

## Spectrum Program

### Session 1

#### Course Title: Topics in Chemistry Honors

### Course Description

Do you know the common name for acetylsalicylic acid? Hint: it can relieve a headache and reduce the risk of heart attack and stroke. This course is designed to expand students' understanding of the chemistry in everyday surroundings. This laboratory-based course exposes students to the fundamentals of chemistry, including atomic theory, stoichiometry, reactions, bonding, periodic trends, and acids and bases. Daily lab experiments allow students to learn hands-on while practicing important lab safety techniques, providing a foundation for advanced study in chemistry.

### Essential Questions

- Why is the scope of chemistry so vast and central to all the sciences?
- In what ways can chemistry be useful in explaining the natural world, preparing people for career opportunities, and producing informed citizens?
- How can the understanding of the properties of matter and how it changes help chemists design materials to fit specific needs?

### Outcomes

Upon successful completion of this course, students will:

- Know
  - differentiation between physical and chemical properties or changes of matter.
  - chemical formula writing by applying the principles of nomenclature using IUPAC rules.
  - electron configurations for the atoms of the elements.
  - stoichiometric calculations. preparation of solutions and dilutions to a specified molarity.
  - how to determine the limiting reagent and calculate the percent yield of a reaction.
  - proper behavior and safety in the laboratory through daily investigations in chemical phenomena.
- Understand
  - the basic principles of matter and how matter changes to form new substances.
  - the structure of atoms and how electrons influence chemical properties of elements.
  - the basics of chemical bonding.
  - the differences between acids and bases.
  - gas properties, phases of matter, and phase changes using the kinetic molecular theory.
- Apply
  - the steps in the scientific method to chemical behavior.
  - knowledge of chemical and physical properties to separate a mixture.
- Analyze, synthesize, or create
  - predict the properties of elements depending on its location on the Periodic Table of the Elements.
  - predict the results of a chemical reaction and write balanced chemical equations.
  - design a procedure for testing unknowns.

### Instructional Strategies

*Topics in Chemistry Honors* is a hands-on science course that incorporates individual and group exploration of the concepts of chemistry. Students will be exposed to a problem-based learning curriculum that will enhance mathematical skills. Inquiry-based lessons will promote student curiosity that will motivate the student to activate prior knowledge. Tiered assignments will allow students to work in their specific learning styles or preferences. Teacher power point presentations and demonstrations, internet visuals, and student flexible grouping activities will inspire the students to seek ways to answer “how” and “why” questions concerning the chemical nature of the physical world.

## Resources and Materials

- **Book**  
Matta, M., Staley, D., Waterman, E., Wilbraham, A., *Prentice Hall Chemistry*, 2005, ISBN 0-13-115262-9
- **Web sites**
  - a. <http://proton.csudh.edu/homework/hwintro.html>  
An electronic homework site from the CSUDH chemistry department containing a variety of fundamental chemical concepts
  - b. <http://science.widener.edu/svb/tutorial/index.html>  
A chemical drill and practice tutorial from CSU containing chapter by chapter word problems and data analysis problems
  - c. <http://funbasedlearning.com>  
A chemical equation balancing drill in model format
- **Materials**  
Scientific Calculator (Graphing Calculator is not required)  
3-ring binder with loose-leaf paper (supplied by CTD).  
Long pants and shoes. No sandals, or open-toed shoes allowed in the lab.

## Student Assessment

- **Pre-Assessment**  
A standardized 60 question multiple choice pre-test will be administered on the first day of class that will measure student chemical knowledge prior to this course.
- **CTD Grading Scale**

A+	100-97%	A	96-93%	A-	92-90%
B+	89-87%	B	86-83%	B-	82-80%
C+	79-77%	C	76-73%	C-	72-70%
D+	69-67%	D	66-63%	D-	62-60%
F	below 60%				
- **Breakdown of Final Grade**
  1. **30% Tests:** Tests will be given each Friday and will cover the material studied during that week.
  2. **25% Laboratory:** There will be a series of 21 labs. Some labs require more than a day to complete and are designed to build confidence and exceptional lab technique. Lab reports will be collected the day after the lab was conducted, unless otherwise noted. A lab practical will be given and recorded as part of the final exam grade.
  3. **15% Opener/Exit Slips/Quizzes:** There will be a short opener or quiz daily on the material studied the previous day. Not all openers or exit slips will be graded since these allow the teacher to assess background knowledge and how well the class, as well as individual students, have grasped a lesson.
  4. **10% Homework:** Homework will be assigned daily to strengthen the student’s chemistry knowledge. Homework is practice, and practice will prepare the student for the quizzes and tests! All students must turn in all assignments by the date and time due. Points will be awarded depending on the quality of the work.
  5. **20% Final Exam:** A comprehensive final exam (students will be given a practice exam as homework several days prior to the final exam as a course review)

- **Post-Assessment**

A comprehensive standardized post assessment will be administered on the last day of class to provide data on student growth.

### Assignments

All assignments are due at the beginning of class on the day indicated on the syllabus. Late assignments will NOT be accepted.

### Schedule

Date(s)	Topic(s)	In-Class Activities	Assignments/Assessments
Sun 6/26	<b>Parent-Teacher Conferences</b> Opening Day Instructions		1. Read over Lab 1. 2. Read over the lab safety handouts.
<b>Day 1</b> Mon 6/27	<b>Chapter 1: Introduction to Chemistry</b> <b>Chapter 2: Matter and Change</b>  Introductions and Policies What is Chemistry? The Scientific Method What is Matter? Substances and Mixtures Physical and Chemical Changes Elements and Compounds Chemical Reactions Conservation of Mass	<b>Laboratory:</b> Tour the Lab Lab Procedures and Safety  <b>Signing of Safety Agreement</b>  <b>Pre-Test Administration</b>  <b>Lab 1: Chemical Apparatus</b>  <b>Lab 2: Phys/Chem Properties</b>	<ul style="list-style-type: none"> <li>▪ Read Chapters 1 &amp; 2</li> <li>▪ Homework: p. 34-36 #35, 62, 70, 78 p. 37 #7 p. 58-59 #35, 39, 41, 43, 46, 49, 50, 54, 56, 66, 67, 70, 71</li> <li>▪ Write-up Lab 1 &amp; 2</li> </ul>
<b>Day 2</b> Tues 6/28	<b>Chapter 3: Scientific Measurement</b> <ul style="list-style-type: none"> <li>▪ Scientific Measurement</li> <li>▪ Precision, Accuracy, and Error</li> <li>▪ Scientific Notation</li> <li>▪ Significant Figures</li> <li>▪ SI Units</li> <li>▪ Density</li> <li>▪ Problem Solving in Chemistry</li> </ul>	<b>Lab 3: Density of Liquids/Solids</b>	<ul style="list-style-type: none"> <li>▪ <b>Quiz 1: Lab Safety and Chap 1/2</b></li> <li>▪ Read Chapter 3</li> <li>▪ Homework: p. 68 – 96: #1, 3, 5, 7, 13, 16, 20, 22, 24, 30, 31, 32, 33, 34, 36, 43, 45, 53, 54, 55, 56, 57.</li> <li>▪ Write-up Labs 3</li> </ul>

<p><b>Day 3</b> Wed 6/29</p>	<p><b>Chapter 4: Atomic Structure</b></p> <ul style="list-style-type: none"> <li>▪ The structure of the atom</li> <li>▪ Protons, Neutrons, Electrons</li> <li>▪ Atomic Number, Mass Number</li> <li>▪ Atomic Mass</li> <li>▪ Isotopes</li> </ul> <p><b>Chapter 5: Electrons in Atoms</b></p> <ul style="list-style-type: none"> <li>▪ Evolution of Atomic Models</li> <li>▪ The Quantum Mechanical Model</li> <li>▪ Orbitals</li> <li>▪ Electron Configurations</li> <li>▪ Light and Atomic Spectra</li> <li>▪ Quantum Mechanics</li> </ul>	<p><b>Lab 4: Metric System Measure</b></p>	<p><b>Quiz 2 : Chapter 3</b></p> <ul style="list-style-type: none"> <li>▪ Read Chapters 4 and 5</li> <li>▪ Homework: <ul style="list-style-type: none"> <li>p. 103 – 124 #6, 7, 10, 13, 14, 17, 19, 23, 25, 36, 50, 81</li> <li>p. 132 – 146: # 3, 6, 7, 8, 10, 14-21.</li> <li>p. 149-151: #25, 26, 30, 33, 36, 37, 39, 41, 42, 45, 48, 50, 55, 59, 63, 65, 69, 71.</li> </ul> </li> <li>▪ Write-up Lab 4</li> </ul>
<p><b>Day 4</b> Thurs 6/30</p>	<p><b>Chapter 6: The Periodic Table</b></p> <ul style="list-style-type: none"> <li>▪ Classifying Elements</li> <li>▪ Periodic Trends</li> </ul>	<p><b>Review for Test 1</b></p> <p><b>Lab 5: Periodic Classification of the Elements</b></p>	<p><b>Quiz 3: Chapter 4 and 5</b></p> <ul style="list-style-type: none"> <li>▪ Prepare for Test 1</li> <li>▪ Read Chapter 6</li> <li>▪ Homework: <ul style="list-style-type: none"> <li>p. 160 – 182: #2 – 7, 12 – 23, 28, 36, 37, 38, 39, 40, 42, 48</li> </ul> </li> <li>▪ Write-up Lab 5</li> </ul>
<p><b>Day 5</b> Fri 7/1</p>	<p><b>Chapter 7: Ionic and Metallic Bonding</b> <b>Chapter 8: Covalent Bonding:</b></p> <ul style="list-style-type: none"> <li>▪ Valence Reactions</li> <li>▪ The Octet Rule</li> <li>▪ Formation of Cations and Anions</li> <li>▪ Ionic Bonds and Ionic Compounds</li> <li>▪ Properties of Ionic Compounds</li> <li>▪ Properties of Metals</li> <li>▪ Molecular Compounds</li> <li>▪ Molecular Formulas</li> <li>▪ The Nature of Covalent Bonds</li> <li>▪ Polar Bonds and Molecules</li> </ul>	<p><b>Lab 6: Structure of Compounds</b></p>	<p><b>Test 1: Chapters 1, 2, 3, 4, 5, 6</b></p> <ul style="list-style-type: none"> <li>▪ Read Chapters 7 and 8</li> <li>▪ Homework: <ul style="list-style-type: none"> <li>p. 193 – 208: #1, 2, 4, 8, 9, 10, 11, 12, 13, 15, 16, 18, 19, 20, 21, 22, 28, 67</li> <li>p. 216 – 244: #5, 8, 9, 10, 11, 12, 19, 20, 21, 28, 30, 37</li> </ul> </li> <li>▪ Write-up Lab 6</li> </ul>
<p><b>Day 6</b> Mon 7/4</p>	<p><b>Chapter 9: Chemical Names and Formulas</b></p> <ul style="list-style-type: none"> <li>▪ Monatomic Ions</li> <li>▪ Polyatomic Ions</li> <li>▪ Naming and Writing Chemical Formulas</li> </ul>	<p><b>Lab 7: Making Models of Ionic Formulas</b></p> <p><b>Lab 8: Oxygen Lab</b></p>	<p><b>Quiz 4: Chapters 7 and 8</b></p> <ul style="list-style-type: none"> <li>▪ Read Chapter 9</li> <li>▪ Homework: <ul style="list-style-type: none"> <li>p. 256 – 279 #6, 8, 9, 10, 11, 12, 13, 17, 18, 19, 22, 24, 29, 30, 31, 32.</li> </ul> </li> <li>▪ Write-up Labs 7 &amp; 8</li> </ul>

<p><b>Day 7</b> Tues 7/5</p>	<p><b>Chapter 11: Chemical Reactions</b></p> <ul style="list-style-type: none"> <li>▪ Writing Chemical Equations</li> <li>▪ Balancing Chemical Equations</li> <li>▪ Types of Chemical Reactions</li> <li>▪ Reactions in Aqueous Solution</li> </ul>	<p><b>Lab 9: Observing Chem Change</b></p> <p><b>Lab 10: Ionic Equations</b></p> <p><b>Lab 11 (Demo) Redox Reactions</b></p>	<p><b>Quiz 5: Chapter 9</b></p> <ul style="list-style-type: none"> <li>▪ Read Chapter 11</li> <li>▪ Homework: p. 324 – 344: # 1, 2, 3, 4, 5, 6, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 28, 29, 33, 34, 35</li> <li>▪ Write-up Labs 9, 10</li> </ul>
<p><b>Day 8</b> Wed 7/6</p>	<p><b>Chapter 10: Chemical Quantities</b></p> <ul style="list-style-type: none"> <li>▪ What is a Mole?</li> <li>▪ The Mass of a Mole of Elements and Compounds</li> <li>▪ Mole-mass and Mole-volume Relationships</li> <li>▪ Percent Composition</li> <li>▪ Empirical Formulas</li> <li>▪ Molecular Formulas</li> </ul>	<p><b>Lab 12: Understanding the Mole</b></p> <p><b>Lab 13: Percent Water in a Hydrate</b></p>	<p><b>Quiz 6: Chapter 11</b></p> <ul style="list-style-type: none"> <li>▪ Read Chapter 10</li> <li>▪ Homework: p. 286 – 310: #1, 3, 4, 5, 6, 7, 8, 16, 17, 18, 19, 20, 22, 23, 32, 33, 34, 35, 36, 37, 38, 39, 45.</li> <li>▪ Write-up Labs 12 and 13</li> </ul>
<p><b>Day 9</b> Thurs 7/7</p>	<p><b>Chapter 12: Stoichiometry</b></p> <ul style="list-style-type: none"> <li>▪ Using Balanced Equations</li> <li>▪ Interpreting Chemical Equations</li> <li>▪ Mole Ratios</li> <li>▪ Stoichiometric Calculations</li> <li>▪ Limiting Reagents and Percent Yields</li> </ul>	<p><b>Lab 14: NaHCO<sub>3</sub> Stoichiometry</b></p> <p><b>Lab 15: Analysis by Precipitation</b></p>	<p><b>Quiz 7: Chapter 10</b></p> <ul style="list-style-type: none"> <li>▪ Read Chapter 12</li> <li>▪ Homework: p. 355 – 375: #1, 4, 12, 13, 14, 15, 16, 18, 19, 24, 25, 28, 29, 30, 31, 32.</li> <li>▪ Write-up Labs 14 &amp; 15</li> </ul>
<p><b>Day 10</b> Fri 7/8</p>	<p><b>Chapter 13: States of Matter</b></p> <ul style="list-style-type: none"> <li>▪ Kinetic Theory</li> <li>▪ Gas Pressure</li> <li>▪ The Nature of Gases</li> <li>▪ The Nature of Liquids</li> <li>▪ The Nature of Solids</li> <li>▪ Evaporation</li> <li>▪ Vapor Pressure</li> <li>▪ Boiling Point</li> <li>▪ Changes of State</li> </ul>	<p><b>Lab 16: Change of State</b></p>	<p><b>Test 2: Chap 7, 8, 9, 10, 11, 12</b></p> <ul style="list-style-type: none"> <li>▪ Read Chapter 13</li> <li>▪ Homework: p. 387 – 404: # 1- 25.</li> <li>▪ Write-up Lab 16</li> </ul>
<p><b>Day 11</b> Mon 7/11</p>	<p><b>Chapter 14: The Behavior of Gases</b></p> <ul style="list-style-type: none"> <li>▪ Boyle's Law</li> <li>▪ Charles's Law</li> <li>▪ Gay-Lussac's Law</li> <li>▪ The Combined Gas law</li> <li>▪ Ideal Gas Law</li> <li>▪ Avogadro's Hypothesis</li> <li>▪ Dalton's Law</li> <li>▪ Graham's Law</li> </ul>	<p><b>Lab 17: Charles's Law</b></p> <p><b>Lab 18 Determining the molar mass of butane</b></p> <p><b>Optional Lab: Mole Rockets</b></p>	<p><b>Quiz 8: Chapter 13</b></p> <ul style="list-style-type: none"> <li>▪ Read Chapter 14</li> <li>▪ Homework: p. 417 – 440: # 1, 2, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 23, 24, 30, 31, 32, 38, 76.</li> <li>▪ Write-up Labs 17 and 18.</li> </ul>

<p><b>Day 12</b> Tues 7/12</p>	<p><b>Chapter 15: Water and Aqueous Systems</b> <b>Chapter 16: Solutions</b></p> <ul style="list-style-type: none"> <li>▪ Water and Its Properties</li> <li>▪ Homogeneous Aqueous Systems</li> <li>▪ Heterogeneous Aqueous Systems</li> <li>▪ Properties of Solutions</li> <li>▪ Factors Affecting Solubility</li> <li>▪ Concentrations of Solutions</li> <li>▪ Colligative Properties of Solutions</li> </ul>	<p><b>Lab 19: Freezing Point Depression</b></p>	<p><b>Quiz 9: Chapter 14</b></p> <ul style="list-style-type: none"> <li>▪ Read Chapters 15 and 16</li> <li>▪ Homework: p. 449 – 462: #1 – 5, 7, 8, 9, 12, 13, 14, 17, 20, 21.</li> <li>▪ p. 477-496: #1, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 23, 24, 25, 27, 29, 31, 33, 35.</li> <li>▪ Write-up Lab 19</li> </ul>
<p><b>Day 13</b> Wed 7/13</p>	<p><b>Chapter 19 Acids, Bases, Salts</b></p> <ul style="list-style-type: none"> <li>• Properties of Acids and Bases</li> <li>• Hydrogen Ions and Acidity</li> <li>• pH and pH Measurement</li> <li>• Arrhenius Acids and Bases</li> <li>• Bronsted-Lowry Acids &amp; Bases</li> <li>• Lewis Acids and Bases</li> <li>• Strengths of Acids and Bases</li> </ul>	<p><b>Lab 20: Classifying Substances as Acids and Bases</b></p>	<p><b>Quiz 10: Chapters 15 and 16</b></p> <ul style="list-style-type: none"> <li>▪ Read Chapter 19: sections 1-3</li> <li>▪ Homework: p. 593 –611: #1 – 21, 28, 29</li> <li>▪ Write-up Lab 20</li> </ul>
<p><b>Day 14</b> Thurs 7/14</p>	<p><b>Chapter 19 (Continued)</b></p> <ul style="list-style-type: none"> <li>• Neutralization Reactions</li> <li>• Titration</li> <li>• Salt Hydrolysis</li> </ul>	<p><b>Review for Final Exam</b></p> <p><b>Lab 21: TBD</b></p> <p><b>Lab Clean-up</b></p>	<p><b>Quiz 11: Chapter 19.1 – 19.3</b></p> <ul style="list-style-type: none"> <li>▪ Read Chapter 19: sections 4-5</li> <li>▪ Homework: p. 614: #30 - 33, 37, 38</li> <li>▪ Write-up Lab 21</li> </ul>
<p><b>Day 15</b> Fri 7/15</p>	<p><b>9:00 am – 11:30 am Final Exam</b> <b>1:00 pm – 4:00 pm Parent/Teacher Conferences, inclusive</b></p>		

### CTD Statement on Third-Party Web Sites

Instructors are required to thoroughly review any third-party web sites they intend to use in their courses for inappropriate content. However, because web content continuously changes, CTD disclaims any responsibility for any of the content contained on third-party web sites used in course materials. If you become aware of anything that may be inappropriate, please notify CTD staff immediately.