WTCS Repository

10-806-129 Chemistry 2

Course Outcome Summary

Course Information

Description	Further study of basic chemical principles (e.g. atomic and molecular structure, reactions, stoichiometry, thermochemistry, and acid/base chemistry) and the application of these principles, including chemical equilibria and kinetics. Introduces properties, structures, and reactions of organic compounds. Elementary aspects of biochemistry are considered.
Instructional Level	College Parallel
Total Credits	4

Course History

Last Revision Date	9/17/2012

Pre/Corequisites

Prerequisite: Each Wisconsin Technical College determines the General Education course prerequisites used by their academic institution. If prerequisites for a course are determined to be appropriate, the final Course Outcome Summary must identify the prerequisites approved for use by the individual Technical College.

Course Competencies

1. Use IUPAC nomenclature for naming organic compounds

Assessment Strategies

1.1. by completing laboratory exercise on nomenclature and functional groups
1.2. on an exam

Criteria

Criteria - Performance will be satisfactory when:

1.1. you use the appropriate naming scheme and select proper IUPAC names for hydrocarbons
1.2. you use the appropriate naming scheme and select proper IUPAC names for alcohols
1.3. you use the appropriate naming scheme and select proper IUPAC names for ketones
1.4. you use the appropriate naming scheme and select proper IUPAC names for carboxylic acids
1.5. you use the appropriate naming scheme and select proper IUPAC names for esters
1.6. you use the appropriate naming scheme and select proper IUPAC names for aldehydes
1.7. you use the appropriate naming scheme and select proper IUPAC names for amines
1.8. you use the appropriate naming scheme and select proper IUPAC names for amides
1.9. you relate routinely use common name organic compounds to their IUPAC counterpart (examples

include: acetone, formaldehyde,and acetaldehyde)
1.10. you draw organic compounds using molecular formulas
1.11. you draw organic compounds using expanded structural formulas
1.12. you draw organic compounds using condensed structures
1.13. you draw organic compounds using skeletal structures
1.14. you draw organic compounds using line structures
1.15. you classify carbons within an organic compound as primary, secondary, tertiary or quaternary
1.16. you classify amines as primary, secondary or tertiary
1.17. you classify alcohols as primary, secondary or tertiary

2. Predict chemical reactions involving organic compounds

Assessment Strategies

2.1. by completing laboratory exercise on organic reactions
2.2. on an exam

Criteria

Criteria - Performance will be satisfactory when:

2.1. you relate physical properties of organic compounds to their expected reactions
2.2. you predict chemical reactions of organic compounds based on various reactants in both academic and laboratory settings
2.3. you identify the reaction types (list to include: oxidation, halogenation, addition, substitution, nitration and reduction)
2.4. you identify the organic compounds that undergo these reactions (list to include: oxidation, halogenation, addition, substitution, nitration and reduction)

3. Determine solubility of organic compounds

Assessment Strategies

3.1. by completing a group activity on solubility
3.2. by completing laboratory exercise involving solubility
3.3. on an exam

Criteria

Criteria - Performance will be satisfactory when:

3.1. you investigate how pH affects solubility of some organic compounds
3.2. you analyze how intramolecular bonds affect solubility
3.3. you analyze how intermolecular bonds affect solubility
3.4. you explain the proper chemical disposal based on solubility of various organic compounds

4. Determine Rate Laws

Assessment Strategies

4.1. by completing reaction mechanisms group activity
4.2. by completing laboratory exercise on kinetics
4.3. on an exam

Criteria

Criteria - Performance will be satisfactory when:

4.1. you explain the reaction rate as it relates to chemical reactions
4.2. you explain the rate constant as it relates to chemical reactions
4.3. you explain the reaction order as it relates to chemical reactions
4.4. you explain the elementary reaction as it relates to chemical reactions
4.5. you explain the catalyst as it relates to chemical reactions
4.6. you explain the collision theory as it relates to chemical reactions
4.7. you explain the rate limiting step as it relates to chemical reactions
4.8. you explain the zero order reaction as it relates to chemical reactions
4.9. you explain the first order reaction as it relates to chemical reactions
4.10. you explain the second order reaction as it relates to chemical reactions
4.11. you explain the half life as it relates to chemical reactions
4.12. you examine experimental data to construct a rate equation

4.13. you calculate various components of a rate equation using experimental data
4.14. you explain effects of changes in concentration on reaction rates
4.15. you explain effects of changes in temperature on reaction rates

5. Relate chemical concentrations and Laws of Chemical Equilibrium to predict chemical reactions

Assessment Strategies

5.1. by completing laboratory exercise on equilibrium
5.2. by completing Equilibrium group activity
5.3. on an exam

Criteria

Criteria - Performance will be satisfactory when:

5.1. you explain static equilibrium
5.2. you explain dynamic equilibrium
5.3. you explain heterogeneous reaction
5.4. you explain reversible reaction
5.5. you explain reaction quotient (Q)
5.6. you explain equilibrium constant
5.7. you write an equilibrium constant expression from a given equation
5.8. you calculate an equilibrium constant from a given equation
5.9. you calculate concentrations/pressures of the reactants and/or products of a given equation when the equilibrium constant is provided
5.10. you explain La Chatelier's Principle
5.11. you predict how change in concentration of a reactant or product would shift equilibrium
5.12. you predict how change in pressure would shift equilibrium
5.13. you predict how change in temperature would shift equilibrium
5.14. you predict how addition of a catalyst would shift equilibrium

6. Determine the solubility of a solid product

Assessment Strategies

6.1. by completing laboratory exercise on equilibrium
6.2. on an exam

Criteria

Criteria - Performance will be satisfactory when:

6.1. you explain the solubility product constant (Ksp)
6.2. you explain precipitate
6.3. you explain saturated solution
6.4. you explain unsaturated solution
6.5. you explain soluble
6.6. you explain slightly soluble and insoluble
6.7. you write Ksp expression for a given compound
6.8. you calculate an unknown concentration given the numerical value of the solubility product and the remaining equilibrium ion concentrations
6.9. you determine whether a compound is soluble, slightly soluble, and/or insoluble based on mathematical calculations

7. Analyze the properties and reactions of acids and bases

Assessment Strategies

7.1. by completing laboratory exercise
7.2. on an exam

Criteria

Criteria - Performance will be satisfactory when:

7.1. you explain the Arrhenius acid and base
7.2. you explain V Bronsted-Lowry acid and base
7.3. you explain conjugate acid

7.4. you explain conjugate base
7.5. you explain oxyacid
7.6. you explain acidity
7.7. you explain alkalinity
7.8. you explain salt (acidic, basic and neutral)
7.9. you explain amphiprotic
7.10. you label reactants and products within an acid/base reaction (acid, base, conjugate acid, conjugate base, salt)
7.11. you predict the products of acid/base reactions
7.12. you predict the relative strengths of acids
7.13. you predict the relative strengths of bases

8. Determine equilibria for the reactions of acids and bases

Assessment Strategies

8.1. by completing laboratory exercise
8.2. on an exam

Criteria

Criteria - Performance will be satisfactory when:

8.1. you explain the acid dissociation constant (Ka)
8.2. you explain the base dissociation constant (Kb)
8.3. you explain the ionization constant for water (Kw)
8.4. you calculate the appropriate constant (Ka, Kb or Kw) for given equations
8.5. you determine where equilibrium lies based on calculations (Ka, Kb or Kw).

9. Measure acids and bases in a laboratory setting

Assessment Strategies

9.1. by completing laboratory exercise
9.2. on an exam

Criteria

Criteria - Performance will be satisfactory when:

9.1. you determine [H30+] and [OH-] ions for a given acid/base reaction
9.2. you perform acid/base reactions in a laboratory setting using titration methods
9.3. you explain pH meter use in determining acid/base status of a solution
9.4. you explain the use of indicators on pH determination
9.5. you select appropriate indicator to determine acid/base status of a given solution

10. Prepare buffer solutions

Assessment Strategies

10.1. by completing laboratory exercise
10.2. on an exam

Criteria

Criteria - Performance will be satisfactory when:

10.1. you explain buffer
10.2. you explain neutralization
10.3. you explain the Henderson-Hasselbalch equation
10.4. you explain pH
10.5. you explain pKa
10.6. you explain pOH
10.7. you explain titration
10.8. you explain how buffer solutions resist changes in pH
10.9. you identify the chemicals that make or do not make good buffers
10.10. you calculate pH, pKa or concentration of buffer using Henderson-Hasselbalch equation
10.11. you predict changes in pH when changing [H3O+] or [OH-] using Henderson-Hasselbalch equation
10.12. you identify the common buffers used in the biotechnology field

11. Explain the use of oxidation-reduction reactions in a chemical setting

Assessment Strategies

11.1. by completing laboratory exercise
11.2. by completing homework packet on redox problems
11.3. on an exam

Criteria

Criteria - Performance will be satisfactory when:

11.1. you explain half-reaction
11.2. you explain oxidation
11.3. you explain reduction
11.4. you explain oxidizing agent
11.5. you explain reducing agent
11.6. you explain redox reaction
11.7. you explain oxidation number
11.8. you explain normality
11.9. you determine the oxidation number of each atom of each element in a compound or ion
11.10. you write both half-reactions for a given redox reaction
11.11. you identify elements in a redox reaction as being oxidized or reduced or as oxidizing or reducing agents
11.12. you balance a redox equation
11.13. you determine equivalents/mole an oxidizing or reducing agent has
11.14. you calculate the change from molarity (moles/liter) to normality (eq/liter).

12. Predict behavior of species involved in the redox reactions that occur in electrochemical cells and batteries

Assessment Strategies

12.1. by completing laboratory exercise
12.2. on an exam

Criteria

Criteria - Performance will be satisfactory when:

12.1. you explain anode
12.2. you explain cathode
12.3. you explain amperes
12.4. you explain coulombs
12.5. you explain Faraday
12.6. you explain positive electrode
12.7. you explain negative electrode
12.8. you sketch and label the components of an electrolytic and voltaic (galvanic) cell
12.9. you examine the function of the basic components in an electrolytic and voltaic (galvanic) cell
12.10. you calculate the standard cell potential for a given redox reaction from a table of standard reduction potentials
12.11. you explain the sign a cell potential must have in order to be spontaneous
12.12. you explain standard conditions for Eo values
12.13. you examine the process of electroplating

13. Correlate the use of thermodynamic properties to predict chemical reactions

Assessment Strategies

13.1. by completing laboratory exercise on equilibrium
13.2. on an exam

Criteria

Criteria - Performance will be satisfactory when:

13.1. you explain spontaneous
13.2. you explain nonspontaneous
13.3. you explain entropy
13.4. you explain free energy
13.5. you explain enthalpy

13.6. you explain the three laws of thermodynamics
13.7. you explain endothermic
13.8. you distinguish between exothermic and endothermic
13.9. you predict whether a reaction results in an increase, decrease, or little change in entropy
13.10. you calculate change in enthalpy, entropy or free energy for a given equation at standard condition (some values derived from table of DHo, DSo, and DGo)
13.11. you identify the specific sign (+, -) that implies a spontaneous process
13.12. you explore the thermodynamic standard conditions

14. Explain the basic concepts of biochemistry as they relate to the biotech industry

Assessment Strategies

14.1. by completing laboratory exercises
14.2. on an exam

Criteria

Criteria - Performance will be satisfactory when:

14.1. you explain an amino acid
14.2. you explain a protein
14.3. you explain a peptide bond
14.4. you explain a carbohydrate
14.5. you explain a lipid
14.6. you explain an enzyme
14.7. you explain a triglyceride
14.8. you explain a nucleic acid
14.9. you draw the basic structures of proteins, lipids, triglycerides and carbohydrates
14.10. you draw the structure of a peptide produced from the reaction of two or more amino acids
14.11. you identify the peptide bonds of a polypeptide
14.12. you identify an enzyme by the -ase suffix
14.13. you summarize the effect of pH and/or temperature change on enzyme function
14.14. you differentiate between fats and oils
14.15. you identify fat or water-soluble vitamins based on polarity
14.16. you distinguish between the primary, secondary, tertiary and quaternary structure of proteins