

Competencies for CHEM 1120 (spring 2005)

65 Items

Text listing as: chapter.section in "Chemistry" by Raymond Chang		
Item	Performance/Task: The student will:	text
General Equilibria		
1	Be able to write the expression for any equilibrium if given a reaction using standard states	14.1-14.3
2	Be able to solve for an unknown quantity in an equilibrium problem when simple substitution is involved (RSCC type 1- when the problem is presented at equilibrium).	14.2-14.3
3	Be able to apply algebra to problems that start out not at equilibrium and approach equilibrium (RSCC type 2)	14.4
4	Be able to apply Le Châtelier's principle to shifts in equilibrium cause by changes in temperature, pressure and concentrations.	14.5
5	Be able to describe the role of a catalyst.	14.5,(13.6)
Acids and Bases and pH		
6	Be able to write any Brønsted-Lowry acid-base reaction (also review from CHEM 1110)	15.1
7	Be able to describe autoionization and be able to make calculations using the K_w	15.2
8	Be able to calculate the pH given either the $[H_3O^+]$ or the $[OH^-]$	15.3
9	Be able to calculate the pH of a strong acid or a strong base	15.4
10	Be able to calculate the pH of a weak acid or a weak base (type 2)	15.5, 15.6
11	Be able to calculate the equilibrium constant for the conjugate of a weak acid or weak base.	15.7
12	Be able to calculate pH of polyprotic acids and know the convention for the 1st, 2nd, etc. ionization constant	15.8
	Review item - know the strong and weak acids and the strong, slightly soluble and weak soluble bases	15.9
13	Be able to do salt hydrolysis problems to obtain pH	15.10
	Review item - Be able to write the reaction between metal or non-metal oxides and water.	15.11
14	Know the definition of amphoteric (and amphiprotic) and how it applies to slightly soluble polyprotic hydroxides.	15.11
15	Know the definition of a Lewis acid and base and be able to identify these in a reaction	15.12
Buffers, Titrations, K_{sp}, K_f and K_d		
16	Be able to calculate the pH of a buffer.	16.2, 16.3
17	Be able to calculate the titration curve for either a strong acid/weak base titration or a strong base/weak acid titration	16.4

18	Be able to calculate the pH of an end point and determine the appropriate indicator	16.5
19	Be able to calculate the common ion effect for solubility using the K_{sp} (type 1)	16.6, 16.8
20	Be able to calculate the molar solubility from any starting solution given the K_{sp} (type 2)	16.6, 16.8
21	Be able to combine solubility calculations with pH	16.9
22	Be able to do type 1 or type 2 problems involving complex ions using either the K_f or K_d	16.10
23	Be able to combine pH, complex ion and solubility problems, especially to the qualitative analysis scheme	16.11
Thermochemistry		
24	Know the definition of energy and the various forms it might assume.	6.1
25	Know the definitions of the following: open system, closed system, isolated system, surroundings, a universe, exothermic, endothermic, state function, state of a system	6.2-6.3
26	Be able to give the first law of thermodynamics and make calculations based upon it.	6.4
27	Be able to define work, heat, internal energy and enthalpy	6.2-6.4
28	Know the definition of molar heat capacity (at either constant volume or pressure) and be able to do problems involving heat capacity	6.5
29	Be able to calculate the enthalpy of reaction from the standard enthalpies of formation.	6.6
30	Be able to calculate the enthalpy of solution from the standard enthalpies of formation of compounds and ions.	6.7+
Thermodynamics		
31	Be able to give an explanation of the zeroth law of thermodynamics	6.5
32	Be able to define what a spontaneous process is.	18.2
33	Be able to relate entropy to microscopic randomness and how to calculate it give the number of microstates.	18.3
34	Know what is meant by "standard state" and standard (molar) state functions	18.3
35	Be able to give the second law of thermodynamics and make calculations based upon it	18.4
36	Be able to tell what the third law of thermodynamics is and reach conclusions based upon it.	18.4
37	Be able to calculate the Gibbs' free energy and know the importance of it in relation to equilibrium.	18.5
38	Be able to derive the equation that relates thermodynamics to the equilibrium constant	18.6
39	Be able to calculate the equilibrium constant from the standard molar Gibbs'	18.6

	free energy	
Electrochemistry		
40	Be able to balance redox reactions by the half reaction method.	19.1
41	Be able to describe how an electrochemical cell works, with it various parts. Cells include: Galvanic, Leclanché, mercury, lead storage, Ni-Cd, lithium , fuel cell, concentration cells, Downs cell,	19.2, 19.6
42	Know the definitions used in electrochemistry including: anode, cathode, electrolyte, anolyte, catholyte, half cell reaction, voltage, electromotive force or emf	19.2
43	Be able to describe and use standard (reduction) potentials and how they are derived from thermodynamics.	19.3
44	Be able to interconvert from standard molar Gibbs' free energy to standart potentials using the standard hydrogen electrode	
45	Be able to calculate standard potentials for a cell.	19.3
46	Be able to calculat non-standard potentials for a cell using the Nernst equation.	19..5
47	Be able to recognize whether a radox reaction is spontaneous or not and, related, whether a cells emf is positive or negative.	19.4
48	Be able to describe the principal mechanism of aqueous corrosion	19.7
49	Be able to calculate quantities of material evolved (or used) in an electroplating (or galvanic) cell using Faraday's law	19.8
Chemical Kinetics		
50	Be able to define mathematically the rate of a reaction and how this is related to other expressions of rate.	13.1
51	Be able to determine a rate law and make calculations base upon a rate law.	13.2
52	Be able to express the simple zero, first, and second order integrated rate laws and use them to make calculations.	13.3
53	Be able to utilize the concept of "half life" for the first order integrated rate law to make calculations.	13.3
54	Be able to explain the collision theory and the transition state theory to calculate the temperature dependance (Arrhenius equation both simple substitution and parametrically) of the rate constant.	13.4
55	Be able to relate reaction mechanisms and elementary steps to obtain the rate law	13.5
56	Know the role of catylsts and be able to site some examples and how it affects a reaction.	13.6
Organic Chemistry		
57	Be able to distinguish the various classes of hydrocarbons and their properties. (aliphatic, aromatic, alkanes, alkenes, alkynes, cyclic, etc.)	24.1, 24.2
58	Be able to name the alkanes, alkenes, alkynes and their (functional) substituted	24.2

	derivatives.	
59	Know the various types of isomers and what the origin is of structural, geometrical and optical isomerism.	24.2
60	Know the important reactions of the aliphatic hydrocarbons.	24.2
61	Know the basic structure of the aromatic hydrocarbons and the role of resonance.	24.3
62	Be able to name some of the simple substituted aromatics.	24.3
63	Be able to describe the mechanism of the aromatic substitution reaction.	24.3
64	Be able to recognize the functional groups: alcohols, carboxylic acids, esters, ethers, aldehydes, ketones, amines, amides, halogens, nitriles	24.4
65	Know the important reactions involving the functional groups.	24.4.