

Chemistry II

A Model Course Guideline

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Foreword

Chemistry II Curricular Guidelines is a model designed to assist in developing a rigorous and relevant course of study for Chemistry II, a course approved in the Secondary Science Program of Study (*Bulletin 741: Louisiana Handbook for School Administrators, 1997-2000*). The model includes a brief outline and more detailed course guidelines that embrace the core content essential skills and understandings embodied in *Compliance Handbook 308: Louisiana Science Framework* (May 1997)(formerly *Bulletin 1962*). It also presents a discussion of standards-based curriculum, the use of technology, inquiry-based science, laboratory safety, assessment, and the concept of rigorous and relevant learning for *all students*.

The intended audience for this publication includes science teachers, science chairpersons, supervisors of science, local curriculum developers, and school administrators who are involved in secondary science curriculum development and committed to high quality science education

Chemistry II

Course Description

The Chemistry II course is designed to enrich and enhance the study of basic chemistry. If the instructor deems it necessary, the objectives in Chemistry I may be used as a review tool before beginning Chemistry II.

The major topics in Chemistry II include the following:

- Chemistry Thermodynamics
- Chemical Kinetics
- Equilibrium
- Solubility
- Electrochemistry
- Nuclear Chemistry
- Organic Chemistry

Chemistry II is considered a one-credit course that parallels the material covered in an entry level college chemistry course. Lab experiences, demonstrations, and problems are used in making contemporary applications in biochemistry and industrial processes. Mathematical skills through Algebra II are used in problem solving.

Prerequisites – Chemistry I

Content Outline

- I. Atoms, Molecules, and Ions
 - A. Valence Shell Electron Pair Repulsion Theory
 - B. Molecular Geometry
 - C. Valence Bond Theory
- II. Stoichiometry
 - A. Balance Redox Equation
 - B. Mass Relations Involving Successive Chemical Reactions with Limiting Reactant and/or Percentage Yield and/or Solutions Concentration
- III. Solutions
 - A. Comparison of Types of Solutions
 - B. Determination of Concentrations
- IV. Energy Relationship Involved in Chemical Thermodynamics
 - A. 1st Law of Thermodynamics
 - B. Terminology
 - C. Internal Energy
 - D. Calorimetry
 - E. Enthalpy
 - F. Hess' Law
 - G. Bond Energies

- H. Born-Haber Cycle
 - I. 2nd Law of Thermodynamics
 - J. Entropy
 - K. Gibb's Free Energy
 - L. Temperature Dependence
- V. Reaction Rates in Terms of Energy
- A. Reaction Rate
 - B. Nature of Reactants
 - C. Rate Law Expression
 - D. Collision Theory
 - E. Rate Law
 - F. Catalysis
- VI. Equilibrium and Factors Influencing Direction of Reactions
- A. Basic Concept
 - B. Equilibrium Constants (K_{eq} , K_{sp})
 - C. Reaction Quotient
 - D. Factors Affecting Equilibrium
 - E. Le Chatelier Principle
 - F. Dalton's Law of Partial Pressures
- VII. Acids and Bases
- A. Acids and Bases Investigations
 - B. Description of Acids and Bases through an Equilibrium Perspective
- VIII. Electrochemistry
- A. Explanation of the Interchange of Chemical and Electrical Energy using Electrochemistry
 - B. Description of the Relationship among Standard Voltage (E°), Standard Free Energy Change (G°), and Equilibrium Constant (K)
- IX. Nuclear Chemistry
- A. Nature and Importance of Radioactive Isotopes
 - B. Nuclear Reactions
- X. Organic Chemistry
- A. Nomenclature
 - B. Bonds
 - C. Structures

Model Curriculum Guidelines

Chemistry II	
TOPICS	BENCHMARKS
<p>I. Atoms, Molecules, and Ions</p> <p>A. VSEPR (Valance Shell Electron Pair Repulsion) Theory</p> <ol style="list-style-type: none">1. Describe or diagram the spins of electron pairs2. Explain molecular shape and bonding <p>B. Molecular Geometry</p> <p>C. Valance Bond Theory</p> <ol style="list-style-type: none">1. Relate molecular shape and bonding to valence electrons2. Relate double and triple bonds to valence electrons	<p>PS-H-B3 PS-H-C3 PS-H-C5 PS-H-A3</p>
<p>II. Stoichiometry</p> <p>A. Redox Equations</p> <ol style="list-style-type: none">1. Write redox equations using accurate formulas and symbols2. Balance by ion-electron method (half reactions methods) <p>B. Mass Relations</p> <ol style="list-style-type: none">1. Describe limiting reactant with successive chemical reactions2. Determine reactant mixtures and yield3. Describe reactions in aqueous solutions4. Apply to quantitative analysis<ol style="list-style-type: none">a. Titrationb. Gravimetric reactions	<p>PS-H-A2 PS-H-D3 S1-H-A3 S1-H-A1 S1-H-A2</p>
<p>III. Solutions</p> <p>A. Determination of Concentrations of Solutions</p> <ol style="list-style-type: none">1. Determine concentration by percent of weight2. Determine concentration molarity3. Describe concentration by parts per thousand, million, billion, and/or trillion	<p>PS-H-C3 S1-H-A3</p>

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TOPICS	BENCHMARKS
<p>IV. Energy Relationship Involved in Chemical Thermodynamics</p> <ul style="list-style-type: none">A. 1st Law of ThermodynamicsB. TerminologyC. Internal EnergyD. CalorimetryE. EnthalpyF. Hess' LawG. Bond EnergiesH. Born-Haber CycleI. 2nd Law of ThermodynamicsJ. EntropyK. Gibb's Free EnergyL. Temperature Dependence	<p>PS-H-F2 S1-H-A3</p>
<p>V. Reaction Rates in Terms of Energy</p> <ul style="list-style-type: none">A. Reaction RateB. Nature of ReactantsC. Rate Law ExpressionD. Collision TheoryE. Rate LawF. Catalysis	<p>PS-H-D4 S1-H-A3 PS-H-D6 PS-H-D7</p>
<p>VI. Equilibrium and Factors Influencing Direction of Reactions</p> <ul style="list-style-type: none">A. Basic ConceptB. Equilibrium Constants (K_{eq}, K_{sp})C. Reaction QuotientD. Factors Affecting EquilibriumE. Le Chatelier PrincipleF. Dalton's Law of Partial Pressures	<p>S1-H-A3 PS-H-D4</p>

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TOPICS	BENCHMARKS
<p>VII. Acids and Bases</p> <p>A. Acids and Bases Investigations</p> <ol style="list-style-type: none">1. Compare theories<ol style="list-style-type: none">a. Arrheniusb. Bronsted-Lowryc. Lewis2. Describe properties of acids and bases using examples3. Describe and determine relative strengths of acids<ol style="list-style-type: none">a. Monoprotic acidsb. Diprotic acidsc. Triprotic acids4. Describe reactions between acids and bases5. Relate salts to neutralization reactions	<p>PS-H-D2 PS-H-D3 S1-H-A3 S1-H-A4</p>
<p>VIII. Electrochemistry</p> <p>A. Explanation of the Interchange of Chemical and Electrical Energy using Electrochemistry</p> <ol style="list-style-type: none">1. Explain conductivity2. Determine the components of an electrochemical cell3. Describe voltaic cells4. Compare electrochemical cells, voltaic cells, and electrolytic cells5. Determine cell potential <p>B. Description of the Relationship among Standard Voltage (E°), Standard Free Energy Change (G°), and Equilibrium Constant (K)</p>	<p>PS-H-F2 PS-H-D6 PS-H-D7 PS-H-D3 S1-H-A3</p>

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TOPICS	BENCHMARKS
<p>IX. Nuclear chemistry</p> <p>A. Use Nuclear Chemistry to Describe the Nature and Importance of Radioactive Isotopes</p> <ol style="list-style-type: none">2. Relate nuclear stability and binding energy3. Identify processes in radioactive decay4. Describe methods of detection of radiation5. Use rate of decay (half-life) to solve age problems6. Describe disintegration series7. Determine the nature of radio nuclides <p>B. Nuclear Reactions</p> <ol style="list-style-type: none">1. Compare fission and fusion2. Discuss effectiveness and dangers of nuclear reactors3. Debate the effectiveness and advisability of nuclear bombs	<p>PS-H-B2 S1-H-A3</p>
<p>X. Organic Chemistry</p> <p>A. Nomenclature</p> <ol style="list-style-type: none">1. Define and identify saturated compounds2. Define and identify unsaturated compounds3. Define and identify functional groups4. Define and identify aromatic compounds <p>B. Types of Bonds in Organic Compounds</p> <ol style="list-style-type: none">1. Compare bond types2. Describe and /or explain organic reactions <p>C. Structures</p> <ol style="list-style-type: none">1. Diagram structural formulas for organic compounds2. Write structural equations for organic reactions3. Examine geometries created by bonds in organic molecules	<p>PS-H-C6 S1-H-A3</p>

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