

Wallenpaupack Area School District

COURSE: Advanced Placement Chemistry

GRADE LEVEL: 11-12

LENGTH OF COURSE: 180 hours

TEXT: Chemistry

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COURSE DESCRIPTION:

This course covers the topics required for the Advanced Placement Chemistry exam and parallels a first-level college chemistry course. Topics include: the states and properties of matter, chemical reactions, descriptive chemistry, chemical calculations, and laboratory work. Advanced Placement Chemistry is a rigorous course designed for the highly motivated science student. The College Board recommends that students have two courses in Algebra and one course each in Chemistry and Physics before taking A.P. Chemistry. Students will be required to spend additional time on material not learned in class, and are expected to prepare seriously to take the A.P. Exam in Chemistry.

CURRICULUM WRITING TEAM:

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DATE OF REVISION:

December 2003

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: Grade 11 - 12

Unit: Review of Chemistry I Topics

PA Standards: 3.1.10.B
3.1.12.B
3.1.10.C
3.1.12.C
3.1.10.D
3.1.12.D
3.1.10.E
3.1.12.E
3.4.10.A
3.4.12.A

| Topics: | Skills: |
|--|--|
| Matter: property and states Atomic theory Quantum theory Periodic properties Chemical bonding Chemical reactions Descriptive chemistry | <ol style="list-style-type: none">1. Differentiate between physical and chemical change, and properties2. Determine the number of protons, neutrons, electrons, and mass number of an isotope from information given3. Use dimensional analysis to convert between moles, atoms, grams, and liters of an element or compound4. Solve for energy, wavelength, and frequency and convert these scales5. Draw electron configuration, orbital notation, noble gas configuration, and electron dot structure of elements6. Predict an element's properties based on its location on the periodic table7. Draw Lewis structures based on shared and unshared electrons using VSEPR theory8. Write chemical formulas in both word and symbol form9. Balance chemical reactions using coefficients10. Formulate products for reactants in a chemical reaction based on the five types of reactions11. Predict if a reaction will occur based on the activity series, solubility table and rules |
| Activities: | Performance Assessments: |
| <ol style="list-style-type: none">1. Supervised self-paced chemical laboratory work in laboratory groups2. Group projects and individual projects3. Cooperative learning groups4. Board demonstrations5. Guided practice6. Homework | <ol style="list-style-type: none">1. Teacher-made chapter tests and quizzes2. Student notebook/portfolio3. Projects (individual & group)4. Laboratory work and reports5. AP exam questions6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Oxidation-Reduction Reactions
and Electrochemistry

PA Standards: 3.4.10.A
3.4.12.A
3.4.12.B

| Topics: | Skills: |
|--|--|
| Redox reactions Oxidation states, 6 rules for states and characteristics Balancing oxidation-reduction reactions Galvanic Cells Cell potential, electrical work, and free energy Dependence of cell potential on concentration Corrosion Electrolysis | <ol style="list-style-type: none">1. Perform redox reactions2. Apply the rules of oxidation numbers3. Balance oxidation-reduction reactions in water, in acid, and in base solutions4. Understand galvanic cells and their components5. Calculate EMF of a galvanic cell6. Understand electrolytic cells7. Solve for E using Nernst equation |
| Activities: | Performance Assessments: |
| <ol style="list-style-type: none">1. Supervised self-paced chemical laboratory work in laboratory groups2. Group projects and individual projects3. Cooperative learning groups4. Board demonstrations5. Guided practice6. Homework | <ol style="list-style-type: none">1. Teacher-made chapter tests and quizzes2. Student notebook/portfolio3. Projects (individual & group)4. Laboratory work and reports5. AP exam questions6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Atomic Structure and Periodicity

PA Standards: 3.1.10.D
3.4.10.B

| Topics: | Skills: |
|--|---|
| Electromagnetic radiation, wave and particle properties Visible Spectrum Bohr model Quantum mechanical model of the atom Four quantum numbers Orbital shapes and energies Polyelectronic atoms History of the periodic table Trends of periodic table including: ionization energies, electron affinity, electronegativity and atomic radius Properties of element on the periodic table based on location | <ol style="list-style-type: none">1. Use dimensional analysis to convert between energy, wavelengths, and frequencies2. Understand the significance of a spectrum3. Become familiar with the Bohr model and quantum mechanical model of the atom4. Apply the four quantum numbers for elements on the periodic table5. Reproduce the orbital shape for elements on the periodic table6. Study the history of the periodic table7. Use periodic trends of ionization energies, electron affinity, electronegativity, and atomic radius to determine an individual atoms properties |
| Activities: | Performance Assessments: |
| <ol style="list-style-type: none">1. Supervised self-paced chemical laboratory work in laboratory groups2. Group projects and individual projects3. Cooperative learning groups4. Board demonstrations5. Guided practice6. Homework | <ol style="list-style-type: none">1. Teacher-made chapter tests and quizzes2. Student notebook/portfolio3. Projects (individual & group)4. Laboratory work and reports5. AP exam questions6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Bonding

PA Standards: 3.4.10.A
3.4.12.A

| Topics: | Skills: |
|--|---|
| Types of chemical bonds Electronegativity Bond polarity and dipole moments Electron configurations Binary ionic bonds and energy Covalent bonds and energy Lewis structures Octet rule exceptions Resonance VSEPR model and molecular shape Hybridization Molecular orbital model Homonuclear and heteronuclear diatomic bonds | <ol style="list-style-type: none">1. Identify types of chemical bonds2. Use electronegativity values to solve for the types of chemical bonds3. Understand the concept of bond polarity and dipole moments4. Predict electron configurations and formulas of compounds5. Measure ionic and covalent bond energy6. Draw Lewis structures7. Implement octet rule exceptions8. Draw resonance bonds9. Construct models using VSEPR and molecular shape theory10. Recognize the types of hybridization11. Draw molecular orbital diagrams12. Distinguish between homonuclear and heteronuclear diatomic bonds and their bond order |
| Activities: | Performance Assessments: |
| <ol style="list-style-type: none">1. Supervised self-paced chemical laboratory work in laboratory groups2. Group projects and individual projects3. Cooperative learning groups4. Board demonstrations5. Guided practice6. Homework | <ol style="list-style-type: none">1. Teacher-made chapter tests and quizzes2. Student notebook/portfolio3. Projects (individual & group)4. Laboratory work and reports5. AP exam questions6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Gases

PA Standards: 3.1.10.D
3.1.12.D
3.4.10.A
3.4.12.A
3.4.10.B

| Topics: | Skills: |
|--|---|
| Pressure Gas laws including Boyle's, Charles', Avogadro's, Gay-Lussac's combined and ideal Gas stoichiometry Dalton's law of partial pressures Kinetic molecular theory of gases Effusion and diffusion Real gases Atmospheric gases | <ol style="list-style-type: none">1. Convert units of pressure and temperature2. Solve gas law problems using Boyle's, Charles', Avogadro's Gay-Lussac's, combined and the ideal gas law3. Perform gas stoichiometry problems4. Solve partial pressure problems5. Differentiate between real and ideal gases6. Calculate rates of effusion and diffusion7. Identify atmospheric gases |
| Activities: | Performance Assessments: |
| <ol style="list-style-type: none">1. Supervised self-paced chemical laboratory work in laboratory groups2. Group projects and individual projects3. Cooperative learning groups4. Board demonstrations5. Guided practice6. Homework | <ol style="list-style-type: none">1. Teacher-made chapter tests and quizzes2. Student notebook/portfolio3. Projects (individual & group)4. Laboratory work and reports5. AP exam questions6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Thermochemistry

PA Standards: 3.1.10.D
3.1.12.E
3.4.10.B
3.4.12.B

| Topics: | Skills: |
|--|---|
| Forms and sources of energy Enthalpy equations, laws, calculations Calorimetry Hess's Law Standard enthalpies of formation Enthalpy equations and calculations in chemical reactions Energy, pressure, heat, and work | <ol style="list-style-type: none">1. Solve enthalpy and calorimeter problems2. Identify sources of energy3. Use Hess's Law to solve for ΔH4. Understand the interrelationships between energy, pressure, heat, and work |
| Activities: | Performance Assessments: |
| <ol style="list-style-type: none">1. Supervised self-paced chemical laboratory work in laboratory groups2. Group projects and individual projects3. Cooperative learning groups4. Board demonstrations5. Guided practice6. Homework | <ol style="list-style-type: none">1. Teacher-made chapter tests and quizzes2. Student notebook/portfolio3. Projects (individual & group)4. Laboratory work and reports5. AP exam questions6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Liquids and Solids

PA Standards: 3.3.10.A
3.4.10.A
3.4.12.A

| Topics: | Skills: |
|---|--|
| Intermolecular forces Liquid state and properties Types of solids Metal bonds Carbon and silicon Molecular and ionic solids Vapor pressure curves Phase diagrams Types of solutions: molarity and molality Solubility factors Ideal and nonideal solutions Colligative properties Boiling point elevation and freezing point depression Colloids | <ol style="list-style-type: none">1. Understand intermolecular forces, dipole-dipole forces and London dispersion forces2. List the properties of a liquid3. Identify types of solids and their structures4. Become familiar with the structure and bonding of metals5. Know the properties of the network atomic solids carbon and silicon6. Interpret phase diagrams7. Calculate the molarity and molality of solutions8. Know solubility factors9. Distinguish between ideal and nonideal solutions10. Perform calculations on ideal and nonideal solutions11. Interpret vapor pressure diagrams to determine boiling point and freezing point12. Calculate the boiling point elevation and freezing point depression constant of a solute13. Know colligative properties and colloid characteristics |
| Activities: | Performance Assessments: |
| <ol style="list-style-type: none">1. Supervised self-paced chemical laboratory work in laboratory groups2. Group projects and individual projects3. Cooperative learning groups4. Board demonstrations5. Guided practice6. Homework | <ol style="list-style-type: none">1. Teacher-made chapter tests and quizzes2. Student notebook/portfolio3. Projects (individual & group)4. Laboratory work and reports5. AP exam questions6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Chemical Kinetics

PA Standards: 3.4.12.A
3.4.10.A

| Topics: | Skills: |
|--|---|
| Reaction rates Rate laws Determination of the form of the rate law Method of initial rates Differential rate law Integrated rate law Rate constants Reaction mechanisms Homogeneous and heterogeneous catalysis | <ol style="list-style-type: none">1. Calculate reaction rates2. Determine the forms of the rate law3. Use method of initial rates4. Use the differential rate law5. Use the integrated rate law6. Solve for the rate constant in a first and second order reaction7. Distinguish between homogenous and heterogeneous catalysis |
| Activities: | Performance Assessments: |
| <ol style="list-style-type: none">1. Supervised self-paced chemical laboratory work in laboratory groups2. Group projects and individual projects3. Cooperative learning groups4. Board demonstrations5. Guided practice6. Homework | <ol style="list-style-type: none">1. Teacher-made chapter tests and quizzes2. Student notebook/portfolio3. Projects (individual & group)4. Laboratory work and reports5. AP exam questions6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Chemical Equilibrium

PA Standards: 3.4.10.A

| Topics: | Skills: |
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| Chemical equilibrium terms Equilibrium constant Equilibrium and pressure Heterogeneous and homogeneous equilibria Equilibrium problems and calculations Le Chatelier's principle | <ol style="list-style-type: none">1. List characteristics and know terms of chemical equilibrium2. Write equilibrium expressions3. Calculate equilibrium constants4. Calculate equilibrium constants using pressure5. Understand how Le Chatelier's principle effects the direction of equilibrium using Q and K6. Solve problems using equilibrium relationships |
| Activities: | Performance Assessments: |
| <ol style="list-style-type: none">1. Supervised self-paced chemical laboratory work in laboratory groups2. Group projects and individual projects3. Cooperative learning groups4. Board demonstrations5. Guided practice6. Homework | <ol style="list-style-type: none">1. Teacher-made chapter tests and quizzes2. Student notebook/portfolio3. Projects (individual & group)4. Laboratory work and reports5. AP exam questions6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Acids and Bases

PA Standards: 3.1.10.B
3.4.12.A
3.4.10.A

| Topics: | Skills: |
|---|--|
| <p>Acids and bases: Arrhenius, Bronsted-Lowry and Lewis Models Strength of an acid PH scale and calculations Bases Polyprotic acids Acid-base properties of salts Acid-base problems using pH, pOH, [H⁺] and [OH⁻] Buffered solutions and buffering capacity Common ion effect Titrations and pH curves Acid-base indicators Precipitation and qualitative analysis</p> | <ol style="list-style-type: none"> 1. Differentiate between Arrhenius, Bronsted-Lowry, and Lewis acids and bases 2. Determine the relative strength of acids and bases 3. Calculate % dissociation and K_a of acids 4. Write the conjugate acid and conjugate base given an acid-base reaction 5. Convert among pH, pOH, [H⁺] and [OH⁻] 6. Identify polyprotic acids 7. Solve for the pH of polyprotic acids 8. Understand the buffering capacity of solutions using the common ion effect 9. Perform titrations (strong acid/strong base, and weak acid/strong base) 10. Plot titration pH curves with software 11. Use acid-base indicators 12. Determine precipitation conditions and molartiy of a titrant from mass of ppt |
| Activities: | Performance Assessments: |
| <ol style="list-style-type: none"> 1. Supervised self-paced chemical laboratory work in laboratory groups 2. Group projects and individual projects 3. Cooperative learning groups 4. Board demonstrations 5. Guided practice 6. Homework | <ol style="list-style-type: none"> 1. Teacher-made chapter tests and quizzes 2. Student notebook/portfolio 3. Projects (individual & group) 4. Laboratory work and reports 5. AP exam questions 6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Descriptive Chemistry

PA Standards: 3.1.10.C
3.1.12.C
3.4.10.A
3.4.12.A

| Topics: | Skills: |
|---|--|
| Periodic table including the metals, metalloids, nonmetals, halogens, representative elements, transition metals, lanthanides, and actinides Location based on properties, preparation and uses, electron configuration, oxidation states, ionization energies, standard reduction potentials Biological importance of elements | <ol style="list-style-type: none">1. Become familiar with trends on the periodic table Identify areas on the periodic table for the location of the metals, metalloids, nonmetals, halogens, representative elements, transition metals, lanthanides, and actinides2. Interpret an elements properties based on its location on the periodic table3. Solve for oxidation state4. List uses of elements, including their biological importance |
| Activities: | Performance Assessments: |
| <ol style="list-style-type: none">1. Supervised self-paced chemical laboratory work in laboratory groups2. Group projects and individual projects3. Cooperative learning groups4. Board demonstrations5. Guided practice6. Homework | <ol style="list-style-type: none">1. Teacher-made chapter tests and quizzes2. Student notebook/portfolio3. Projects (individual & group)4. Laboratory work and reports5. AP exam questions6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Nuclear Chemistry

PA Standards: 3.4.10.A
3.4.12.A
3.4.10.A

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|---|---|
| Topics: Atomic subdivisions Zone of stability and magic numbers Balancing nuclear equations Nuclear transformations in equations Nuclear stability Radioactive decay and kinetics Detection and uses of radioactivity, dating and medical applications Thermodynamic stability Nuclear fission and fusion Effects of radiation | Skills: 1. Know the parts of an atom 2. Use the zone of stability and magic numbers to predict the outcome of a nuclear decay 3. Balance nuclear equations using alpha, beta, gamma, and positron emission, electron capture, and bombardment 4. Perform half-life problems 5. Become familiar with the uses of radioactivity, including radioactive dating and medical applications 6. Calculate the thermodynamic stability of the nucleus of an atom 7. Distinguish between nuclear fission and fusion 8. List effects of radiation |
| Activities: 1. Supervised self-paced chemical laboratory work in laboratory groups 2. Group projects and individual projects 3. Cooperative learning groups 4. Board demonstrations 5. Guided practice 6. Homework | Performance Assessments: 1. Teacher-made chapter tests and quizzes 2. Student notebook/portfolio 3. Projects (individual & group) 4. Laboratory work and reports 5. AP exam questions 6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Organic Chemistry

PA Standards: 3.4.10.A
3.4.12.A

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| Topics: Organic chemistry Alkanes, alkenes, alkynes, alkadienes, Aromatic hydrocarbons, alcohols, aldehydes, ketones, and amines Nomenclature Isomers Polymers | Skills: 1. Know what makes a substance organic 2. Identify alkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, aldehydes, ketones, and amines 3. Name alkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, aldehydes, ketones, and amines 4. Draw isomers 5. List properties of polymers |
| Activities: 1. Supervised self-paced chemical laboratory work in laboratory groups 2. Group projects and individual projects 3. Cooperative learning groups 4. Board demonstrations 5. Guided practice 6. Homework | Performance Assessments: 1. Teacher-made chapter tests and quizzes 2. Student notebook/portfolio 3. Projects (individual & group) 4. Laboratory work and reports 5. AP exam questions 6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Review of Course

PA Standards: 3.1.10.C
3.1.12.C
3.1.10.D
3.1.12.D
3.1.12.E
3.2.10.B
3.2.12.B
3.2.10.C
3.2.12.C
3.4.10.A
3.4.12.A
3.4.10.B
3.4.12.B

| Topics: | Skills: |
|--|---|
| Oxidation-reduction reactions and electrochemistry Atomic structure and periodicity Bonding Gases Thermochemistry Liquids and solids Chemical kinetics Chemical equilibrium Acids and bases Descriptive chemistry Nuclear chemistry Organic chemistry | <ol style="list-style-type: none">1. Balance oxidation-reduction reactions2. Know atomic structure3. Use periodicity to determine an elements properties4. Show bonding between substance5. Perform gas law problems6. List forms of energy7. Solve energy and calorimeter problems8. Identify properties of liquids and solids9. Calculate chemical kinetic problems10. Solve for chemical equilibrium11. List properties of acids and bases12. Solve for pH, pOH, and concentration of acids and bases13. Use periodic trends to predict properties of elements14. Balance nuclear reactions15. Name and draw organic compounds |
| Activities: | Performance Assessments: |
| <ol style="list-style-type: none">1. Supervised self-paced chemical laboratory work in laboratory groups2. Group projects and individual projects3. Cooperative learning groups4. Board demonstrations5. Guided practice6. Homework | <ol style="list-style-type: none">1. Teacher-made chapter tests and quizzes2. Student notebook/portfolio3. Projects (individual & group)4. Laboratory work and reports5. AP exam questions6. Final exam |

Wallenpaupack Area School District

Course: Advanced Placement Chemistry

Grade Level: 11-12

Unit: Independent Project

PA Standards: 3.2.10.B
3.2.12.B
3.2.10.C
3.2.12.C
3.3.10.A
3.4.10.A
3.4.12.A

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|---|---|
| Topics: Scientific method Data gathering and recording skills Public speaking and presentation | Skills: 1. Use the scientific method to solve a problem 2. Record and interpret data 3. Formulate a professional presentation |
| Activities: 1. Supervised self-paced chemical laboratory work in laboratory groups 2. Group projects and individual projects 3. Cooperative learning groups 4. Board demonstrations 5. Guided practice 6. Homework | Performance Assessments: 1. Teacher-made chapter tests and quizzes 2. Student notebook/portfolio 3. Projects (individual & group) 4. Laboratory work and report 5. AP exam questions 6. Final exam |