$?

3) Number of components c: minimum number of species necessary to specify the composition of the system = number of species in the system minus the number of conditions that relate the quantity of different species to each other.

4) What is the number of components in a) an aqueous solution of NaCl; b) water at pH 7; c) a solution mixture of benzene and ethanol?

5) Variance of the system (degrees of freedom) is the number of independent intensive variables for describing the system, such as temperature, pressure or concentration.

6) What is the phase rule?

7) Draw a phase diagram for water. Point out the co-existence curves (or phase boundaries) for liquid-solid; liquid-gas; gas-solid equilibriums; triple point and critical point.

8) What is the thermodynamic quantity that drives phase transition at constant pressure?

9) At triple point what is the thermodynamic quantity that is the same for all three phases?

10) What is Raoult's law ?

11) Given a pressure-composition (P-x/y) diagram for a liquid mixture in equilibrium with vapor.

12) What is the number of number of degree of freedom f in the liquid, vapor phase and the coexistence region?

13) Given a point in the diagram read out the composition in the liquid and vapor phase.

14) Explain how isothermal distillation works using the pressure-composition diagram. Which phase is removed during the distillation? Which component is left in the residual liquid?

15) How does the diagram change if the liquid mixture has positive or negative deviation from the ideal behavior?

16) When does one want to use the temperature-composition diagram to describe the liquid-vapor equilibrium? Which curve is the boiling point curve? What are the boiling points for the pure liquids? Which liquid is more volatile?

17) Explain fractional distillation using the P-x/y diagram. What kind of liquid mixtures can be separated using fractional distillation? Use the diagram to explain the vaporization and condensation cycle.

18) What kind of liquid mixtures can be separated using steam distillation?

19) What is azeotrope?