Wallingford Public Schools - HIGH SCHOOL COURSE OUTLINE

Course Title: Chemistry	**Course Number**: A 2313 H 2322
Department: Science	**Grade(s)**: 10, 11, 12
Level(s): Academic and Honors	**Credit**: 1

Course Description:
Chemistry investigates matter and the changes that it undergoes. Topics include: atomic structure, formula and equation writing, bonding, solutions, ionization, kinetic-molecular theory, acid-base theory and the interrelations and impact of chemistry on society. Theories that are presented focus on the behavior of atoms, ions, and molecules. Students will be expected to develop the ability to express theories both verbally and mathematically. (Prerequisite: Algebra 1)

Required Instructional Materials	**Completion/Revision Date**
• *Modern Chemistry*, Holt, 2000. • *Chemistry,* Wilbraham, Staley, Matta, and Waterman, Prentice Hall, 2005. • Teacher resources that accompany the text • Current and sufficient laboratory materials and equipment for each of the learning strands • Appropriate safety equipment – goggles, aprons, eyewash, safety shower, etc. • Information technologies – internet and library resources Wall-size Periodic Table	Revisions Approved by Board of Education on December 15, 2008

Mission Statement of the Curriculum Management Team

The mission statement of the Science Curriculum Management Team is to promote scientific literacy emphasizing the process, content, and interdisciplinary nature of science.

Enduring Understandings for the Course

- Inquiry is the integration of process skills, the application of scientific content and critical thinking to solve problems.
- Science is the method of observation and investigation used to understand our world.
- Technological tools have helped scientists to update theories that describe the nature of atoms.
- The Periodic Table is arranged in a logical sequence that can be used to predict the properties of elements.
- Matter can be described, organized, and classified for understanding.
- Scientific ideas evolve as new information is discovered.
- Chemists use and understanding of bond types to explain the behavior of matter.
- Advances in chemistry have personal and societal costs and benefits.
- Chemical symbols, formulas, and equations are understood internationally and are

written based upon universally accepted guidelines.
• Basic principles of the Kinetic Molecular Theory govern the interactive relationship between energy and physical phase changes.
• Energy not only provides the ability to do work, but drives systems and cycles of our universe, solar system, Earth, and life.
• The unique nature of solute-solvent interaction explains the solution process.
• Applied practical applications of colligative properties support modern society, i.e., antifreeze and ice cream manufacturing.
• The environment is a complex assemblage of interacting and evolving chemical, physical, and biological processes.
• The current state of any environment is maintained by the dynamic exchange of the processes that dictate its nature. Changes in any of the interacting processes will impact the current state.
• Acids and bases and the pH scale are important to understanding the environment, household chemicals, and homeostasis in the human body.

LEARNING STRAND

1.0 Scientific Reasoning and Communication Skills

NOTE: This learning strand should be taught through the integration of the other learning strands. This learning strand is not meant to be taught in isolation as a separate unit.

ENDURING UNDERSTANDING(S)

- Inquiry is the integration of process skills, the application of scientific content and critical thinking to solve problems.
- Science is the method of observation and investigation used to understand our world.

LEARNING OBJECTIVES The student will:

1.1 Generate scientific questions to be investigated.
1.2 Apply appropriate instruments needed to collect data precisely.
1.3 Analyze experimental design and data so as to question validity, identify variables, and improve experimental design.
1.4 Develop conclusions based on critical data analysis identifying further investigations and/or questions based on the results.
1.5 Organize data in tables and graphs.
1.6 Utilize graphs in order to determine patterns and make predictions.
1.7 Apply computer-based tools to research and present information.
1.8 Gather information using a variety of print and non-print sources.
1.9 Support scientific arguments using a variety of print and non-print sources.
1.10 Present scientific information orally.
1.11 Present scientific information in an expository format so that it adheres to standard forms of grammar and mechanics.
1.12 Understand and demonstrate lab safety practices and procedures.

INSTRUCTIONAL SUPPORT MATERIALS

- Sufficient laboratory instrumentation
- Appropriate Safety Equipment

SUGGESTED INSTRUCTIONAL STRATEGIES

- Performance tasks
- Open-ended labs
- Inquiry
- Modeling
- Hands-on, minds-on lab activities
- Computer created spreadsheets and graphs
- See other learning strands for integration

SUGGESTED ASSESSMENT METHODS

- Lab reports
- Open-ended questions
- Teacher observations
- Essays and/or compositions
- Excel spreadsheets and graphs
- Research based projects
- Computer created spreadsheets and graphs
- See other learning strands for integration

LEARNING STRAND

2.0 Atomic Theory

ENDURING UNDERSTANDING(S)

- Technological tools have helped scientists to update theories that describe the nature of atoms
- The Periodic Table is arranged in a logical sequence that can be used to predict the properties of elements.
- Matter can be described, organized, and classified for understanding.
- Scientific ideas evolve as new information is discovered.

LEARNING OBJECTIVES – The students will:

2.1 Investigate the historical development of the modern atomic theory.

2.2 Compare and contrast subatomic particles with respect to mass, charge, and location in the atom.

2.3 Predict the electron configurations of atoms using the Periodic Table as a tool.

2.4 Describe periodic trends.

- Atomic radius
- Ionization energy
- Electronegativity
- Electron affinity

2.5 Identify elements according to their flame test and spectral lines as seen through a spectroscope. (i.e. the colors in fireworks or emission spectra).

2.6 Calculate the Energy values for specific wavelengths of light. (i.e. ultraviolet vs infrared).

INSTRUCTIONAL SUPPORT MATERIALS

- Spectroscope and gas tube samples
- Voltage supply box
- Atomic models and posters

SUGGESTED INSTRUCTIONAL STRATEGIES

- Laboratory investigations and inquiry activities (aluminum foil lab, spectroscope analysis and flame tests)
- Time line, graphic organizer and sequencing activity on history on atomic theory
- Question, answer, and discussion
- Graphing activity on periodic trends
- Cooperative Activities (labs, pair and share, etc.)
- Problem solving (finding wavelength, frequency, and Energy of an electron)
- Demonstrations (Fireworks models)
- Videos (Atomic structure and light)

SUGGESTED ASSESSMENT METHODS

- Laboratory observations, reports, and performance assessment.
- Abstract /summaries of scientific articles relating to atomic theory.
- Homework (readings, questions, and problems)
- Tests and quizzes
- Student participation

LEARNING STRAND

3.0 Chemical Bonding

ENDURING UNDERSTANDING(S

- Chemists use an understanding of bond types to explain the behavior of matter.
- Advances in chemistry have personal and societal costs and benefits.

LEARNING OBJECTIVES – The students will:

3.1 Identify bond type by electronegativity differences. (ionic, polar, and non polar)
3.2 Apply the octet rule to explain and diagram Lewis structures.
3.3 Construct molecular models with single, double, and triple bonds.
3.4 Compare and contrast the distinctive properties of ionic and molecular compounds.
3.5 Predict molecular shape by using VSEPR theory.
3.6 Describe the formation of macromolecules (polymers) using the covalent bonding principles.
3.7 Identify examples of common polymers and their uses. (nylon, Teflon, pvc)

INSTRUCTIONAL SUPPORT MATERIALS

- Molecular model kits
- Electronegativity table
- Conductivity apparatus

SUGGESTED INSTRUCTIONAL STRATEGIES

- Laboratory investigations and inquiry activities. (Model construction, melting point of ionic and molecular compounds)
- Color code index cards for electronegativity differences
- Diagram models and identify appropriate bonding
- Activity on molecular geometry
- Question, answer, and discussion
- Problem solving
- Demonstrations (water stream polarity, surface tension, Teflon tape lab, nylon rope trick, polyurethane foam)
- Video on recycling of plastics

SUGGESTED ASSESSMENT METHODS

- Laboratory assessment understanding models.
- Laboratory reports
- Abstracts/summaries relating to chemical bonding and plastics recycling)
- Homework (readings, questions, and problems)
- Tests and quizzes
- Student participation

LEARNING STRAND

4.0 The Language of Chemistry

ENDURING UNDERSTANDING(S)

- Chemical symbols, formulas, and equations are understood internationally and are written based upon universally accepted guidelines.

LEARNING OBJECTIVES – The students will:

4.1 Demonstrate how to write correct chemical formulas and chemical equations.
4.2 Balance chemical equations by applying the mole concept.
4.3 Calculate percent composition and then determine an empirical formula.
4.4 Identify reaction types and predict reaction outcomes. (synthesis, decomposition, etc)
4.5 Analyze chemical reactions for limiting reactant and percent yield.
4.6 Solve stoichiometric calculations for balanced equations.

INSTRUCTIONAL SUPPORT MATERIALS

- Electronic balances
- Ion sheets for cations and anions.

SUGGESTED INSTRUCTIONAL STRATEGIES

- Laboratory investigations (mass/mass and percent yield, empirical formula determination)
- Lecture
- Question, answer, and discussion
- Cooperative problem solving
- Problem solving
- Modeling (balancing chemical equations)

SUGGESTED ASSESSMENT METHODS

- Laboratory observation and reports.
- Homework (readings, questions, and problems)
- Tests and quizzes
- Student participation

LEARNING STRAND

5.0 Phases of Matter

ENDURING UNDERSTANDING(S)

- Basic principles of the Kinetic Molecular Theory govern the interactive relationship between energy and physical phase changes.
- Energy not only provides the ability to do work, but drives systems and cycles of our universe, solar system, Earth, and life.

LEARNING OBJECTIVES – The students will:

5.1 Apply the Kinetic Molecular Theory to explain solids, liquids, and gases.
5.2 Analyze the interrelationships of pressure, temperature, and volume as they apply to each of the Gas Laws.
5.3 Calculate gas volumes and masses using standard molar volume and the Ideal Gas Law.
5.4 Interpret energy changes associated with a physical phase change diagram of a substance.
5.5 Calculate energy values associated with the processes of boiling, freezing, melting, and sublimation. (H only)

INSTRUCTIONAL SUPPORT MATERIALS

- Eudiometer
- Vacuum bell jar apparatus
- Absolute zero apparatus

SUGGESTED INSTRUCTIONAL STRATEGIES

- Laboratory investigations (determination of the molar volume of a gas, molar mass of a volatile liquid, Boyle's Law lab).
- Lecture
- Question, answer, and discussion
- Cooperative Activities
- Problem solving
- Demonstrations (Absolute zero demo, Dynamite soap)

SUGGESTED ASSESSMENT METHODS

- Laboratory performance and report.
- Abstracts/summaries of global warming, refrigeration, ozone depletion)
- Homework (readings, questions, and problems)
- Tests and quizzes
- Student participation

LEARNING STRAND

6.0 The Solution Process

ENDURING UNDERSTANDING(S)

- The unique nature of solute-solvent interaction explains the solution process.
- Applied practical applications of colligative properties support modern society, i.e., antifreeze and ice cream manufacturing.
- The environment is a complex assemblage of interacting and evolving chemical, physical, and biological processes.

LEARNING OBJECTIVES The student will:

6.0 Differentiate between heterogeneous and homogeneous mixtures.

6.1 Compare solute-solvent combinations to identify true solutions, colloids, and suspensions.

6.2 Identify energy and other physical factors that affect the solution process.

6.3 Demonstrate methods of preparing solution of differing concentrations.

- Calculate molarity
- Calculate molality
- Percent by mass
- Percent by volume (Honors)
- Mole fraction (Honors)

6.4 Discuss four colligative properties.

6.5 Calculate freezing point depressions and boiling point elevations for specific solution concentrations.

INSTRUCTIONAL SUPPORT MATERIALS

- Volumetric flasks
- Electronic balances
- Hot plates
- Thermometers
- Ice

SUGGESTED INSTRUCTIONAL STRATEGIES

- Laboratory investigations (freezing point depression lab, solubility determination)
- Question, answer, and discussion
- Problem solving
- Demonstrations (solution, colloid, or suspension)

SUGGESTED ASSESSMENT METHODS

- Laboratory observation and performance assessment
- Laboratory reports.
- Abstracts/summaries of soda manufacturing, blood chemistry, scuba diving)
- Tests and quizzes
- Student participation

LEARNING STRAND

7.0 Acids and Bases

ENDURING UNDERSTANDING(S)

- The environment is a complex assemblage of interacting and evolving chemical, physical, and biological processes.
- The current state of any environment is maintained by the dynamic exchange of the processes that dictate its nature. Changes in any of the interacting processes will impact the current state.
- Acids and bases and the pH scale are important to understanding the environment, household chemicals, and homeostasis in the human body.

LEARNING OBJECTIVES The student will:

7.1 Express the differences among acid base theories.
7.2 Compare and contrast the physical and chemical properties of acids and bases.
7.3 Explain the process of neutralization.
7.4 Demonstrate & calculate a titration reaction in the laboratory.
7.5 Apply the pH scale to compare various acid/base strengths.
7.6 Explain the function of a buffer system in maintaining pH.
7.7 Evaluate the impact of acid/base chemistry on the environment and society.

INSTRUCTIONAL SUPPORT MATERIALS

- Burets or some titration apparatus.
- Appropriate indicators.

SUGGESTED INSTRUCTIONAL STRATEGIES

- Laboratory investigations (vinegar titration).
- Direct instruction
- Question, answer, and discussion
- Problem solving
- Demonstrations

SUGGESTED ASSESSMENT METHODS

- Laboratory observation and performance assessment.
- Laboratory reports
- Research project (web quest on acid rain)
- Abstracts, scientific understanding
- Homework (readings, questions, and problems)
- Tests and quizzes
- Student participation

Chemistry Curriculum Map Wallingford Public Schools

Revised June 29, 2008

SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY
2. Atomic Theory (13 blocks) 10 blocks	2. Atomic Theory (13 blocks – end mid-October) 11 blocks	Chemical Bonding (13 blocks) 7 blocks	Finish Chemical Bonding Language of Chemistry 4.1-4.4 8 blocks	Language of Chemistry 4.1-4.4 7 blocks COMMON MID-TERMS
FEBRUARY	**MARCH**	**APRIL**	**MAY**	**JUNE**
Language of Chemistry 4.5 & 4.6 (Stoichiometry) 7 blocks	Phases of Matter (gas law) 9 blocks - CAPT	Solution Process 8 blocks	Acids and Bases 10 blocks	Review COMMON FINAL EXAM 4 blocks

Learning Strand 1 Objectives – Scientific Reasoning and Communication Skills will be integrated throughout all the units.