

CHEMISTRY DEPARTMENT, PORTLAND STATE UNIVERSITY

CHEMISTRY 440/540, PHYSICAL CHEMISTRY.

FALL, 2009

Venue: UTS 206

Instructor: Shankar Rananavare

Office Hours: Monday, Wednesday: 2:00-4:00 pm in SB2 358

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, 9/29	Organization, Introduction, Numerical Methods	627 - 635
		Partial Differentials	683 - 693
2	Wed, 10/1	Partial differentials	683 - 693
		Pressure, Gas Laws (Boyle, Charles, Avogadro) Ideal gas law.	637 - 674
3	Fri, 10/3	Real gases, compressibility factor, Two parameter equations of state	642 - 648
		Cubic equation of state; law of corresponding states	648 - 658
4	Mon, 10/6	Virial coefficients, Boyle temperature, L-Jones potentials	658 - 674
		First law of thermodynamics	765 - 800
5	Wed, 10/8	First law, State Functions, adiabatic expansion	769 - 780
6	Fri, 10/10	Adiabatic processes, cont'd, Enthalpy, Heat capacity	780 - 786
		Thermochemistry	787 - 796
7	Mon, 10/13	Hess Law	789 - 796
		Kirchoff's Law, Joule-Thompson Experiment/Coefficient/Inversion temperature	797- 800

8	Wed, 10/15	Statistical Mechanics: Boltzmann Factor, Probability Ensembles, Ensemble Averages	693 – 716 696 – 700
9	Fri, 10/17	Translational Partition Function for monatomic gas Heat capacity at C_v ; distinguishable molecules	700 – 702 702 – 710
10	Mon, 10/20	Molecular partition functions	713 – 716
11	Wed, 10/22	Stirling's approximation, Entropy Second Law of thermodynamics, Q_{rev} , State Functions	809 – 820 820 – 822
12	Fri, 10/25	Spontaneity, $S = k_B \ln W$, Clausius Inequality Entropy as a state function	824 – 830 831 - 834
13	Mon, 10/27	Make-up class	
	Mon, 10/27	First exam given, covers lectures 1 - 12	
14	Wed, 10/29	Third law of thermodynamics, third law entropies, heat capacity Absolute entropies	853 – 860 861 - 864
15	Fri, 10/31	Standard molar entropies Helmholtz and Gibbs energies	865 – 870 881 – 910
16	Mon, 11/03	Helmholtz energy and spontaneity Examples, calculations, Maxwell relations	884 – 887 888 - 904
17	Wed, 11/05	Maxwell relations, cont'd, Fundamental Equation	893 – 901

		Gibbs-Helmholtz equation, Fugacity	901 - 910
18	Fri, 11/7	Phase Equilibria	925 – 952
		Water, carbon dioxide, benzene phase diagrams, critical point	929 - 933
19	Mon, 11/10	Chemical potential and phase changes	933 – 940
		The Clausius-Clayperon equation	941 – 949
	Tue, 11/11	Veterans' Day	
20	Wed, 11/12	Liquid-liquid solutions	963 – 998
		Partial molar quantities, Gibbs-Duhem equation, Raoult's law	966 - 972
21	Fri, 11/14	Make-up lecture	
22	Mon, 11/17	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, 11/19	Activities, activity coefficients, non-ideal mixtures	987 – 993
		Standard states	993 - 998
24	Fri, 11/21	Solid-liquid solutions, colligative properties	1011-1047
		Activity of non-volatile solute	1015 - 1020
25	Mon, 11/24	Freezing point depression, evaluation of	1020 - 1022

		Osmotic pressure; mean activity coefficients	1023 - 1030
26	Wed, 11/26	The Debye-Huckel Theory	1031 - 1037
		The spherical approximation to D-Huckel theory	1035 – 1037
	Fri, 11/23	The day after Thanksgiving, no university exercises	
27	Mon, 12/1	Chemical equilibrium	1049 – 1082
		Equilibrium constant, Le Chatelier's principle	1053 - 1057
28	Wed, 12/3	Effect of extent of reaction on Gibbs energy, Gibbs and spontaneity	1058 – 1066
29	Fri, 12/05	Basic revision of course content	
30	Mon, 12/08	Final Exam, 12:30 PM – 2:20 PM, CH 401.	

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.