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CHM – 116 Winter 2011 Test 1

All reactions aren't the same.

How do you determine how far a reaction goes? - Equilibrium and Composition (Sections 14.1 – 14.5)

- Describe equilibrium as a dynamic process.
- Relate the expression for the equilibrium coefficient and the balanced chemical equation.
- Distinguish between heterogeneous and homogenous equilibria.
- Write equilibrium expressions for heterogeneous equilibria.
- Relate values of K_c and K_p

Problems: 2 – 10, 21, 22, 23, 24, 25, 27, 28, 29, 31, 32, 33, 34

What we do with equilibria? - Using K and Q (Sections 14.6 – 14.9)

- Relate the value of K and the extent of reaction.
- Use the reaction quotient to determine the direction a reaction will proceed.
- Use equilibrium tables to solve equilibrium problems.
- Determine the shift in equilibrium position after various perturbations.

Problems: 11 – 20, 35, 37, 39, 41, 43, 45, 47, 48, 51, 53, 55, 57, 61, 63, 65, 67, 69, **71, 74, 77, 79, 84, 87, 91a**

What does (s) really mean? - Solubility Product (Sections 16.5 – 16.8)

- Define the term solubility product.
- Write solubility product expressions for compounds.
- Use solubility product expressions to solve problems.
- Explain the common-ion effect.
- Devise simple reaction schemes to separate mixtures of ions.
- Write formation constant expressions for complex ion equilibria.
- Explain how complex ions formation influences solubility.

Problems: 19-21, 23, 85, 87, 89, 91, 93, 95, 97, 105, 109, 111, 127, 129

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CHM – 116 Winter 2011 Test 2

Equilibrium and the Real World – Acids and Bases

What is an acid? - Definition of Acids and Bases (Sections 15.1 – 15.3)

- Compare the Bronsted-Lowry and Arrhenius definitions of acids and bases.
- Identify conjugate acids and bases in a chemical reaction.
- Write proton transfer equilibria involving weak acids and bases.

Problems: 3 – 9, 33, 35, 37, 38, 39

Strong or weak – What's the difference? - Weak Acids and Bases (Sections 15.4 – 15.7 & 15.9 – 15.11)

- Write K_a or K_b expressions for weak acid/base equilibria.
- Classify acids or bases as strong or weak based on values of K_a or K_b.
- Represent species in solution and their relative amounts with simple drawings
- Calculate the pH, $[H_3O^+]$, pOH, and $[OH^-]$ in solutions of strong acids and bases.
- Calculate the pH, $[H_3O^+]$, pOH, and $[OH^-]$ of a solution of a weak acid or base.
- Determine the relative strength of conjugate acids and bases using pK_a and pK_b values.
- Write chemical equations for polyprotic acid dissociation.
- Solve problems using polyprotic acids.
- Identify structural factors that influence acid strength.
- Define and identify Lewis Acids and Bases in chemical reactions.

Problems: 11 – 21, 25 – 30, 41, 43, 45, 47, 48, 49, 51, **53**, 55, 57, 59, 61, 63, 65, 67, 71, 75, 77, 79, 81, 83, 85, 104, 105, 107, 109, 111, 113, 117, 119, 121, **123, 125, 129**

How can that change the pH? - Acid Base Properties of Salt Solutions (Sections 15.8)

- Write equations that illustrate how salts that contain a conjugate acid or base determine the pH of the solution formed.
- Calculate the pH of a salt solution.

Problems: 22 – 24, 133, 89, 91, 93, **95**, 97, 99, 131, 133, 135

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CHM – 116 Winter 2011 Test 3

The Real World Isn't That Simple – Buffers

How does pH change or not change? - Buffer Solutions and Titrations (Sections 16.1 – 16.4)

- Define a buffer solution.
- Identify combinations of compounds that would produce a buffer solution.
- Calculate the pH of a solution containing a weak acid or base and a salt.
- Calculate the pH of a buffer solution using both ICE tables and the Henderson Hasselbalch equation.
- Explain how a buffer works.
- Recognize titration curves for strong-strong titrations and weak-strong titrations.
- Calculate pH at various points on a titration curve.
- Explain the function of indicators.

Problems: 1-18, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 53, , 56, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75, 83, 113, 115, 117, 119, 121, 131, 133

What does spontaneous mean? - The Direction of Spontaneous Change (Sections 17.1 – 17.4)

- Define spontaneous.
- Define entropy and relate it to disorder/randomness and energy dispersal.
- State the Second Law of Thermodynamics.

Problems: 1-10, 27, 29, 31, 33, 35, 37, 77, 92,

So how does this all go together? - Free Energy and Equilibrium (Sections 17.5 – 17.9)

- Express the total entropy change as a change in free energy.
- Calculate the free energy change for a chemical process.
- Use the sign of the free energy change to determine if the reaction is spontaneous.
- Calculate the temperature at which a reaction becomes spontaneous.
- Describe what is meant by reactions at standard conditions.
- Explain the difference between ΔG and ΔG^o
- Relate free energy changes to equilibrium constants and values of the reaction quotient.
- Draw and interpret a free-energy curve.

Problems: 11-26, 39, 41, 43, 45, 47, 51, 53, 55, 57, 59, 61, 65, 67, 69, 71, 75, 79, 83, 85, 91, 99, 101, 103

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CHM – 116 Winter 2011 Test 4

Last Pieces of the Puzzle – What we can do and how fast we can do it!

What happens when electron move? - Oxidation-Reduction Reactions (Sections 18.1 – 18.2)

- Write half-reactions for redox reactions.

Problems: 41

Can we make use of moving electrons? - Voltaic and Electrical Work (Sections 18.3 – 18.6)

- Define anode and cathode in terms of oxidation and reduction.
- Calculate the standard cell potential for a given electrochemical cell using Reduction Potentials.
- Calculate ΔG^o vales from standard cell potentials and visa versa.
- Calculate equilibrium constants from standard cell potentials and visa versa.
- Calculate the cell potential for a concentration cell using the Nerst equation.

Problems: 1-21, 43, 45, 47, 53, 55, 61, 63, 65, 67, 69, 73, 75, 77

What determines how fast a reaction goes? - Concentrations and Rates (Sections 13.1 – 13.5)

- Define reaction rate and relate the reaction rate for different substances in the reaction.
- Describe the factors that influence rates of chemical reactions.
- Determine the rate law from experimental data.
- Use the integrated rate laws to solve problems.
- Identify reactions as first or second order by the linear plots of data.
- Describe an effective collision in terms of energy and orientation.
- Use collision theory to explain the temperature dependence of reaction rates.
- Use the Arrhenius equation to solve problems.
- Define activation energy, steric factor, and transition state.

Problems: 25, 27, 29, 33, 35, 37, 41, 43, 49, 51, 53, 55, 59, 63, 65,

What are the details? - Reaction Mechanisms and Catalysts (Sections 13.6 – 13.7)

- Define mechanism.
- Identify the order of each elementary step in a mechanism.
- Use the experimental rate law to accept or reject a possible mechanism.
- Derive the predicted rate law for a proposed mechanism.
- Define catalysts and explain how they work.

Problems: 69, 71, 85, 91, 93, 95