Final Exam Study Guide

This study guide is not exhaustive, but it should serve as a starting point for studying

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In order to be prepared for the test, students should know how to use the following tables in the appendix of F&R:

a. Physical properties (B.1)
b. Generalized compressibility charts
c.
d. Heat Capacity (B.2)
e. Antoine Equation (B.4)
f. Any other tables for unit conversions and physical properties of chemicals

In order to be prepared for the final exam, students should be able to:

1. Perform unit conversions for both metric and English units
2. Convert between molar flow rates, volumetric flow rates and mass flow rates
3. List the assumptions or conditions necessary to use the following equations:
    a. Raoult's law
    b. Ideal gas equation
    c. PV=znRT (compressibility factor)
4. Choose the appropriate material balance for a system or subunit:
    a. Extent of reaction
5. Derive appropriate equations for material balances for:
    a. Overall processes
    b. Individual units
    c. Mixing points
    d. Splitting points
6. Define or explain the following terms or processes:
    a. Percent yield
    b. Single pass conversion
    c. Overall conversion
    d. Inert species
    e. Saturated vapor
    f. Superheated vapor
    g. Combustion
    h. Open process system
    i. Closed process system
    j. Isothermal process
    k. Adiabatic process
    l. Flow work
    m. Shaft work
    n. Specific internal energy
    o. Specific volume
    p. Specific enthalpy

   q. State property
   r. Heat capacity at constant volume
   s. Heat capacity at constant pressure
   t. Heat of fusion
   u. Heat of vaporization
   v. Heat of reaction
   w. Exothermic reaction
   x. Endothermic reaction
   y. Latent heat
   z. Sensible heat
7. Write and balance chemical equations for combustion processes
8. Calculate the heat of reaction for a given set of chemical equations
   a. Heat of formation method
   b. Heat of reaction method
9. Describe the purpose of recycle and purge streams
10. Choose an appropriate reference state for energy balance calculations
11. Draw a hypothetical path for changes in T,P or phase in a given system using the following path types:
   a. Isothermal pressure changes
   b. Isobaric temperature changes
   c. Isothermal, isobaric phase changes
12. Calculate changes in enthalpy or internal energy for the following situations using tabulated values and/or heat capacity estimations (table B.2)
   a. Changes in P at constant T and phase (solid, liquid, gas)
   b. Changes in T at constant P and phase (solid, liquid, gas)
   c. Phase changes at constant T and P
13. Derive the energy balance equation for open systems and know when to neglect the following terms:
   a. Kinetic energy
   b. Potential energy
   c. Enthalpy
   d. Shaft work
   e. Heat
14. Write and solve reactive-system energy balance equations for
   a. The heat transfer required for specified inlet and outlet conditions
   b. The outlet temperature corresponding to a specified heat input
   c. The product composition corresponding to a specified heat input and a specified outlet temperature
15. Properly utilize the following equations when solving material and energy balances
   a. Raoult's law (single condensable component and multicomponent)
   b. Ideal gas law

   c. Antoinne Equation
   d. Cp correlations for enthalpy changes
   e. PV=znRT (compressibility factor)
16. Outline the general problem solving procedure for mass and energy balances
17. Apply your knowledge of material and energy balances to multicomponent, multiphase and multiunit systems