CHEMISTRY DEPARTMENT, PORTLAND STATE UNIVERSITY

CHEMISTRY 440/540, PHYSICAL CHEMISTRY. FALL, 2011 Venue: SB1 107; 12:45 – 13:50 PM

Instructor: R. H. Simoyi (SB2 372)

Syllabus:

The chapters and page numbers referred to in this syllabus are from *Physical Chemistry,* by McQuarrie and Simon

Lecture No.	Date	Topic	Pages
1	Mon, 9/26	Organization, Introduction, Numerical Methods	627 - 635
		Partial Differentials	683 - 693
2	Wed, 9/28	Partial differentials	683 - 693
		Pressure, Gas Laws (Boyle, Charles, Avogadro) Ideal gas law.	637 - 674
3	Fri, 9/30	Real gases, compressibility factor, Two parameter equations of state	642 – 648
		Cubic equation of state; law of corresponding states	648 - 658
4	Mon, 10/3	Virial coefficients, Boyle temperature, L-Jones potentials	658 – 674
		First law of thermodynamics	765 - 800
5	Wed, 10/5	First law, State Functions, adiabatic expansion	769 – 780
6	Fri, 10/7	Adiabatic processes, cont'd, Enthalpy, Heat capacity	780 – 786
		Thermochemistry	787 – 796
7	Mon, 10/10	Hess Law	789 – 796
		Kirchoff's Law, Joule-Thompson Experiment/Coefficient/Inversion temperature	797- 800

8	Wed, 10/12	Statistical Mechanics: Boltzmann Factor, Probability	693 – 716
		Ensembles, Ensemble Averages	696 – 700
9	Fri, 10/14	Translational Partition Function for monatomic gas	700 – 702
		Heat capacity at C_v; distinguishable molecules	702 – 710
10	Mon, 10/17	Molecular partition functions	713 – 716
11	Wed, 10/19	Stirling's approximation, Entropy	809 – 820
		Second Law of thermodynamics, Q_{rev}, State Functions	820 – 822
12	Fri, 10/21	Spontaneity, $S = k_B \ln W$, Clausius Inequality	824 – 830
		Entropy as a state function	831 - 834
13	Mon, 10/24	Make-up class	
	Mon, 10/24	**First exam given, covers lectures 1 - 12**	
14	Wed, 10/26	Third law of thermodynamics, third law entropies, heat capacity	853 – 860
		Absolute entropies	861 - 864
15	Fri, 10/28	Standard molar entropies	865 – 870
		Helmholtz and Gibbs energies	881 – 910
16	Mon, 10/31	Helmholtz energy and spontaneity	884 – 887
		Examples, calculations, Maxwell relations	888 - 904
17	Wed, 11/02	Maxwell relations, cont'd, Fundamental Equation	893 – 901

		Gibbs-Helmholtz equation, Fugacity	901 - 910
18	Fri, 11/4	Phase Equilibria	925 – 952
		Water, carbon dioxide, benzene phase diagrams, critical point	929 - 933
19	Mon, 11/7	Chemical potential and phase changes	933 – 940
		The Clausius-Clayperon equation	941 – 94
20	Wed, 11/9	Liquid-liquid solutions	963 – 998
		Partial molar quantities, Gibbs-Duhem equation, Raoult's law	966 - 972
21	Fri, 11/11	Make-up lecture	
22	Mon, 11/14	Distillation, Raoult's and Henry's laws	972 – 980
		Temperature-composition diagrams	981 – 986
	Mon, 11/14	**Second exam given [covers lectures 1 – 21]**	
23	Wed, 11/16	Activities, activity coefficients, non-ideal mixtures	987 – 993
		Standard states	993 - 998
24	Fri, 11/18	Solid-liquid solutions, colligative properties	1011-1047
		Activity of non-volatile solute	1015 - 1020
25	Mon, 11/20	Freezing point depression, evaluation of	1020 - 1022
		Osmotic pressure; mean activity coefficients	1023 - 1030

26	Wed, 11/23	The Debye-Huckel Theory	1031 - 1037
		The spherical approximation to D-Huckel theory	1035 – 1037
	Fri, 11/25	**The day after Thanksgiving, no university exercises**	
27	Mon, 11/28	Chemical equilibrium	1049 – 1082
		Equilibrium constant, Le Chatelier's principle	1053 - 1057
28	Wed, 11/30	Effect of extent of reaction on Gibbs energy, Gibbs and spontaneity	1058 – 1066
29	Fri, 12/02	Basic revision of course content	
30	**Mon, 12/05**	**Final Exam, 12:30 PM – 2:20 PM, SB1 107.**	

Note: Depending upon the rate at which topics will be covered; Chapter 26 on Chemical Equilibrium may be set aside and handled in the winter quarter in Chem 441/541.

Professor Simoyi, however, will not be continuing with the class for Chem 441/541. A new professor will take over during the winter term.