

# Dr. Stephanie Katz

Chemistry Syllabus • 2009-2010

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**Course Philosophy:** “What in the world is Chemistry?” a first year student might ask. My answer would be, “What in the world *isn't* Chemistry?” Chemistry is the study of matter (the “stuff” in the Universe), any observable change which matter experiences, and the measurable energy differentials which accompany changes in matter. As such, it is often considered the central science; not surprisingly, Chemistry is the course directly between your physical science education and your biological studies. We will explore matter at the particulate level focusing on three perspectives: the nanoscopic (think *microscopic* but smaller), the macroscopic (what you can hold in your hand), and the symbolic (how we denote it on paper). I will help you to see the connection between these perspectives and your everyday life. Like many science classes, success in Chemistry requires an aptitude in critical thinking and problem solving. Simply having a grasp of content knowledge is not enough to achieve high marks; you must also know how to manipulate information and synthesize concepts into new situations with which you are unfamiliar. We will learn more than the basics; I'd like you to build a broader and deeper understanding of the subject. My ultimate goal is prepare each of you for high achievement on the Chemistry SAT 2 in May.

Our classroom is a place where you can learn and have fun at the same time. It is extremely important to keep a positive attitude during the moments when you feel frustrated. While Chemistry can be a difficult subject, if you practice good study habits you will find it much easier. Patience and a sense of humor are essential. If you are having trouble with concepts, make sure you ask me to clarify the material. It is also important for you to recognize your responsibility in the learning process. Our classroom should be a team effort; teaching and learning are equally important components. Your job is to take notes in class, complete all assigned work on time, and ask questions when you do not understand. I will make time to help you whenever you need me!

## Course Materials:

1. **Textbook:** Davis, R.E., Frey, R., Sarquiz, M., Sarquiz, J.L., *Modern Chemistry*, Holt, McDougal, 2009; ISBN 13: 978-0-030-36786-1; ISBN 10: 0-030-36786-7
2. **Required Materials:** One 1”, 3-ring binder and loose-leaf notebook paper for note-taking; scientific calculator; blue, red, and black pens and/or pencils; earphones; one **bound** Composition note book to be used as a lab notebook; and one entirely different notebook (spiral or bound composition, your choice) to be used for problem sets.
3. **Optional Materials:** Instead of 3-ring binder and loose-leaf paper you may substitute a spiral notebook for note-taking; SAT 2 Chemistry Baron's or Princeton Review (for extra SAT 2 practice problems); pocket folders or other organizational folder system; colored pens or highlighter pens (for taking notes); and 3x5 index cards (for learning vocabulary, ions, and equations).

**Grading Procedures:** As quoted directly from the Linden Hall Student Handbook, “Rather than trimester exams, a mid-year and final exam will be given. The mid-year exam will occur in February and the final exam in May. Both are cumulative and will be counted as follows: the mid-year exam will count as 10% of the final grade and the final exam will count as 15% of the final grade. To emphasize the importance of growth through the school year, the weight of each

trimester grade has been changed. The first trimester will count as 15%, the second as 25%, the third as 35%, the mid-year exam as 10%, and the final exam as 15%.”

**Grading Scale:** You will receive a **percentage grade** in this class, using the following method:  $(\text{Total points earned} \div \text{total points possible to earn}) \times 100\% = \text{your percentage grade}$ . This percent will be turned into a **letter grade** using the school-determined grading scale: A- to A+: 90-100; B- to B+: 80-89; C- to C+: 70-79; D- to D+: 60-69; and F: 0-59.

### **Coursework Policies:**

1. Students who successfully complete a year in this class are encouraged to take the Chemistry SAT 2 Exam in May. This is not a requirement of this class; however, after a year in Chemistry at Linden Hall, you should be amply prepared to achieve high marks on the SAT 2 Chemistry test. We will spend some time at the end of the year on test taking strategies and completing practice tests. If you have any questions about this test, please don't hesitate to ask me.
2. All assignments are due **at 4:00 PM** on the due date. This policy encourages students to come to class on the day an assignment is due and ask questions on parts of the assignment she does not understand. This also allows students to attend Academic Help the day an assignment is due and finish the assignment after hearing other students' questions in class.
3. Late assignments may be subject to a **50% grade penalty** especially assignments that are not submitted on the due date by 4:00PM. According to the Student Handbook, "Short-range assignments, like daily homework, for example, should be completed by arranging for Academic Help time **on the day it was due and not turned in** by coming to the teacher to complete the assignment. If the student does not come for Academic Help on the day of a missed homework assignment, then she must come the next day; point deduction for late work at this time should be at the discretion of the teacher. If the student does not report on the second day for Academic Help, then this action is considered a cut and will be followed by a pink slip." Therefore, while I will not *usually* deduct 50% for a late assignment, the school policy allows me to decide how many points to deduct, and it is possible I may deduct up to 50%. Excused absences represent an exception to this late policy, so please make sure that you let me know if you have a valid reason for being absent, including the proper documentation to accompany your absence. Additional exceptions are allowable but will be discussed on a case by case basis. Please always feel free to discuss with me your reasons for submitting a late assignment, but always do so in a respectful matter. Also know that while I will ALWAYS accept late work, I will be the judge and jury about what late points will be deducted. If you feel that you will be unable to submit an assignment on time, it is best if you discuss it with me BEFORE the due date!
4. All assignments are to be submitted into my INBOX, which is located at the front of my classroom. Once you place your assignment into the INBOX, **you** are not permitted to remove your assignment from the INBOX for any reason. If you need to retrieve an assignment that you previously submitted, **you should ask me** to retrieve the assignment for you. This policy protects everyone's assignments. Please submit your assignment into *your class period's* INBOX, i.e. place your assignment in the INBOX marked Chemistry Period A or Chemistry Period C.
5. PRIOR APPROVAL IS REQUIRED (from me and only me) if you are going to submit an assignment via email. You may only email an assignment that has been okayed by me in advance. Please do NOT assume just because you sent it that I received it. Email is NOT always a reliable method of submitting assignments. If you want to be certain an emailed

assignment has been received by me, request a receipt email or ask me in person. If I don't receive it, it is considered not submitted.

6. Assignments should be submitted with the name of the assignment, your full English name, class name, period, and date (e.g. Experiment 1, Susie Student, Chemistry, Per A, 8/30/09) PRINTED at the top RIGHT corner of your paper UNLESS if there is a designated space for this information elsewhere. If I receive an assignment without a student name which I cannot identify by process of elimination or handwriting, I will hang the unnamed assignment on the class bulletin board for the student author to claim; please note, assignments received without a student name subsequently turned in the following day may be subject to a late penalty.
7. Handwritten assignments should be completed in either BLUE or BLACK ink or PENCIL only. Other colored pens should NEVER be used. When you are instructed to correct your own assignment, RED pen should be used for corrections.
8. Your work must be legible or it will not receive a grade. Unless otherwise specified, you are permitted to type assignments if you feel that your handwriting is illegible.
9. Missed work, labs, and tests must be made up in accordance with Linden Hall policy. Please note...it is your responsibility to obtain work missed due to absence, regardless of whether it is an excused or unexcused absence! Please consult your classmates, the in-class bulletin board, my webpage, or simply ask me for the assignment when you miss class. If you know, in advance, that you will be absent, please let me know as soon as possible, especially if you are going to be absent the day of a test or quiz.

### **Classroom Policies:**

1. **General Expectations** - You should bring your (spiral or) 3-ring notebook and Laptop computer (Netbook) to class every day. You will be taking notes directly into your Netbook or your notebook, whichever is most comfortable for you; however we will often access guided notes electronically. If you prefer to print PowerPoint slides or other electronic resources and bring them to class, they will be made available to you on my website ahead of class time. Much of what will be discussing will be easier to handwrite, as we will write chemical equations and have mathematical problems to solve, so it is important that you have both paper and your Netbook available. You will have many electronic resources this year, including PowerPoints, video podcasts (screencasts), electronic flashcards, e-concept maps, and more. I have gone to great lengths to make sure you have a variety of resources, so please be prepared for the myriad opportunities to learn.

2. **Staying informed** - My webpage ([www.chemkatz.com](http://www.chemkatz.com)) is updated on a regular basis to keep pace with the flow of the class. Students are expected to access my webpage **daily** to stay abreast of changes and daily classroom expectations and assignments. If you print out the "Week-at-a-Glance" (WAG) page over the weekend, it may look very different by Tuesday. Your WAG page can be found on the "Click HERE" link on my website. Once you are redirected to the "teacher web" homepage, you will find the WAG page on the #8 (or #9) Chemistry link. You may subscribe to my teacher web homepage via the RSS link at the bottom of the teacher web homepage; however, if you do so, you will get updates when I make changes to any and all of my classes. Alternatively you can save the #8 (or #9) link as one of your favorites and check the WAG page each day to monitor important changes. Our class's agenda will change to best serve your learning needs. You will also notice you can access your grades on the #13 Grades Chem A or #14 Grades Chem C link. You will be given an ID number to log in and access your grades. If you or your parents have questions, please contact me via email. Finally, at the top right hand corner of the teacher web homepage, there is an email link (looks like a mailbox) which is the same email at the top of

this syllabus. My school voice mail extension is listed on the #1 Dr. Katz link. Voicemail is the place to leave me a voice message; however, email is the best way to reach me! I will check email up until 9pm and then again on the following day; I will usually return email within one day, if possible. I only check voice mail until 4pm and I will usually return voicemail messages within one day if possible.

3. **Class Participation** - Learning is not an individual endeavor. Therefore, class cooperation is an essential component of the learning environment. Each marking period, you will be assessed on your class cooperation by my subjective evaluation of your ability to work effectively with your classmates and contribute to class discussions. Class participation will be assessed as part of your effort grade.

4. **Safety in the Laboratory** – Safety is everyone’s responsibility. We will be performing many experiments in this class that pose potential safety risks. The risks will be significantly minimized by using common sense precautions and following the appropriate safety rules. You will be expected to read, learn, and sign a two-page safety contract (found on the #5 Handouts link) before you perform any experiments in my class. Your signature on this safety contract is a promise to me and your classmates that you will take all precautions necessary to keep the lab environment hazard-free. Your parents or guardians (dorm parents will suffice) are also expected to sign the safety contract because it is important that they are aware of the potential risks you may encounter and that you are being tasked with the responsibility of following these safety rules. Please have your parents read and sign both pages after you have read and signed both pages of the contract. Once you and your parents have both read and signed it, please promptly return it to me.

5. **Problem Sets (PS)** – PS will be assigned to correspond with the material we are covering. Due dates will be posted on the WAG page and in the classroom. Unless otherwise indicated, PS will NOT be graded. Answer keys will be available in the classroom for you to use to check your assignments. You should correct your PS with these answer keys using a RED pen as though you are the teacher and ask questions on problems you don’t understand. PS are a required part of the Chemistry curriculum and will be assessed as part of your effort grade. You should complete all PS in a spiral or bound notebook which is separate from where you keep your notes or labs. PS notebooks will be collected periodically during the trimester so I can check your progress.

6. **Honor Code** – Students are expected to uphold the Linden Hall Honor Code. While students are often encouraged to work collaboratively, there are unequivocal differences between collaboration and collusion. Intentional acts of plagiarism or other types of academic dishonesty will be met with firm consequences as outlined in the Student Handbook.

7. **Labs** – We will be performing a variety of laboratory experiments throughout the year. You will receive a separate handout explaining your lab requirements and the lab report format. You will be notified in advance on the day we perform a wet lab involving chemicals. On these days you are required to wear long pants and closed toed shoes for safety reasons.

### Tentative Schedule

2009-2010 School year	Chapter in	Instructional Units
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	<b>Textbook</b>	
Trimester 1, Week 1- 2	Ch 1 – 2	I. Review of Physical Science as it relates to Chemistry
Trimester 1, Week 3	Ch 2	II. Scientific Measurement & Lab Review
Trimester 1, Weeks 4 & 5	Ch 3 – 4	III. Atomic Structure & the Role of Electrons
Trimester 1, Weeks 6 & 7	Ch 4 – 5	IV. Electrons and the Periodic Table
Trimester 1, Week 8 & 9	Ch 6	V. Chemical Bonding
Trimester 1, Week 10 & 11	Ch 7	VI. Formulas and Equations
Trimester 2, Week 1 & 2	Ch 8 & 9	VII. Reactions and Stoichiometry
During Thanksgiving break		
Trimester 2, Week 3 & 4	Ch 10 & 11	VIII. Gases
During Winter Break		
Trimester 2, Weeks 5 & 6	Ch 13 & 14	IX. Solutions
Trimester 2, Week 7 & 8	Ch 15 & 16	X. Acids and Bases
Trimester 2, Week 9		February Cumulative Mid-year Exam
Trimester 2, Weeks 10 & 11	Ch 17	XI. Reaction Energy and Kinetics
Trimester 2, Week 12 Trimester 3, Week 1	Ch 18	XII. Equilibrium
Trimester 3, Weeks 2 & 3	Ch 19	XIII. Electrochemistry
Spring Break		
Trimester 3, Week 4 & 5	Ch 20 & 21	XIV. Hydrocarbons and Environmental Compounds
Trimester 3, Week 5 & 6	Ch 22	XV. Nuclear Chemistry
Trimester 3, Week 7	Ch 12	XVI. Liquids and Solids
Trimester 3, Week 8		Practice SAT 2 Exam
Trimester 3, Week 9 – 10		Final Exam Review and Final Exam

### **Chemistry Outline:**

- I. Review of Chemistry and Matter and Basic Math
  - A. Review of Chapters 1 & 2
  - B. Scientific Notation
  - C. Laboratory Safety
  - D. Lab Report Format [Handout]

## II. Scientific Measurement

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

## III. Atomic Structure

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

## IV. The Periodic Table

- A. Mendeleev
- B. Metals, Nonmetals, Metalloids
- C. Explanation of the Squares
- D. Families or Groups
- E. Main Group Elements (s and p sublevels), Transition Elements (d block), Inner Transition elements (f block)
- F. Periodic Trends
  1. Atomic Radius
  2. Ionization Energy
  3. Ionic Radius
  4. Electronegativity

## V. Chemical Bonding

- A. Ionic Bonding
  1. Valance Electrons
  2. Criss-Cross Rule
  3. Cations and Anions
- B. Metallic Bonding "sea of electrons"
- C. Covalent Bonding
  1. Octet Rule & Exceptions
  2. Single, Multiple bonds
  3. Structural Formula
  4. Resonance
- D. Molecular Geometry: VSEPR Theory
  1. Polar Bonds and Molecules
- E. Intermolecular Forces
  1. Van der Waals Forces
  2. Dipole-dipole forces

- 3. Hydrogen Bonds
- VI. Chemical Names and Formulas
  - A. Naming Ions
    - 1. Monatomic Ions
      - a. Cations (type I and II)
      - b. Anions
    - 2. Polyatomic Ions
  - B. Naming and Writing Formulas for Ionic Compounds
    - 1. Binary Ionic Compounds
    - 2. Polyatomic Ionic Compounds
  - C. Naming and Writing Formulas for Molecular Compounds
  - D. Naming and Writing Formulas for Acids and Bases (-ide, -ite, -ate conventions)
  - E. Laws Governing Formulas and Names
    - 1. Laws of Definite and Multiple Proportions
    - 2. Flowchart for Naming
    - 3. Flowchart for Writing Formulas
- VII. Chemical Quantities
  - A. The Mole
  - B. Mole-Mass and Mole-Volume Relationships
  - C. Percent Composition and Chemical Formulas, Empirical Formulas
- VIII. Chemical Reactions
  - A. Writing Chemical Equations
  - B. Balancing Chemical Equations
  - C. Types of Chemical Reactions
  - D. Net Ionic Equations
- IX. Stoichiometry
  - A. Significance of the Balanced Coefficients
  - B. Interpreting Chemical Equations
  - C. Using Mole Ratios
  - D. Limiting Reagent and Percent Yield
- X. States of Matter
  - A. The Nature of Gases
    - 1. Kinetic Molecular Theory
    - 2. Gas Pressure
    - 3. Kinetic Energy and Temperature
  - B. The Nature of Liquids
    - 1. A Model for Liquids
    - 2. Evaporation
    - 3. Vapor Pressure
    - 4. Boiling Point
  - C. The Nature of Solids
    - 1. A Model for Solids
  - D. Changes of State
    - 1. Sublimation
    - 2. Phase Diagrams
    - 3. Phase Change Diagrams
- XI. The Behavior of Gases
  - A. Properties of Gases
  - B. Gas Laws
  - C. Ideal Gases vs. Real Gases

D. Dalton's Law of Partial Pressures

E. Graham's Law of Diffusion

## XII. Solutions

A. Factors Affecting Solubility

B. Concentration: Molarity, Molality, Percent by Mass/Volume

C. Colligative Properties

1. Vapor Pressure Lowering

2. Freezing Point Depression

3. Boiling Point Elevation

## XIII. Thermochemistry

A. Exothermic and Endothermic Processes

B. Units for Measuring Heat Flow

C. Heat Capacity and Specific Heat

D. Thermochemical Equations

E. Heat of Fusion; Phase Change Diagram

F. Heats of Vaporization and Condensation

G. Heats of Solution

H. Hess's Law & Heats of Formation

## XIV. Reaction Rates and Equilibrium

A. Collision Theory

B. Activation Energy

C. Factors Affecting Reaction Rates

D. Reversible Reactions & Le Chatelier's Principle

E. Equilibrium Constants

1. Definition

2. Interpretation of the size of K

F. Solubility Product Constant and Common Ion Effect

G. Entropy and Free Energy

1. Spontaneous Reactions

2. Gibbs Free Energy  $\Delta G = \Delta H - T\Delta S$

H. Rate Laws and Reaction Mechanisms

## XV. Acids, Bases and Salts

A. Properties of Acids and Bases

B. Definitions: Arrhenius, Bronsted-Lowry, Lewis, conjugates

C. Self-Ionization of Water; Ion Product Constant

D. The pH Scale

1. Calculating pH

2. Measuring pH

E. Acid-Base Indicators

F. Strong and Weak Acids and Bases; Dissociation Constants

G. Concentration and Strength vs. Strong and Weak

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

I. Acid-Base Titrations

1. Titration Curve

2. Equivalence Point

3. Determining  $K_a$

J. Salt Hydrolysis; Buffers

## XVI. Redox and Electrochemistry

A. Oxidation and Reduction: Redox

1. Electron transfer

2. Oxidation Numbers
3. Balancing Redox Equations
  - a. Oxidation Number Method
  - b. Half-Reaction Method

B. Electrochemical Cells

1. Definitions: Anode, Cathode, Electrolyte, Standard Reduction Potentials
2. Galvanic Cells – Spontaneous
3. Electrolytic Cells – Nonspontaneous
  - a. Electroplating
  - b. Electrolysis of Water & Brine

XVII. Organic Chemistry

- A. Hydrocarbons, Alkanes, Alkenes, Alkynes, Hydrocarbon Rings
- B. Isomers

XVIII. Nuclear Chemistry

- A. Types of Radiation: Alpha, Beta, Gamma
- B. Balancing Nuclear Reactions
- C. Nuclear Decay, Half-Life, Transmutation
- D. Fission and Fusion