Geneva CUSD 304
Content-Area Curriculum Frameworks
Grades 6-12
Science

Mission Statement	<u>The Mission of Science Education Is:</u> 1) To nurture an active interest in science that continues throughout life. 2) To teach the learning skills and concepts necessary for the scientific process. 3) To develop student understanding of the interrelationships between science, society, and the environment 4) To encourage students to discover and develop their talent in science.
Course Sequence (Grades 6-12)	**6th grade:** Earth Science **7th grade:** Life Science **8th grade:** Physical Science **9th grade:** General Science Earth Science Biology Biology Honors **10th ,11th,12 grade:** Chemistry Chemistry Honors Physics Astronomy Natural Disasters Anatomy and Physiology I and II Horticulture I and II AP Chemistry AP Biology AP Environmental Science

Course Framework

Course Title	**Advanced Placement Chemistry**
Grade Level	11th/12th
Semesters (1-2-3-4)	2
Prerequisite	Grade of A in Chemistry or department approval, Algebra II
Course Description	This is an advanced, capstone science course that is presented in a more rigorous and analytical manner than general chemistry. It should not be considered as a simple continuation of general chemistry. This course allows students to pursue college-level chemistry while still in high school and to receive advanced placement credit upon entering college. The course covers the topics and laboratories typically offered by colleges in the freshman year. Topics covered include atomic theory, chemical bonding, states of matter, reactions, and descriptive chemistry. Students enrolled in AP courses are expected to take the AP exam offered in May
District-approved Materials and/or Resources	Chemical Principles and Reactions Publisher: Thomson Learning ISBN: 05344-08788 Copy write: 2004

Unit Frameworks

Unit of Study: major topics	**Safety, Matter and Measurement**	Resources that will support instruction Safety packet/contract, text, syllabus, lab, lab format sheet, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a Formulate hypotheses referencing prior research and knowledge. 11.A.5b Design procedures to test the selected hypotheses. 11.A.5c Conduct systematic controlled experiments to test the selected hypotheses. 11.A.5d Apply statistical methods to make predictions and to test the accuracy of results 11.A.5e Report, display, and defend the results of investigations to audiences that may include professionals and technical experts. 11.B.5c Build and test different models or simulations of the design solution using suitable materials, tools, and technology. 11.B.4f Evaluate the test results based on established criteria, note sources of error and recommend improvements. 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 12.D.5b Analyze the effects of gravitational, electromagnetic, and nuclear forces on a physical system. 13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies. 13.A.5d Explain using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims.	

Objectives o **Conceptual** o **Factual** o **Procedural**	1. Convert between °F, °C, and K. 2. Determine the number of significant figures in a measured quantity. 3. Determine the number of significant figures in a calculated quantity. 4. Use conversion factors to change the units of a measured quantity. 5. Relate density to mass and volume. 6. Understand the differences between chemical and physical properties and changes. 7. Given its solubility, relate mass of solute to that of solvent 8. Learn safety issues and procedures for the chemistry classroom.	
Assessments	Performance Tasks Tests HW set Lab Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Atoms, Molecules, Ions/Mass Relations in Chemistry; Stoichiometry**	Resources that will support instruction Text, lab, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5c Conduct systematic controlled experiments to test the selected hypotheses. 11.A.5d Apply statistical methods to make predictions and to test the accuracy of results 11.A.5e Report, display, and defend the results of investigations to audiences that may include professionals and technical experts. 11.B.5b Select criteria for a successful design solution to the identified problem. 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 12.D.5b Analyze the effects of gravitational, electromagnetic, and nuclear forces on a physical system. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies. 13.A.5d Explain using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims. 13.B.5e Assess how scientific and technological progress has affected other fields of study, careers, and job markets and aspects of everyday life.	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Relate a nuclear symbol to the number of protons and neutrons in the nucleus. 2. Relate structural, condensed structural, and molecular formulas. 3. Predict formulas of ionic compounds from charges of ions. 4. Relate names to formulas for ionic compounds, binary molecular compounds, acids 5. Relate the atomic mass of an element to isotopic masses and abundances. 6. Use Avogadro's number to calculate the mass of an atom or molecule. 7. Use molar mass to relate:moles to mass of a substance and molecular formula to simplest formula. 8. Use the formula of a compound to find percent composition or its	

	equivalent. 9. Find the simplest formula of a compound from chemical analysis. 10. Balance chemical equations by inspection. 11. Use a balanced equation to: relate masses of reactants and products, find the limiting reactant, theoretical yield, and percent yield.	
Assessments	Performance Tasks Tests HW set Lab Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Reactions in Aqueous Solutions**	Resources that will support instruction Text, lab, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a Formulate hypotheses referencing prior research and knowledge. 11.A.5b Design procedures to test the selected hypotheses. 11.A.5c Conduct systematic controlled experiments to test the selected hypotheses. 11.A.5d Apply statistical methods to make predictions and to test the accuracy of results 11.A.5e Report, display, and defend the results of investigations to audiences that may include professionals and technical experts. 11.B.5b Select criteria for a successful design solution to the identified problem. 11.B.5e Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities. 13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies. 13.B.5e Assess how scientific and technological progress has affected other fields of study, careers, and job markets and aspects of everyday life.	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Relate molarity of a solute to: number of moles and volume, molarities of ions. 2. Apply the precipitation diagram (Figure 4.3) to: predict precipitation reactions, write net ionic equations for precipitation reactions.	

	3. Carry out stoichiometric calculations for reactions in solution. 4. With the aid of Tables 4.1 and 4.2, write net ionic equations for acid-base reactions. 5. Determine oxidation numbers. 6. Balance redox half-equations and overall equations.	
Assessments	Performance Tasks Tests HW set Lab Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Gases**	Resources that will support instruction Text, lab, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a Formulate hypotheses referencing prior research and knowledge. 11.A.5b Design procedures to test the selected hypotheses. 11.A.5c Conduct systematic controlled experiments to test the selected hypotheses. 11.A.5d Apply statistical methods to make predictions and to test the accuracy of results 11.A.5e Report, display, and defend the results of investigations to audiences that may include professionals and technical experts. 11.B.5b Select criteria for a successful design solution to the identified problem. 11.B.5e Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements 11.B.5f Using available technology, prepare and present findings of the tested design solution to an audience that may include professional and technical experts. 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities. 13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies.	

Objectives o **Conceptual** o **Factual** o **Procedural**	1. Convert between units of P, V, T, and amount of gas. 2. Use the ideal gas law to:solve initial and final state problems; calculate P, V, T or n; calculate density or molar mass; relate amounts and volumes of gases in reactions 3. Use Dalton's law to relate partial pressures to: total pressure, mole fractions. 4. Calculate the speeds of gas molecules. 5. Use Graham's law to relate rate of effusion to molar mass.	
Assessments	Performance Tasks Tests HW set Lab Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Electronic Structure and the Periodic Table**	Resources that will support instruction Text, lab, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a Formulate hypotheses referencing prior research and knowledge. 11.A.5b Design procedures to test the selected hypotheses. 11.A.5c Conduct systematic controlled experiments to test the selected hypotheses. 11.A.5d Apply statistical methods to make predictions and to test the accuracy of results 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 12.D.5a Analyze factors that influence the relative motion of an object (e.g., friction, wind shear, cross currents, potential differences). 12.D.5b Analyze the effects of gravitational, electromagnetic, and nuclear forces on a physical system. 12.F.5a Compare the processes in the life cycle of stars (e.g., gravitational collapse, thermonuclear fusion, nova) and evaluate the supporting evidence 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies. 13.A.5d Explain using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims. 13.B.5a Analyze challenges created by international competition for increases in scientific knowledge and technological capabilities (e.g., patent issues, industrial espionage, technology obsolescence). 13.B.5e Assess how scientific and technological progress has affected other fields of study, careers, and job markets and aspects of everyday life.	

	13.B.5b Analyze and describe the processes and effects of scientific and technological breakthroughs.	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Relate wavelength, frequency, and energy. 2. Use the Bohr model to identify lines in the hydrogen spectrum. 3. Identify quantum numbers of electrons in atoms. 4. Derive the electron capacities of energy levels. 5. Write electron configurations, full or abbreviated, for atoms or ions. 6. Draw orbital diagrams for atoms and ions. 7. Identify periodic trends in radii, ionization energy, and electronegativity	
Assessments	Performance Tasks Tests HW set Lab Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Covalent Bonding**	Resources that will support instruction Text, lab, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a Formulate hypotheses referencing prior research and knowledge. 11.A.5b Design procedures to test the selected hypotheses. 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 12.D.5b Analyze the effects of gravitational, electromagnetic, and nuclear forces on a physical system. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies. 13.A.5d Explain using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims.	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Draw Lewis structures for molecules and polyatomic ions. 2. Write resonance forms. 3. Use Table 7.3 and Figure 7.8, applying the VSEPR, to predict molecular geometry. 4. Knowing the geometry of a species, predict whether it will be polar. 5. State the hybridization of an atom in a bonded species. 6. State the number of sigma and pi bonds in a species. 7. Understand the molecular orbital process.	
Assessments	Performance Tasks Tests HW set Lab Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Thermochemistry**	Resources that will support instruction Text, lab, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a Formulate hypotheses referencing prior research and knowledge. 11.A.5b Design procedures to test the selected hypotheses. 11.A.5c Conduct systematic controlled experiments to test the selected hypotheses. 11.A.5d Apply statistical methods to make predictions and to test the accuracy of results 11.A.5e Report, display, and defend the results of investigations to audiences that may include professionals and technical experts. 11.B.5a Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time, and costs. 11.B.5b Select criteria for a successful design solution to the identified problem. 11.B.5e Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements 11.B.5f Using available technology, prepare and present findings of the tested design solution to an audience that may include professional and technical experts. 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities. 13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational	

	studies, controlled laboratory experiments, computer modeling, and statistical studies. 13.B.5c Design and conduct and environmental impact study, analyze findings, and justify recommendations. 13.B.5d Analyze the costs, benefits, and effects of scientific and technological policies at the local, state, national, and global levels (e.g., genetic research, Internet access).	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Relate heat flow to specific heat, m, and t. 2. Calculate q for a reaction from calorimetric data. 3. Apply the rules of thermochemistry to: relate ΔH to mass of reactant or product, relate ΔH to forward and reverse reactions. 4. Apply Hess's law to calculate ΔH . 5. Relate $\Delta H°$ to enthalpies of formation. 6. Relate ΔE, q, and w. 7. Relate ΔH and ΔE.	
Assessments	Performance Tasks Tests HW set Lab Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Liquids and Solids**	Resources that will support instruction Text, lab, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a Formulate hypotheses referencing prior research and knowledge. 11.A.5b Design procedures to test the selected hypotheses. 11.A.5c Conduct systematic controlled experiments to test the selected hypotheses. 11.A.5d Apply statistical methods to make predictions and to test the accuracy of results 11.A.5e Report, display, and defend the results of investigations to audiences that may include professionals and technical experts. 11.B.5b Select criteria for a successful design solution to the identified problem. 11.B.5e Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities. 13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies.	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Use the ideal gas law to determine whether a liquid will completely vaporize. 2. Use the Clausius-Clapeyron equation to relate vapor pressure to temperature. 3. Use a phase diagram to determine the phase(s) present at a given *T* and *P*. 4. Identify the type of intermolecular forces in different substances.	

	5. Classify substances as molecular, network covalent, ionic, or metallic. 6. Relate unit cell dimensions to atomic or ionic radii.	
Assessments	Performance Tasks Tests HW set Lab Class notes	Other Evidence

Unit Frameworks

<table>
<tr><td>Unit of Study:
major topics</td><td colspan="2">Organic Chemistry</td><td>Resources that will support instruction
Text, overheads, Hw answer key</td></tr>
<tr><td>Illinois Learning Standards, Benchmarks,

National Standards Assessment Frameworks, or other standards that will be taught in this unit</td><td colspan="3">11.A.5a Formulate hypotheses referencing prior research and knowledge.
11.A.5b Design procedures to test the selected hypotheses.
11.A.5c Conduct systematic controlled experiments to test the selected hypotheses.
12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems.
12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures.
13.B.5b Analyze and describe the processes and effects of scientific and technological breakthroughs.
13.B.5e Assess how scientific and technological progress has affected other fields of study, careers, and job markets and aspects of everyday life.</td></tr>
<tr><td>Objectives
o Conceptual
o Factual
o Procedural</td><td colspan="3">1. Draw: structural isomers, geometric isomers, optical isomers, containing chiral carbon atoms.
2. Distinguish between alkanes, alkenes, and alkynes.
3. Draw structural formulas for alcohols, carboxylic acids, and esters.
4. Relate the structure of an addition or condensation polymer to those of the corresponding monomer(s).
5. Name and determine formulas for each of the main types of organic counpounds.
6. Recognize key types of organic reactions and predict the products.</td></tr>
<tr><td>Assessments</td><td colspan="2">Performance Tasks

Tests
HW set
Class notes</td><td>Other Evidence</td></tr>
</table>

Unit Frameworks

Unit of Study: major topics	**Solutions**		Resources that will support instruction Text, lab, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a	Formulate hypotheses referencing prior research and knowledge.	
	11.A.5b	Design procedures to test the selected hypotheses.	
	11.A.5c	Conduct systematic controlled experiments to test the selected hypotheses.	
	11.A.5d	Apply statistical methods to make predictions and to test the accuracy of results	
	11.A.5e	Report, display, and defend the results of investigations to audiences that may include professionals and technical experts.	
	11.B.5b	Select criteria for a successful design solution to the identified problem.	
	11.B.5e	Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements	
	12.C.5a	Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems.	
	12.C.5b	Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures.	
	12.E.5	Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations).	
	13.A.5a	Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities.	
	13.A.5b	Explain criteria that scientists use to evaluate the validity of scientific claims and theories.	
	13.A.5c	Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies.	
	13.B.5e	Assess how scientific and technological progress has affected other fields of study, careers, and job markets and aspects of everyday life.	

<table>
<tr><td>Objectives
o Conceptual
o Factual
o Procedural</td><td colspan="2">1. Make dilution calculations.
2. Calculate a concentration (M, X, mass %, m).
3. Convert from one concentration unit to another.
4. Apply Henry's law to relate gas solubility to partial pressure.
5. Apply Raoult's law to calculate vapor pressure lowering.
6. Relate freezing point, boiling point, osmotic pressure to solute concentration.
7. Use colligative properties to determine molar mass of a solute.
8. Use colligative properties to determine extent of ionization.</td></tr>
<tr><td>Assessments</td><td>Performance Tasks

Tests
HW set
Lab
Class notes</td><td>Other Evidence</td></tr>
</table>

Unit Frameworks

Unit of Study: major topics	**Rate of Reaction**	Resources that will support instruction Text, lab, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a Formulate hypotheses referencing prior research and knowledge. 11.A.5b Design procedures to test the selected hypotheses. 11.A.5c Conduct systematic controlled experiments to test the selected hypotheses. 11.A.5d Apply statistical methods to make predictions and to test the accuracy of results 11.A.5e Report, display, and defend the results of investigations to audiences that may include professionals and technical experts. 11.B.5a Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time, and costs. 11.B.5b Select criteria for a successful design solution to the identified problem. 11.B.5e Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements 11.B.5f Using available technology, prepare and present findings of the tested design solution to an audience that may include professional and technical experts. 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities. 13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments,	

	computer modeling, and statistical studies. 13.B.5c Design and conduct and environmental impact study, analyze findings, and justify recommendations. 13.B.5d Analyze the costs, benefits, and effects of scientific and technological policies at the local, state, national, and global levels (e.g., genetic research, Internet access).	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Determine the rate expression (reaction order) from: initial rate data. concentration-time data, using Table 11.2, reaction mechanism. 2. Relate concentration to time for a first, second, and zero-order reaction. 3. Use the Arrhenius equation to relate rate constant to temperature.	
Assessments	Performance Tasks Tests HW set Lab Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Gaseous Chemical Equilibrium**	Resources that will support instruction Text, lab, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a Formulate hypotheses referencing prior research and knowledge. 11.A.5b Design procedures to test the selected hypotheses. 11.A.5c Conduct systematic controlled experiments to test the selected hypotheses. 11.A.5d Apply statistical methods to make predictions and to test the accuracy of results 11.A.5e Report, display, and defend the results of investigations to audiences that may include professionals and technical experts. 11.B.5a Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time, and costs. 11.B.5b Select criteria for a successful design solution to the identified problem. 11.B.5e Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements 11.B.5f Using available technology, prepare and present findings of the tested design solution to an audience that may include professional and technical experts. 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities. 13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments,	

	computer modeling, and statistical studies. 13.B.5c Design and conduct and environmental impact study, analyze findings, and justify recommendations. 13.B.5d Analyze the costs, benefits, and effects of scientific and technological policies at the local, state, national, and global levels (e.g., genetic research, Internet access).	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Relate the expression for K to chemical equation. 2. Calculate K, knowing: appropriate K's for other reactions, all the equilibrium partial pressures, all the original and one equilibrium partial pressure. 3. Use the value of K to determine: the direction of reaction, equilibrium partial pressures of all species. 4. Use Le Châtelier's principle to predict what will happen when the conditions on an equilibrium system are changed.	
Assessments	Performance Tasks Tests HW set Lab Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Acids and Bases**		Resources that will support instruction Text, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a	Formulate hypotheses referencing prior research and knowledge.	
	11.A.5b	Design procedures to test the selected hypotheses.	
	11.A.5c	Conduct systematic controlled experiments to test the selected hypotheses.	
	11.A.5d	Apply statistical methods to make predictions and to test the accuracy of results	
	11.A.5e	Report, display, and defend the results of investigations to audiences that may include professionals and technical experts.	
	11.B.5a	Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time, and costs.	
	11.B.5b	Select criteria for a successful design solution to the identified problem.	
	11.B.5e	Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements	
	11.B.5f	Using available technology, prepare and present findings of the tested design solution to an audience that may include professional and technical experts.	
	12.C.5a	Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems.	
	12.C.5b	Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures.	
	12.E.5	Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations).	
	13.A.5a	Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities.	
	13.A.5b	Explain criteria that scientists use to evaluate the	

	validity of scientific claims and theories. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies. 13.B.5c Design and conduct and environmental impact study, analyze findings, and justify recommendations. 13.B.5d Analyze the costs, benefits, and effects of scientific and technological policies at the local, state, national, and global levels (e.g., genetic research, Internet access).	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Classify a species as a Brønsted-Lowry acid or base and explain by a net ionic equation. 2. Given $[H^+]$, $[OH^-]$, pH, or pOH, calculate the other three quantities. 3. Given the pH and original concentration of a weak acid solution, calculate K_a. 4. Given K_a of a weak acid and its original concentration, calculate $[H^+]$. 5. Given K_b of a weak base and its original concentration, calculate $[OH^-]$. 6. Given K_a for a weak acid, calculate K_b for its conjugate base (or vice-versa). 7. Predict whether a salt solution is acidic, basic, or neutral. 8. Relate oxoacids to the corresponding oxides and compare their acid strengths.	
Assessments	Performance Tasks Tests HW set Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Equilibria in Acid-Base Solutions/Precipitation Equilibria**	Resources that will support instruction Text, lab, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a Formulate hypotheses referencing prior research and knowledge. 11.A.5b Design procedures to test the selected hypotheses. 11.A.5c Conduct systematic controlled experiments to test the selected hypotheses. 11.A.5d Apply statistical methods to make predictions and to test the accuracy of results 11.A.5e Report, display, and defend the results of investigations to audiences that may include professionals and technical experts. 11.B.5a Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time, and costs. 11.B.5b Select criteria for a successful design solution to the identified problem. 11.B.5e Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements 11.B.5f Using available technology, prepare and present findings of the tested design solution to an audience that may include professional and technical experts. 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 12.E.5 Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations). 13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities.	

	13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies.	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Calculate the pH of a buffer as originally prepared. 2. Choose a buffer to get a specified pH. 3. Calculate the pH of a buffer after addition of H^+ or OH^- ions. 4. Determine the color of an indicator at a given pH. 5. Calculate the pH during an acid-base titration. 6. Choose the proper indicator for an acid-base titration. 7. Calculate K for an acid-base reaction. 8. Write the expression for K_{sp} for any ionic solid. 9. Use the value of K_{sp} to: calculate the concentration of one ion, knowing that of the other, determine whether a precipitate will form, calculate the water solubility of an ionic compound, calculate the solubility in a solution containing a common ion, determine which ion will precipitate first from a solution. 10. Calculate K for: dissolving a metal hydroxide in strong acid, dissolving a precipitate in a complexing agent. 11. Write balanced net ionic equations to explain why a precipitate dissolves in: strong acid, NH_3 or OH^-	
Assessments	Performance Tasks Tests HW set Lab Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Spontaneity of Reactions**	Resources that will support instruction Text, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.B.5a Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time, and costs. 11.B.5b Select criteria for a successful design solution to the identified problem. 11.B.5e Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities. 13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies. 13.B.5c Design and conduct and environmental impact study, analyze findings, and justify recommendations.	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Deduce the sign of ΔS for a process from randomness considerations. 2. Calculate $\Delta S°$ for a reaction, using Table 17.1. 3. Calculate $\Delta G°$ at any temperature, knowing $\Delta H°$ and $\Delta S°$. 4. Calculate $\Delta G°$ at 25°C from free energies of formation. 5. Calculate the temperature at which $\Delta G° = 0$. 6. Calculate ΔG from $\Delta G°$, knowing all pressures and/or concentrations. 7. Relate $\Delta G°$ to K. 8. Calculate $\Delta G°$ for coupled reactions.	

Assessments	Performance Tasks Tests HW set Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Nuclear Reactions**	Resources that will support instruction Text, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a Formulate hypotheses referencing prior research and knowledge. 11.A.5b Design procedures to test the selected hypotheses. 11.A.5d Apply statistical methods to make predictions and to test the accuracy of results 11.A.5e Report, display, and defend the results of investigations to audiences that may include professionals and technical experts. 11.B.5a Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time, and costs. 11.B.5b Select criteria for a successful design solution to the identified problem. 11.B.5e Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements 12.A.5b Analyze the transmission of genetic traits, diseases, and defects. 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 12.D.5b Analyze the effects of gravitational, electromagnetic and nuclear forces on a physical system. 12.E.5 Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations). 13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities. 13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories.	

	13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies. 13.B.5b Analyze and describe the processes and effects of scientific and technological breakthroughs. 13.B.5c Design and conduct and environmental impact study, analyze findings, and justify recommendations. 13.B.5d Analyze the costs, benefits, and effects of scientific and technological policies at the local, state, national, and global levels (e.g., genetic research, Internet access). 13.B.5e Assess how scientific and technological progress has affected other fields of study, careers, and job markets and aspects of everyday life.	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Write balanced nuclear equations. 2. Relate activity to rate constant and number of atoms. 3. Relate activity to age of organic objects. 4. Relate Δm to ΔE in a nuclear reaction. 5. Calculate binding energies.	
Assessments	Performance Tasks Tests HW set Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Electrochemistry**	Resources that will support instruction Text, lab, overheads, practice test, Hw answer key
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a Formulate hypotheses referencing prior research and knowledge. 11.A.5b Design procedures to test the selected hypotheses. 11.A.5c Conduct systematic controlled experiments to test the selected hypotheses. 11.A.5d Apply statistical methods to make predictions and to test the accuracy of results 11.A.5e Report, display, and defend the results of investigations to audiences that may include professionals and technical experts. 11.B.5b Select criteria for a successful design solution to the identified problem. 11.B.5e Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities. 13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies. 13.B.5e Assess how scientific and technological progress has affected other fields of study, careers, and job markets and aspects of everyday life.	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Draw a diagram for a voltaic cell, labeling electrodes and direction of current flow. 2. Use standard potentials (Table 18.1) to: compare the relative strengths of different oxidizing agents; different reducing agents; calculate E° and/or	

	reaction spontaneity. 3. Relate E° to ΔG° and K. 4. Use the Nernst equation to relate voltage to concentration. 5. Relate mass of product to amount of electricity (coulombs) or amount of energy (joules) used in electrolysis reactions. 6. Write balanced equations to represent: metallurgical processes, reactions of Group 1 and Group 2 metals, redox reactions of transition metals.	
Assessments	Performance Tasks Tests HW set Lab Class notes	Other Evidence

Unit Frameworks

Unit of Study: major topics	**Complex Ions**	Resources that will support instruction Text, overheads
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.5a Formulate hypotheses referencing prior research and knowledge. 11.A.5e Report, display, and defend the results of investigations to audiences that may include professionals and technical experts. 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. 13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories. 13.A.5c Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies.	
Objectives o **Conceptual** o **Factual** o **Procedural**	1. Relate the composition of a complex ion to its charge, coordination number, and the oxidation number of the central metal. 2. Sketch the geometry of a complex ion and identify geometric isomers. 3. Give the electron configuration and/or orbital diagram of a transition metal cation. 4. Derive orbital diagrams for high-spin and low-spin complexes.	
Assessments	Performance Tasks Class notes	Other Evidence