

Honors Chemistry Syllabus 2008-2009

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Required Materials: textbook, notebook (bound; can be spiral bound) for class notes, **lab notebook** (bound, not spiral bound), **binder** (for worksheets and returned tests, quizzes, and assignments), pencils and pens (blue or black ink), scientific calculator. You may also want to purchase a hole punch, index cards, and card holder. **Note: Not all tests allow the use of a calculator.**

Grading System: Approximately 13 major tests (100 points each) and 15 quizzes (10 - 25 points each) will be given each year. Tests and quizzes are worth 75% of your class grade.

Approximately 15 labs will be completed each year. Lab reports are worth 25% of your class grade. Each student must submit her own lab report (group reports are not acceptable). Two exams (one at the end of the first trimester and one at the end of the year) are cumulative.

Academic Dishonesty: Any student found cheating on a test or assignment will receive a grade of “0” for that test or assignment. Cheating includes, but is not limited to, copying another student’s work (with or without their knowledge), allowing another student to copy your work, or using materials during a test other than those allowed. Studying together can be beneficial, but the work each student submits must be their own. Plagiarism will not be tolerated.

Work Required of Students:

Attendance is expected. After entering the classroom, students are to immediately begin getting themselves ready for class by opening their books and/or notebooks, taking out assignments that are due, and listening for instructions.

Homework (both written work and reading assignments) is to be done in full and on time. Late work will not be accepted. Homework is to be done on loose-leaf paper or in the Chemistry notebook, in pencil, and brought to class when due. **Students are expected to check their answers with the appropriate solutions and to ask questions if they do not understand something.** The effort put into doing and checking homework counts toward your class participation grade. Homework completion can and will be ascertained in many ways, including (but not limited to) pop quizzes on reading assignments, pop quizzes on written work, or a request that homework be turned in or viewed by the teacher.

Quizzes and Tests will occur approximately once per week. Unannounced (“pop”) quizzes are possible. Chapter tests will emphasize the material covered in that chapter, but may contain previously covered material also.

Laboratory work will occur approximately once every two weeks. Laboratory procedures will be discussed in detail in a separate handout. Students will be put into groups by the teacher and must work together. All students are expected to participate in all labs unless absent that day. All students must turn in their own lab report by the due date. If absent, a student is held responsible for material covered that day, but will not be expected to make up the lab.

Exams will be given twice per year: once at the end of the first semester and once at the end of the third semester. Both exams are cumulative.

*******HONORS CHEMISTRY STUDENTS ARE REQUIRED TO TAKE THE SAT CHEMISTRY SUBJECT TEST IN MAY. *******

Tentative Chemistry Schedule Text: Prentice Hall Chemistry (Wilbraham et al.)

NOTE: The schedule that follows is tentative and subject to change. All changes will be announced in class. A more detailed schedule will be given every two weeks.

Wk	Chapters
1	Intro
2	Ch 3
3	Ch 4
4	Ch 5
5	
6	Ch 6 & 7
7	Ch 8
8	
9	Ch 9 & 10
10	Ch 11
11	Ch 12
12	Ch 13
13	Ch 14
14	Ch 15 & 16
15	
16	Ch 17
17	Ch 17 & 18
18	Ch 18
19	
20	Ch 19
21	Ch 19 & 20
22	
23	Ch 21
24	
25	Ch 22-24

26	Ch 25
27	
28	
29	
30	
31	
32	
33	

Chemistry and Honors Chemistry Content Outline (* denotes Honors Chemistry only)

I. Quick Review of Chemistry and Matter; Basic Math

- A. Review of Vocabulary from Chapters 1 & 2
- B. Scientific Notation [Appendix C]
- C. Laboratory Safety [Appendix D]
- D. Lab Report Format [Handout]

II. Scientific Measurement *Lab 1: Density*

- A. Metric Units: Fundamental and Derived [3.2]
- B. Metric Prefixes [3.2]
- C. Definitions of Mass, Volume, Density [SAT II book]
- D. Measurement
 - 1. Uncertainty; Significant Figures (Recording Data and Arithmetic) [3.1]
 - 2. Accuracy, Precision, and Percent Error [3.1]
 - 3. Scientific Notation [3.1]
- E. Dimensional Analysis [3.3] (emphasis here)

III. Atomic Structure *Lab 2: Flame Tests and Spectra*

- A. Dalton's Atomic Theory (brief) [4.1]
- B. Subatomic Particles (J.J. Thomson, Millikan, Rutherford) [4.2]
- C. Atomic Number, Mass Number, Isotopes, amu [4.3]
- D. Models of the Atom
 - 1. Bohr Model [5.1]
 - 2. Quantum Mechanical Model [5.1]
- E. Electron Arrangement in Atoms
 - 1. Atomic Orbitals (s, p, d) [5.1]; Quantum Numbers
 - 2. Aufbau Principle, Pauli Exclusion Principle, Hund's Rule [5.2]
 - 3. Exceptions [5.2]
- F. Atomic Spectra [5.3]
- G. Quantum Mechanics and Heisenberg Uncertainty Principle [5.3]

IV. The Periodic Table

- A. Mendeleev [6.1]
- B. The Periodic Law (Elements are arranged in order of increasing atomic number) [6.1]
- C. Metals, Nonmetals, Metalloids (Semimetals) [6.1]
- D. Explanation of the Squares [6.2]
- E. Families or Groups [6.2] (alkali metals, alkaline earth metals, active metals, halogens, noble gases) [SAT II book]
- F. Representative Elements (s and p sublevels), Transition (d), Inner Transition (f) [6.2]
- G. Periodic Trends [6.3]
 - 1. Atomic Size
 - 2. Ionization Energy
 - 3. Ionic Size
 - 4. Electronegativity

V. Chemical Bonding *Lab 3: Molecular models*

- A. Ionic Bonding [7.1, 7.2]
 - 1. Valence Electrons
 - 2. Octet Rule
 - 3. Cations and Anions
- B. Metallic Bonding [7.3] “sea of electrons”
- C. Covalent Bonding [8.1]
 - 1. Octet Rule & Exceptions [8.2]
 - 2. Single, Multiple [8.2]
 - 3. Structural Formula [8.2]
 - *4. Coordinate Covalent Bonding [8.2]
 - 5. Bond Disassociation Energy [8.2]
 - *6. Resonance [8.2]
- D. Molecular Geometry: VSEPR Theory [8.3]
- E. Orbitals & *Hybrid Orbitals [8.3]
- F. Polar Bonds and Molecules [8.4]
 - 1. Van der Waals Forces
 - 2. Hydrogen Bonds
- *G. Network Solids [8.4]

VI. Chemical Names and Formulas (memorize!)

- A. Naming Ions [9.1]
 - 1. Monatomic Ions
 - a. Cations
 - b. Anions
 - c. Multivalent Metal Ions (Stock and Classical Names)
- 2. Polyatomic Ions
- B. Naming and Writing Formulas for Ionic Compounds [9.2]
 - 1. Binary Ionic Compounds
 - 2. Polyatomic Ionic Compounds

C. Naming and
Writing Formulas for
Molecular
Compounds [9.3]

- D. Naming and Writing Formulas for Acids and Bases [9.4] (-ide, -ite, -ate Conventions)
- E. Laws Governing Formulas and Names [9.5]
 - 1. Laws of Definite and Multiple Proportions
 - 2. Flowchart for Naming
 - 3. Flowchart for Writing Formulas

VII. Chemical Quantities

- A. The Mole [10.1]
- B. Mole-Mass and Mole-Volume Relationships [10.2]
- C. Percent Composition and Chemical Formulas [10.3], Empirical Formulas

VIII. Chemical Reactions

- A. Writing Chemical Equations (words and symbols) [11.1]
- B. Balancing Chemical Equations [11.1]
- C. Types of Chemical Reactions [11.2]: Combination, Decomposition, Single- and Double-
Replacement, Combustion
- D. Net Ionic Equations [11.3]

IX. Stoichiometry *Lab 4: Magnesium Combustion, Lab 5: Molecular Mass Determination*

- A. Significance of the Balanced Coefficients: Recipes [12.1]
 - B. Interpreting Chemical Equations: number of atoms, molecules, or moles; mass;
volume [12.1]
- C. Using Mole Ratios [12.2]
- D. Limiting Reagent and Percent Yield [12.3]

X. States of Matter *Lab 6: Freezing / Melting of Water*

- A. The Nature of Gases [13.1]
 - 1. Kinetic Theory
 - 2. Gas Pressure
 - 3. Kinetic Energy and Temperature
- B. The Nature of Liquids [13.2]
 - 1. A Model for Liquids
 - 2. Evaporation
 - 3. Vapor Pressure
 - 4. Boiling Point
- C. The Nature of Solids [13.3]
 - 1. A Model for Solids
 - *2. Crystal Structure and Unit Cells
- D. Changes of State [13.4]
 - 1. Sublimation
 - *2. Phase Diagrams (P vs. T); Phase Change Diagrams (SAT II book)

XI. The Behavior of Gases

- A. Compressibility [14.1]
- B. Ideal Gas Law (including Boyle's Law, Charles's Law, and Gay-Lussac's Law) [14.2, 14.3]
- C. Ideal Gases vs. Real Gases [14.3]
- D. Dalton's Law of Partial Pressures [14.4]; Partial Volumes (SAT II book)
- *E. Graham's Law of Diffusion [14.4]

XII. Water and Aqueous Systems

- *A. Surface Tension [15.1]
- B. Polarity [15.1]
- C. Solvent vs. Solute [15.2]
- D. Electrolyte vs. Nonelectrolyte [15.2]
- *E. Hydrates [15.2]
- *F. Suspensions & Colloids [15.3]

XIII. Solutions

- A. Factors Affecting Solubility [16.1]
- B. Solution Concentration Scales: Molarity, Molality, Percent by Mass/Volume [16.2/4]
- *C. Colligative Properties [16.3]
 - 1. Vapor Pressure Lowering
 - 2. Freezing Point Depression, Boiling Point Elevation

XIV. Thermochemistry

- A. Exothermic and Endothermic Processes [17.1]
- B. Units for Measuring Heat Flow [17.1]
- C. Heat Capacity and Specific Heat [17.1]
- D. Thermochemical Equations [17.2]
- E. Heat of Fusion and Solidification [17.3]; *Phase Change Diagram (SAT II book)
- F. Heats of Vaporization and Condensation [17.3]
- *G. Heats of Solution [17.3]
- *H. Hess's Law [17.4] & Heats of Formation

XV. Reaction Rates and Equilibrium (may have to supplement)

- A. Collision Theory [18.1]
- B. Activation Energy [18.1]
 - C. Factors Affecting Reaction Rates [18.1] (temperature, concentration, surface area, catalysts)
 - D. Reversible Reactions & Le Chatelier's Principle [18.2] (concentration, temperature, pressure)
- E. Equilibrium Constants [18.2]
 - 1. Definition
 - 2. Interpretation of the size of K
 - *3. Mathematical practice (quadratics)
- F. Solubility Product Constant and Common Ion Effect [18.3]
- G. Entropy and Free Energy [18.4]
 - 1. Spontaneous Reactions
 - 2. Gibbs Free Energy $G = H - TS$
- *H. Rate Laws and Reaction Mechanisms [18.5]

XVI. Acids, Bases and Salts *Titration Lab*

- A. Properties of Acids and Bases [19.1]
- B. Definitions: Arrhenius, Bronsted-Lowry, Lewis, conjugate [19.1]
- C. Self-Ionization of Water; Ion Product Constant [19.2]
- D. The pH Scale [19.2]
 - 1. Calculating (math, including logarithms)
 - 2. pOH
 - 3. Measuring pH
- E. Acid-Base Indicators [19.2]
- F. Strong and Weak Acids and Bases; *Dissociation Constants [19.3]
- G. Concentration and Strength vs. Strong and Weak [19.3]

H. Acid-Base Neutralizations: Salt Formation and the Net Ionic Equation [19.4]

*I. Acid-Base Titrations [19.4]; [supplement with SAT II book]

1. Titration Curve
2. Equivalence Point
3. Determining K_a

*J. Salt Hydrolysis; Buffers [19.5]

XVII. Redox and Electrochemistry

A. Oxidation and Reduction: Redox [20.1]

1. Electron Shift

*2. Corrosion

3. Oxidation Numbers [20.2]

4. Balancing Redox Equations [20.3]: Oxidation Number Changes and Half-Reactions

B. Electrochemical Cells [21.1]

1. Definitions: Anode, Cathode, Electrolyte [SAT II book]

2. Voltaic Cells (Galvanic Cells) – Spontaneous

3. Cells as Energy Sources

C. Electrical Potential [21.2]

1. Volts

2. Standard Reduction Potentials

3. + Spontaneous, - Nonspontaneous

D. Electrolytic Cells – Nonspontaneous [21.3]

1. Electroplating

2. Electrolysis of Water & Brine

XVIII. Organic Chemistry

A. Hydrocarbons, Alkanes, Alkenes, Alkynes, Hydrocarbon Rings [22.1, 22.2, 22.4]

B. Isomers [22.3] (if time)

XIV. Nuclear Chemistry

A. Types of Radiation: Alpha, Beta, Gamma [25.1]

B. Balancing Nuclear Reactions [25.1]

*C. Nuclear Decay, Half-Life, Transmutation [25.2]

D. Fission and Fusion [25.3]