

**Roslyn High School**  
**Advanced Placement Chemistry**  
**Course Outline**  
**Fall Semester**

**Text : Chemistry The Central Science**  
**Brown, LeMay, Bursten, Murphy, Woodward**  
**Twelfth Edition, 2012**

**I. Atomic Structure and the Periodic Table**

**A. Historical Development of the Modern Atomic Theory**

- Democritus, Thompson, Dalton, Rutherford, Bohr
- Wave-Mechanical Model, Atomic Mass (average isotopic mass), Atomic Number, Isotopes, Protons, Neutrons, Electrons (Sub-atomic Particles)

**B. Periodic Table**

- Mendeleev, Mosley
- Periodic Relationships
- Ionization Energy, Electron Affinity, Electronegativity

**II. Nuclear Chemistry**

**A. Nuclear Stability (Belt of Stability), Natural vs. Artificial Transmutation**

**B. Nuclear Equations and Half-Life Calculations**

**C. Applications**

**III. States of Matter**

**A. Gases**

- Kinetic Molecular Theory
- Ideal Gas vs. Real Gas
- Dalton's Law of Partial Pressures, Graham's Law of Effusion
- Avogadro's Hypothesis

**B. Liquids and Solids**

- Phase Changes and Changes of State
- Vapor Pressure and Boiling
- Structures of Solids, Lattice Energies

**IV. Chemical Bonding**

**A. Ionic, Covalent and Metallic Bonds**

**B. Intermolecular Attractive Forces and Physical properties**

**C. Lewis Structures, Resonance, Sigma and Pi Bonds**

**D. Molecular Geometry, VSEPR, Hybridization and Molecular orbitals**

**V. Solutions**

**A. Types of Solutions**

**B. Factors that affect Solubility**

**C. Concentration Terms**

- Molarity
- Molality
- ppm
- Mole Fraction

**D. Colligative properties**

- Freezing Point Depression
- Boiling Point Elevation
- Vapor Pressure Lowering

**VI. Laboratory Experiences will be selected from the following :**

1. Determination of the Formula of a Compound
2. Determination of the Percent Water in a Hydrate
3. Determination of Molar Mass by Vapor Density
4. Determination of Molar Mass by Freezing Point Depression
5. Determination of Molar Volume of a Gas
6. Standardization of a Solution using a Primary Standard
7. Determination of Mass and Mole Relationships in a Chemical Reaction
8. Reaction Rate and the Order of a Reaction
9. Separation and Qualitative Analysis of Cations and Anions
10. Synthesis of a Coordination Compound and its Chemical Analysis
11. Analytical Gravimetric Determination
12. Colorimetric or Spectrophotometric analysis
13. Separation by Chromatography

**Roslyn High School**  
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**Spring Semester**

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**I. Chemical Reactions**

**A. Reaction Types**

- Double Replacement Reactions : reactions that go to completion such as acid-base neutralization and the formation of precipitates
- Redox Reactions : oxidation numbers, balanced redox reactions, electrolytic Cells, voltaic cells, standard cell potentials, prediction of the products, use of Faraday's constant

**B. Stoichiometry**

- Balanced Equations
- Net Ionic Equations
- Mole, mass and volume relationships based on the balance equation
- Limiting Reagents and percent yield calculations

**II. Kinetics**

**A. Reaction Rates**

- Order of a reaction
- Experimental rate law
- Rate constant
- Temperature effects

**B. Collision Theory**

- Energy of Activation
- Role of a Catalyst
- Rate-determining step

**III. Equilibrium**

**A. Equilibrium Systems**

- Phase equilibrium
- Solution Equilibrium
- Chemical Equilibrium

**B. Le Chatlier's Principle**

**C. Quantitative relationships including  $K_{eq}$ ,  $K_p$ ,  $K_a$ ,  $K_b$ ,  $K_{sp}$ , pKa, pH and the "common-ion" effect**

- IV. Thermodynamics**
- A. State Functions**
  - B. Laws of Thermodynamics**
  - C. Relationships of free energy change to equilibrium constants and cell potentials**
- V. Introduction to Organic Chemistry**
- A. Properties of Organic Compounds**
  - B. Hydrocarbon Homologous Series**
  - C. Functional Groups**
  - D. Organic Reactions**
- VI. Laboratory Experiences will be selected from the following :**
1. Determination of Concentration by Acid-Base Titration
  2. Determination of Concentration by Oxidation-Reduction Titration
  3. Determination of the Equilibrium Constant for a Chemical Reaction
  4. Use of Appropriate Indicators for Acid-Base Titrations
  5. Reaction Rate and the Order of a Reaction
  6. Determination of the Enthalpy Change associated with a Reaction
  7. Preparation and properties of Buffer Solutions
  8. Determination of an Electrochemical Series
  9. Measurements Using Electrochemical cells and Electroplating
  10. Synthesis, Purification and an Analysis of an Organic Compound

Lecture/Lab Time:

We spend 25% of our course time performing laboratory activities.

Our single/double schedule puts us at 15 class periods (40 minutes each period) every 2 weeks for a total of 300 minutes each week and 600 every 2 weeks. This puts us at 75 minutes for lab each week (150 every 2 weeks) and 225 for lab each week (450 minutes every 2 weeks).