Topics for Exam 1, Wednesday, October 24, 2007; 7 – 8:30 PM

Notes: The exam will involve at least the following: definitions, derivation(s) and calculations.

1. Newton-Raphson Technique
2. Non-converging iterations
3. Numerical Intergration
4. Simpson Method
5. Runge-Kutta, Euler methods
6. Partial derivatives
7. **Cubic form of the VDW's equation**
8. First and second partial derivatives of the VDW's equation
9. Cross derivatives
10. Total derivatives
11. Estimating ΔP from its total derivative
12. Ideal gas behavior
13. **Three basic postulates of the kinetic theory of gases**
14. Pressure units
15. Pressure calculations
16. Gas Laws
17. **Boyle's law isotherms**
18. Charles and Avogadro's laws
19. **Compressibility factor, Z**
20. Two-parameter equations of state
21. **WVW,s, RK and PR equations**
22. Berthelot, Dieterici, Virial equation of state
23. Comparison of the PR and RK equations
24. Critical point, critical isotherm
25. Condensation
26. **Maxwell construction**
27. Evaluating critical constants in the VDW's equation, inflexion point
28. **Evaluating P_cV_c/RT_c**
29. Law of corresponding states
30. **Evaluating a, b in critical constants for the VDW's (the RK is too complex for exams!)**
31. Deriving VDW equation in terms of reduced variables (equation 44 in lecture notes)
32. Using the law of corresponding states
33. **Deriving Z in terms of reduced variables (equation 47 in lecture notes)**
34. **Virial equations of state**
35. **Boyle temperature (definition of)**
36. **Dalton's law of partial pressures**
37. **Evaluating partial pressures**
38. Evaluating mole fractions

39. Statement of the first law (definition)
40. Acquisitive form of the first law
41. Zeroth Law of Thermodynamics
42. Systems, definition of
43. Definition of work, energy
44. Deriving expansion work
45. Deriving isothermal reversible expansion work
46. State Functions
47. Evaluation of work
48. Adiabatic expansions
49. Proof that ΔU is a state function while q and w are not…
50. Work done in an adiabatic expansion
51. Derivation of $T_2/T_1 = (V_1/V_2)^{1/c}$
52. Enthalpy
53. Heat Capacity
54. Derivation of $P_1V_1^{\gamma} = P_2V_2^{\gamma}$ (equation 19.23 in text)
55. Enthalpies of transition
56. Thermochemistry
57. Enthalpies of formation
58. Hess Law and evaluation of reaction enthalpies
59. Kirchoff's law
60. Internal energy, internal pressure
61. Isothermal compressibility and calculations involving
62. Expansion coefficient
63. Joule-Thompson experiment
64. Joule-Thompson coefficient
65. Isothermal J-T coefficient; experimental determination of
66. Joule-Thompson inversion temperature
67. C_p, C_v relationships and derivations of
68. Partition Functions
69. Ensembles
70. Probabilities, Boltzmann distribution
71. Derivation of average energy of an ensemble, $\langle E \rangle = -(\delta \ln Q/\delta\beta)_{N,V}$
72. Translational, rotational and vibrational partition functions
73. Evaluating average energy of a monatomic gas from its translational PF
74. The rigid rotator-harmonic oscillator
75. Evaluation of average rotational energy
76. Heat capacity and PF's
77. The Einstein model
78. Pressure and partition function
79. Partition function of indistinguishable particles
80. Partition function of distinguishable particles/molecules
81. Fermions and Bosons
82. Molecular Partition Functions
83. Stirling's approximation