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

Mission Statement	The Mission of Science Education Is:		
	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 Seguence	6 th grade:		
(Grades 6-12)	Earth Science		
	7th grade:		
	Life Science		
	8 th grade:		
	Physical Science		
	9 th grade:		
	General Science		
	Earth Science		
	Biology Biology Honors		
	Biology Honors		
	10 ,11 ,12 grade:		
	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	11 th /12th	
Semesters (1-2-3-4)	2	
Prerequisite	Grade of A in Chemistry or department approval, Algerbra 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 of Study:	Safety, Matter an	d Measurement	Resources that will support instruction
major topics			Safety packet/contract, text, syllabus,
			lab, lab format sheet, overheads,
			practice test, Hw answer key
Illinois Learning	11.A.5a	Formulate hypotheses	referencing prior research
Standards,		and knowledge.	
Benchmarks,	11.A.5b	Design procedures to hypotheses.	test the selected
National Standards	11.A.5c	Conduct systematic co	ontrolled experiments to
Assessment		test the selected hypot	theses.
Frameworks, or	11.A.5d	Apply statistical meth	ods to make predictions
other standards		and to test the accurac	ey of results
that will be taught	11.A.5e	Report, display, and d	efend the results of
in this unit		investigations to audie	ences that may include
		professionals and tech	inical experts.
	11.B.5c	Build and test differer	nt models or simulations of
		the design solution us	ing suitable materials, tools,
	11 D 4£	and technology.	
	11.B.4I	Evaluate the test resul	ts based on established
		criteria, note sources (of error and recommend
	12 C 5a	A nolyza reactions (a g muchaer reactions	
	12.C.3a	hurning of fuel decomposition of waste) in	
		natural and man-made energy systems	
	12 C 5h	Analyze the properties of materials (e.g. mass	
	12.0.30	hoiling point melting	point hardness) in relation
		to their physical and/c	or chemical structures
	12 D 5b	Analyze the effects of	gravitational
	12.0.00	electromagnetic and i	nuclear forces on a physical
		system.	
	13.A.5b	Explain criteria that so	cientists use to evaluate the
		validity of scientific c	laims and theories.
	13.A.5c	Explain the strengths,	weaknesses, and uses of
		research methodologie	es including observational
		studies, controlled lab	oratory experiments,
		computer modeling, a	nd statistical studies.
	13.A.5d	Explain using a practi	cal example (e.g., cold
		fusion), why experime	ental replication and peer
		review are essential to	scientific claims.

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

Unit of Study:	Atoms, Molecules	, Ions/Mass	Resources that will support instruction
major topics	Relations in Chem	nistry;	Text, lab, overheads, practice test, Hw
	Stoichiometry		answer key
Illinois Learning	11.A.5c	Conduct systematic co	ontrolled experiments to
Standards,		test the selected hypot	theses.
Benchmarks,	11.A.5d	Apply statistical meth	ods to make predictions
		and to test the accurac	cy of results
National Standards	11.A.5e	Report, display, and d	efend the results of
Assessment		investigations to audie	ences that may include
Frameworks, or		professionals and tech	inical experts.
other standards	11.B.5b	Select criteria for a su	ccessful design solution to
that will be taught		the identified problem	1.
in this unit	12.C.5a	Analyze reactions (e.g	g., nuclear reactions,
		burning of fuel, decor	nposition of waste) in
		natural and man-made	e energy systems.
	12.C.5b	Analyze the propertie	s of materials (e.g., mass,
		boiling point, melting	point, hardness) in relation
	10 0 51	to their physical and/o	or chemical structures.
	12.D.5b	Analyze the effects of gravitational,	
		electromagnetic, and nuclear forces on a physical	
	12 4 5	system.	
	13.A.5c	Explain the strengths,	weaknesses, and uses of
		research methodologies including observational	
		studies, controlled laboratory experiments,	
	12 4 5 1	computer modeling, and statistical studies.	
	13.A.30	Explain using a practi	cal example (e.g., cold
		ravious are accortial to	aniantific alors
	12 D 5 a	A gaoga how goigntifie	and technological program
	13.D.3e	Assess now scientific	da of study, servers, and job
		markets and aspects of	f everyday life
Objectives	1 Relate a i	nuclear symbol to the n	umber of protons and neutrons in the
• Concentual	nucleus	nuclear symbol to the h	tumber of protons and neutrons in the
\circ Factual	2 Relate st	ructural condensed stru	ictural and molecular formulas
\circ Procedural	3 Predict fo	ormulas of ionic compo	unds from charges of ions
	4 Relate na	mes to formulas for jou	nic compounds binary molecular
	compounds	acids	ine compounds, omary morecular
	5 Relate th	e atomic mass of an ele	ment to isotopic masses and abundances
	6 Use Avo	gadro's number to calcu	late the mass of an atom or molecule
	7. Use mola	ar 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
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Unit of Study:	Reactions in Aqu	eous Solutions	Resources that will support instruction
major topics	-		Text, lab, overheads, practice test, Hw
			answer key
			-
Illinois Learning	11.A.5a	Formulate hypotheses	referencing prior research
Standards,		and knowledge.	
Benchmarks,	11.A.5b	Design procedures to test the selected	
		hypotheses.	
National Standards	11.A.5c	Conduct systematic co	ontrolled experiments to
Assessment		test the selected hypot	theses.
Frameworks, or	11.A.5d	Apply statistical meth	ods to make predictions
other standards		and to test the accurac	ey of results
that will be taught	11.A.5e	Report, display, and d	efend the results of
in this unit		investigations to audie	ences that may include
		professionals and tech	inical experts.
	11.B.5b	Select criteria for a su	ccessful design solution to
	11 D 5	the identified problem	
	11.B.5e	Apply established crit	eria to evaluate the
		suitability, acceptabili	ity, benefits, drawbacks and
		consequences for the	tested design solution and
	12 C 5a	recommend modifications and refinements	
	12.C.5a	Analyze reactions (e.g	g., nuclear reactions,
		notural and man made	apargy systems
	12 C 5h	Analyze the propertie	s of materials (e.g. mass
	12.0.50	hoiling point melting point hardness) in relation	
		to their physical and/c	or chemical structures
	13 A 5a	Design procedures and	d policies to eliminate or
	10.11.04	reduce risk in potentia	ally hazardous science
		activities	
	13.A.5b	Explain criteria that so	cientists use to evaluate the
		validity of scientific c	laims and theories.
	13.A.5c	Explain the strengths,	weaknesses, and uses of
		research methodologi	es including observational
		studies, controlled lab	oratory experiments,
		computer modeling, and statistical studies.	
	13.B.5e	Assess how scientific	and technological progress
		has affected other field	ds of study, careers, and job
		markets and aspects of everyday life.	
Objectives	1. Relate mola	arity of a solute to: numb	er of moles and volume, molarities of
 Conceptual 	ions.		
• Factual	2. Apply the p	precipitation diagram (Fig	gure 4.3) to: predict precipitation
• Procedural	reactions, writ	reactions, write net ionic equations for precipitation reactions.	

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

Unit of Study:	Gases		Resources that will support instruction
major topics		Text, lab, overheads, practice test, Hw	
			answer key
T11. · T ·	11 4 7		
Illinois Learning	11.A.5a	Formulate hypotheses	referencing prior research
Stanuarus, Bonohmorks	11 A 5b	Design procedures to	tast the selected
Denemiai KS,	11.A.30	hypotheses.	
National Standards	11.A.5c	Conduct systematic controlled experiments to	
Assessment		test the selected hypotheses.	
Frameworks, or	11.A.5d	Apply statistical meth	ods to make predictions
other standards	11 4 5	and to test the accurac	cy of results
that will be taught	11.A.5e	investigations to audi	letend the results of
in this unit		professionals and task	unical exports
	11 B 5h	Select criteria for a su	ccessful design solution to
	11.0.50	the identified problem	
	11.B.5e	Apply established crit	teria 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	
	10 0 5	technical experts.	
	12.C.5a	Analyze reactions (e.g	g., nuclear reactions,
		burning of fuel, decor	nposition of waste) in
	12 C 5h	Analyze the propertie	s of materials (e.g. mass
	12.0.50	hoiling point melting	point hardness) in relation
		to their physical and/c	or chemical structures.
	13.A.5a	Design procedures an	d policies to eliminate or
		reduce risk in potentia	ally hazardous science
		activities.	
	13.A.5b	Explain criteria that se	cientists use to evaluate the
		validity of scientific c	laims and theories.
	13.A.5c	Explain the strengths,	weaknesses, and uses of
		research methodologi	es including observational
		studies, controlled lab	oratory experiments,
		computer modering, a	nu statistical studies.

Objec	ctives	1. Convert between units of P, V, T, a	nd amount of gas.	
0	Conceptual	2. Use the ideal gas law to:solve initial and final state problems; calculate P, V,		
0	Factual	T or n; calculate density or molar mas	s; relate amounts and volumes of gases in	
0	Procedural	reactions		
		3. Use Dalton's law to relate partial pr	essures to: total pressure, mole fractions.	
		4. Calculate the speeds of gas molecul	es.	
		5. Use Graham's law to relate rate of e	ffusion to molar mass.	
Asses	sments	Performance Tasks	Other Evidence	
		Tests		
		HW set		
		Lab		
		Class notes		

Unit of Study:	Electronic Struct	ture and the Periodic	Resources that will support instruction
major topics	Table		Text, lab, overheads, practice test, Hw
			answer key
Illinois Learning	11.A.5a	Formulate hypotheses	referencing prior research
Standards,		and knowledge.	01
Benchmarks,	11.A.5b	Design procedures to hypotheses.	test the selected
National Standards Assessment	11.A.5c	Conduct systematic contest the selected hypot	ontrolled experiments to
Frameworks. or	11.A.5d	Apply statistical meth	ods to make predictions
other standards		and to test the accurac	cy of results
that will be taught	12.C.5a	Analyze reactions (e.g	g., nuclear reactions,
in this unit		burning of fuel, decon	nposition of waste) in
		natural and man-made	e energy systems.
	12.C.5b	Analyze the properties	s of materials (e.g., mass,
		boiling point, melting	point, hardness) in relation
		to their physical and/c	or chemical structures.
	12.D.5a	Analyze factors that II	nfluence the relative motion
		of an object (e.g., friction, wind shear, cross	
	12 D 51	Analyze the effects of gravitational, electromagnetic, and nuclear forces on a physical	
	12.D.30		
	12 F 5a	Compare the processe	es in the life cycle of stars
	12.1.04	(e g gravitational col	lapse thermonuclear
		fusion, nova) and eval	luate the supporting
		evidence	
	13.A.5c	Explain the strengths,	weaknesses, and uses of
		research methodologie	es including observational
		studies, controlled lab	oratory experiments,
		computer modeling, a	nd statistical studies.
	13.A.5d	Explain using a practi	cal example (e.g., cold
		fusion), why experime	ental replication and peer
	12 D C	review are essential to	scientific claims.
	13.B.5a	Analyze challenges cr	eated by international
		and technological con	abilities (e.g. potent issues
		industrial espionage t	autilites (c.g., patent issues,
	13 R 5e	Assess how scientific	and technological progress
	15.0.50	has affected other field	ds of study careers and job
		markets and aspects o	f everyday life.

		13.B.5b Analyze and describe	the processes and effects of	
		scientific and technological breakthroughs.		
Objec	tives	1. Relate wavelength, frequency, and	energy.	
0	Conceptual	2. Use the Bohr model to identify line	s in the hydrogen spectrum.	
0	Factual	3. Identify quantum numbers of electr	ons in atoms.	
0	Procedural	4. Derive the electron capacities of end	ergy levels.	
		5. Write electron configurations, full of	or abbreviated, for atoms or ions.	
		6. Draw orbital diagrams for atoms an	d ions.	
		7. Identify periodic trends in radii, ion	ization energy, and electronegativity	
Asses	sments	Performance Tasks	Other Evidence	
		Tests		
		HW set		
		Lab		
		Class notes		

major topics Text, lab, overheads, practice test, Hw answer key Text, lab, overheads, practice test, Hw	ajor topics
answer key	
Illinois Learning 11 A 5a Formulate hypotheses referencing prior research	inois Learning
Standards.	andards.
Benchmarks, 11.A.5b Design procedures to test the selected hypotheses.	enchmarks,
National Standards12.C.5aAnalyze reactions (e.g., nuclear reactions,	ational Standards
Assessment burning of fuel, decomposition of waste) in	sessment
Frameworks, or natural and man-made energy systems.	ameworks, or
other standards 12.C.5b Analyze the properties of materials (e.g., mass,	her standards
that will be taught boiling point, melting point, hardness) in relation	at will be taught
in this unit to their physical and/or chemical structures.	this unit
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 1. Draw Lewis structures for molecules and polyatomic ions.	bjectives
• Conceptual 2. Write resonance forms.	• Conceptual
• Factual 3. Use Table 7.3 and Figure 7.8, applying the VSEPR, to predict molecular	• Factual
• Procedural geometry.	• Procedural
4. Knowing the geometry of a species, predict whether it will be polar.	
6. State the number of sigma and ni honds in a species.	
7 Understand the molecular orbital process	
Assessments Performance Tasks Other Evidence	sessments
Tests	
HW set	
Lab	
Class notes	

Unit of Study:	Thermochemistry		Resources that will support instruction
major topics		Text, lab, overheads, practice test, Hw	
			answer key
Illinois Learning	11.A.5a	Formulate hypotheses	referencing prior research
Standards,		and knowledge.	
Benchmarks,	11.A.5b	Design procedures to test the selected hypotheses.	
National Standards Assessment	11.A.5c	Conduct systematic controlled experiments to test the selected hypotheses.	
Frameworks, or other standards	11.A.5d	Apply statistical methods to make predictions and to test the accuracy of results	
that will be taught in this unit	11.A.5e	Report, display, and d	efend the results of ences that may include
		professionals and tech	inical experts.
	11.B.5a	Identify a design prob	lem that has practical
		applications and prop	ose possible solutions,
		considering such cons	straints as available tools,
	11 D 5h	materials, time, and co	osts.
	11.D.30	the identified problem	
	11.B.5e	Apply established crit	teria to evaluate the
		suitability, acceptabili	ty, benefits, drawbacks and
		consequences for the	tested design solution and
		recommend modificat	tions and refinements
	11.B.5f	Using available technologies	ology, prepare and present
		audience that may inc	lude professional and
		technical experts	idde professional and
	12.C.5a	Analyze reactions (e.g	g., nuclear reactions,
		burning of fuel, decor	nposition of waste) in
		natural and man-made	e energy systems.
	12.C.5b	Analyze the propertie	s of materials (e.g., mass,
		to their physical and/	point, naraness) in relation
	13 A 5a	Design procedures an	d policies to eliminate or
		reduce risk in potentia	ally hazardous science
		activities.	-
	13.A.5b	Explain criteria that se	cientists use to evaluate the
	10 1 5	validity of scientific claims and theories.	
	13.A.5c	Explain the strengths, weaknesses, and uses of	
Frameworks, or other standards that will be taught in this unit	11.A.5d 11.A.5e 11.B.5a 11.B.5b 11.B.5c 11.B.5f 12.C.5a 12.C.5b 13.A.5a 13.A.5b 13.A.5c	hypotheses. Conduct systematic controlled experiments to test the selected hypotheses. Apply statistical methods to make predictions and to test the accuracy of results Report, display, and defend the results of investigations to audiences that may include professionals and technical experts. Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time, and costs. Select criteria for a successful design solution to the identified problem. Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements Using available technology, prepare and present findings of the tested design solution to an audience that may include professional and technical experts. Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities. Explain criteria that scientists use to evaluate the validity of scientific claims and theories	

		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	ogical policies at the local,	
			state, national, and glo	obal levels (e.g., genetic	
			research, Internet acce	ess).	
Objec	ctives	1. Relate heat	flow to specific heat, m,	, and t.	
0	Conceptual	2. Calculate q	for a reaction from calo	rimetric data.	
0	Factual	3. Apply the r	ules of thermochemistry	to: relate ΔH to mass of reactant or	
0	Procedural	product,			
		relate ΔH to for	prward and reverse react	ions.	
		4. Apply Hess	's law to calculate ΔH .		
5. Relate ΔH° to enthalpies of formation		on.			
6. Relate ΔE , q, and w.					
		7. Relate ΔH a	and ΔE .		
Asses	sments	Performance Task	S	Other Evidence	
		Tests			
		HW set			
		Lab			
		Class notes			

Unit	Frameworks
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Unit of Study:	Liquids and Solids		Resources that will support instruction
major topics		Text, lab, overheads, practice test, Hw	
			answer key
ти т	11 4 5		<u> </u>
Illinois Learning	11.A.5a	Formulate hypotheses	referencing prior research
Standards, Ponobmorks	11 A 5b	and knowledge.	test the selected
Dencimarks,	11.A.50	hypotheses.	
National Standards	11.A.5c	Conduct systematic controlled experiments to	
Assessment		test the selected hypotheses.	
Frameworks, or	11.A.5d	Apply statistical meth	ods to make predictions
other standards		and to test the accurac	ey of results
that will be taught	11.A.5e	Report, display, and d	etend the results of
in this unit		investigations to audie	ences that may include
		professionals and tech	inical experts.
	11.B.5b	Select criteria for a su	ccessful design solution to
	11 D 5	the identified problem	l.
	11.B.3e	Apply established crit	try hanafita drawhaalsa and
		suitability, acceptability	tosted design solution and
		recommend modificat	ions and refinements
	12 C 5a	Analyze reactions (e.c.	nuclear reactions
	12.C.Ja	hurning of fuel decomposition of waste) in	
		natural and man-made energy systems	
	12 C 5h	Analyze the properties	s of materials (e.g. mass
	12.0.00	boiling point melting	point hardness) in relation
		to their physical and/o	or chemical structures.
	13.A.5a	Design procedures and	d policies to eliminate or
		reduce risk in potentia	lly hazardous science
		activities.	5
	13.A.5b	Explain criteria that so	cientists use to evaluate the
		validity of scientific c	laims and theories.
	13.A.5c	Explain the strengths,	weaknesses, and uses of
		research methodologie	es including observational
		studies, controlled lab	oratory experiments,
		computer modeling, a	nd statistical studies.
Objectives	1. Use the idea	Jse the ideal gas law to determine whether a liquid will completely	
• Conceptual	vaporize.	ze.	
• Factual	2. Use the C	lausius-Clapeyron equ	ation to relate vapor pressure to
• Procedural	temperature		
	3. Use a pha	se diagram to determin	he the phase(s) present at a given T and
			In Course in difference 1 (
	4. Identify t	he type of intermolecul	lar 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	Other Evidence	
	Tests HW set Lab Class notes		

Unit of Study:	Organic Chemist	try	Resources that will support instruction	
major topics			Text, overheads, Hw answer key	
Illinois Learning	11.A.5a	Formulate hypotheses referencing prior research		
Standards,		and knowledge.		
Benchmarks,	11.A.5b	Design procedures to test the selected hypotheses.		
National Standards	11.A.5c	Conduct systematic controlled experiments to		
Assessment		test the selected hypotheses.		
Frameworks, or	12.C.5a	Analyze reactions (e.g	g., nuclear reactions,	
other standards		burning of fuel, decor	nposition of waste) in	
that will be taught		natural and man-made	e energy systems.	
in this unit	12.C.5b	Analyze the propertie	s of materials (e.g., mass,	
		boiling point, melting	point, hardness) in relation	
		to their physical and/o	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 fiel	ds of study, careers, and job	
		markets and aspects o	f everyday life.	
Objectives	1. Draw: structural isomers, geometric isomers, optical isomers, containing			
 Conceptual 	chiral carbon atoms.			
 Factual 	2. Distinguish between alkanes, alkenes, and alkynes.		es, and alkynes.	
• Procedural	3. Draw struct	ural formulas for alcoho	ols, carboxylic acids, and esters.	
	4. Relate the s	tructure of an addition o	or condensation polymer to those of the	
	corresponding	monomer(s).		
	5. Name and c	letermine formulas for e	ach of the main types of organic	
	counpounds.			
	6. Recognize key types of organic read		actions and predict the products.	
Assessments Performance Tasks		S	Other Evidence	
	—			
	Tests			
	HW set			
	Class notes			
	1			

Unit of Study:	Solutions		Resources that will support instruction
major topics		Text, lab, overheads, practice test, Hw	
			answer key
	11.4.5		
Illinois Learning	11.A.5a	Formulate hypotheses referencing prior research	
Standards,	11 4 51	and knowledge.	
Benchmarks,	11.A.50	hypotheses.	
National Standards	11.A.5c	Conduct systematic controlled experiments to	
Assessment		test the selected hypotheses.	
Frameworks, or	11.A.5d	Apply statistical meth	ods to make predictions
other standards		and to test the accurac	cy of results
that will be taught	11.A.5e	Report, display, and d	lefend the results of
in this unit		investigations to audio	ences that may include
	11 D Cl	professionals and tech	inical experts.
	11.B.30	Select criteria for a su	iccessful design solution to
	11 D 5a	Apply astablished arit	l.
	11.D.36	suitability accontabili	ity bonofits drawbacks and
		consequences for the	tested design solution and
		recommend modificat	tions and refinements
	12 C 5a	Analyze reactions (e.	nuclear reactions
	12.0.54	hurning of fuel decomposition of waste) in	
		natural and man-made	e energy systems
	12.C.5b	Analyze the propertie	s of materials (e.g., mass.
		boiling point, melting	point, hardness) in relation
		to their physical and/c	or chemical structures.
	12.E.5	Analyze the processes	s involved in naturally
		occurring short-term a	and long-term Earth events
		(e.g., floods, ice ages,	temperature, sea-level
		fluctuations).	
	13.A.5a	Design procedures an	d policies to eliminate or
		reduce risk in potentia	ally hazardous science
	12 4 51	activities. Γ	· .·
	13.A.50	Explain criteria that so	clentists use to evaluate the
	12 1 50	Explain the strengths	weaknesses and uses of
	13.A.30	research methodologi	es including observational
		studies controlled lab	oratory experiments
		computer modeling a	nd statistical studies
	13 B 5e	Assess how scientific and technological progress	
	10.000	has affected other fields of study careers and job	
		markets and aspects of everyday life.	

Objec	tives	1. Make dilution calculations.		
0	Conceptual	2. Calculate a concentration (M, X, mass %, m).		
0	Factual	3. Convert from one concentration unit to another.		
0	Procedural	4. Apply Henry's law to relate gas solu	ubility to partial pressure.	
		5. Apply Raoult's law to calculate vap	or pressure lowering.	
		6. Relate freezing point, boiling point,	, osmotic pressure to solute concentration.	
		7. Use colligative properties to determ	nine molar mass of a solute.	
		8. Use colligative properties to determ	nine extent of ionization.	
Asses	sments	Performance Tasks	Other Evidence	
		Tests		
		HW set		
		Lab		
		Class notes		

Unit of Study: Rate of Reaction Resources that will support instructi	on	
major topics Text, lab, overheads, practice test, H	w	
answer key		
Illinois Learning11.A.5aFormulate hypotheses referencing prior research		
Standards, and knowledge.	and knowledge.	
Benchmarks, 11.A.5b Design procedures to test the selected hypotheses.	Design procedures to test the selected hypotheses.	
National Standards 11.A.5c Conduct systematic controlled experiments to Assessment test the selected hypotheses	Conduct systematic controlled experiments to	
Eramoworks or 11 A 5d Apply statistical methods to make predictions		
other standards and to test the accuracy of results		
that will be taught 11 A 5e Report display and defend the results of		
in this unit 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		
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.		
15.A.SC Explain the strengths, weaknesses, and uses 01 research methodologies including observational		
research methodologies metuding observational		

	c 13.B.5c 13.B.5d 13.B.5d Si Si	computer modeling, and statistical studies. Design and conduct and environmental impact study, analyze findings, and justify recommendations. Analyze the costs, benefits, and effects of scientific and technological policies at the local, state, national, and global levels (e.g., genetic	
	re	esearch, Internet acce	ess).
Objectives	1. Determine the	rate expression (react	tion order) from: initial rate data.
• Conceptual	concentration-tim	e data, using Table I	1.2, reaction mechanism.
• Factual	2. Relate concentr	ation to time for a fin	rst, second, and zero-order reaction.
• Procedural	3. Use the Arrhen	ius equation to relate	Other Evidence
Assessments	Tests HW set Lab Class notes		Other Evidence

Unit of Study:	Gaseous Chemical	ical Equilibrium Resources that will support instruction	
major topics			Text, lab, overheads, practice test, Hw
			answer key
Illinois Learning	11 A 5a	Formulate hypotheses	referencing prior research
Standards.	11.7 1. 5 a	and knowledge	referencing prior research
Benchmarks.	11.A.5b	Design procedures to test the selected	
,		hypotheses.	
National Standards	11.A.5c	Conduct systematic co	ontrolled experiments to
Assessment		test the selected hypot	theses.
Frameworks, or	11.A.5d	Apply statistical meth	ods to make predictions
other standards		and to test the accurac	cy of results
that will be taught	11.A.5e	Report, display, and d	efend the results of
in this unit		investigations to audie	ences that may include
	11 D 5 a	professionals and tech	inical experts.
	11.D.Ja	applications and prop	ase possible solutions
		considering such cons	etraints as available tools
		materials time and co	osts
	11.B.5b	Select criteria for a su	ccessful design solution to
		the identified problem.	
	11.B.5e	Apply established criteria to evaluate the	
		suitability, acceptability, benefits, drawbacks and	
		consequences for the t	tested design solution and
		recommend modificat	tions and refinements
	11.B.5f	Using available techno	ology, prepare and present
		findings of the tested	design solution to an
		audience that may inc	lude professional and
	12 C 5a	technical experts.	nuclear reactions
	12.0.5a	hurning of fuel decon	g., nuclear reactions,
		natural and man-made	energy systems
	12 C 5b	Analyze the properties	s of materials (e.g. mass
	12.0.00	boiling point, melting	point, hardness) in relation
		to their physical and/c	or chemical structures.
	13.A.5a	Design procedures and	d policies to eliminate or
		reduce risk in potentia	ally hazardous science
		activities.	
	13.A.5b	Explain criteria that so	cientists use to evaluate the
		validity of scientific c	laims and theories.
	13.A.5c	Explain the strengths,	weaknesses, and uses of
		research methodologie	es including observational
		studies, controlled lab	oratory experiments,

			computer modeling, and statistical studies.		
		13.B.5c	Design and conduct a	nd environmental impact	
			study, analyze finding	s, and justify	
			recommendations.		
		13.B.5d	Analyze the costs, benefits, and effects of		
			scientific and technological policies at the local,		
			state, national, and glo	obal levels (e.g., genetic	
			research, Internet acco	ess).	
Objec	ctives	1. Relate the ex	pression for K to chem	ical equation.	
0	Conceptual	2. Calculate K,	knowing: appropriate l	K's for other reactions,	
0	Factual	all the equilibrium partial pressures, all the original and one equilibrium partial			
0	Procedural	pressure.			
		3. Use the value of K to determine: the direction of reaction, equilibrium partial			
		pressures of all	ssures of all species.		
		4. Use Le Chât	àtelier's principle to predict what will happen when the conditions		
		on an equilibrium system are changed.			
Asses	sments	Performance Tasks	5	Other Evidence	
		Tests			
		HW set			
		Lab			
		Class notes			

Unit of Study:	Acids and Bases	Resources that will support instruction	
major topics		Text, overheads, practice test, Hw	
		answer key	
Illinois Learning	11.A.5a	Formulate hypotheses referencing prior research	
Standards.		and knowledge.	
Benchmarks,	11.A.5b	Design procedures to test the selected	
,		hypotheses.	
National Standards	11.A.5c	Conduct systematic controlled experiments to	
Assessment		test the selected hypotheses.	
Frameworks, or	11.A.5d	Apply statistical methods to make predictions	
other standards		and to test the accuracy of results	
that will be taught	11.A.5e	Report, display, and defend the results of	
in this unit		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	
	11 D 50	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	
	12 0 5	technical experts.	
	12.C.3a	Analyze reactions (e.g., nuclear reactions,	
		natural and man made energy systems	
	12 C 5h	Analyze the properties of materials (e.g. mass	
	12.0.30	hoiling point melting point hardness) in relation	
		to their physical and/or chemical structures	
	12 E 5	Analyze the processes involved in naturally	
	12.1.0	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	

	13.A.5c 13.B.5c	validity of scientific claims and theories. Explain the strengths, weaknesses, and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling, and statistical studies. Design and conduct and environmental impact study, analyze findings, and justify	
	13.B.5d	recommendations. 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	1. Classify a species as	a Brønsted-Lowry	acid or base and explain by a net ionic
 Conceptual 	equation.		
 Factual 	2. Given [H ⁺], [OH ⁻], p	H, or pOH, calcula	ate the other three quantities.
• Procedural	3. Given the pH and ori	ginal concentration	n of a weak acid solution, calculate K _a .
	4. Given K_a of a weak a	icid and its origina	l concentration, calculate $[H^+]$.
	5. Given K_b of a weak b	base and its origination	al 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 sal	solution is acidic, basic, or neutral.	
	8. Relate oxoacids to the	e corresponding of	xides and compare their acid strengths.
Assessments	Performance Tasks		Other Evidence
	T (
	l ests		
	H w Set		
	Class notes		

Unit of Study: major topics	Equilibria in Acid-Base Solutions/Precipitation	Equilibria	Resources that will support instruction Text, lab, overheads, practice test, Hw
			answerkey
Illinois Learning	11.A.5a	Formulate hypo	theses referencing prior research
Benchmarks,	11.A.5b	Design procedu	ires to test the selected
National Standards	11.A.5c	Conduct system	natic controlled experiments to
Frameworks, or other standards	11.A.5d	Apply statistica	l methods to make predictions
that will be taught in this unit	11.A.5e	Report, display,	, and defend the results of o audiences that may include
	11.B.5a	professionals ar Identify a desig	nd technical experts. n problem that has practical
		applications and propose possible solutions, considering such constraints as available tools,	
	11.B.5b	Select criteria for a successful design solution to	
	11.B.5e	Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and	
	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	
	12.C.5b	Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation	
	12.E.5	to their physical Analyze the pro occurring short-	I and/or chemical structures. Decesses involved in naturally -term and long-term Earth events
		(e.g., floods, ice fluctuations).	e ages, temperature, sea-level
	13.A.5a	Design procedu reduce risk in p activities.	res and policies to eliminate or otentially hazardous science

		13.A.5b	Explain criteria	that scientists use to evaluate the	
			validity of scier	tific claims and theories.	
		13.A.5c	Explain the stre	ngths, weaknesses, and uses of	
			research metho	dologies including observational	
			studies, control	led laboratory experiments,	
			computer mode	ling, and statistical studies.	
Objec	tives	1. Calculate the pH of a buffer as originally prepared.			
0	Conceptual	2. Choose a buffer to	get a specified p	H.	
0	Factual	3. Calculate the pH o	f a buffer after ac	ldition of H^+ or OH^- ions.	
0	Procedural	4. Determine the colo	or of an indicator	at a given pH.	
		5. Calculate the pH d	uring an acid-bas	e titration.	
		6. Choose the proper	indicator for an a	cid-base titration.	
		7. Calculate K for an	acid-base reactio	n.	
		8. Write the expression	on for K_{sp} for any	ionic solid.	
		9. Use the value of K	sp to: calculate the	e 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 o	g acid, NH ₃ or OH ⁻		
Assess	sments	Performance Tasks		Other Evidence	
		Tests			
		HW set			
		Lab			
		Class notes			

Unit of Study:	Spontaneity of Re	eactions	Resources that will support instruction
major topics			Text, overheads, practice test, Hw
			answer key
	11 D 5-	1.1	1
Illinois Learning	11.B.5a	Identify a design prob	olem that has practical
Stanuarus, Donohmorka		applications and prop	ose possible solutions,
Dencimarks,		materials time and or	osts
National Standards	11 B 5b	Select criteria for a successful design solution to	
Assessment	11.D.50	the identified problem	
Frameworks, or	11 B 5e	Apply established crit	reria to evaluate the
other standards	11.0.00	suitability acceptabili	ity benefits drawbacks and
that will be taught		consequences for the	tested design solution and
in this unit		recommend modificat	tions and refinements
	12.C.5a	Analyze reactions (e.g	g., nuclear reactions,
		burning of fuel, decor	nposition of waste) in
		natural and man-made	e energy systems.
	12.C.5b	Analyze the propertie	s of materials (e.g., mass,
		boiling point, melting	point, hardness) in relation
		to their physical and/o	or chemical structures.
	13.A.5a	Design procedures an	d policies to eliminate or
		reduce risk in potentially hazardous science	
		activities.	
	13.A.5b	Explain criteria that scientists use to evaluate the	
	12 4 5	validity of scientific claims and theories.	
	13.A.5c	Explain the strengths,	weaknesses, and uses of
		research methodologi	es including observational
		computer modeling	nd statistical studies
	13 B 5c	Design and conduct a	nd environmental impact
	15.0.30	study analyze finding	and justify
		recommendations	s, and justify
Objectives	1. Deduce the sign	of ΔS for a process from	m randomness considerations.
 Conceptual 	2. Calculate ΔS° for	culate ΔS° for a reaction, using Table 17.1.	
 Factual 	3. Calculate ΔG° a	t any temperature, know	ving ΔH° and ΔS° .
 Procedural 	4. Calculate ΔG° a	F° at 25°C from free energies of formation.	
	5. Calculate the ter	ate the temperature at which $\Delta G^{\circ} = 0$.	
	6. Calculate ΔG from the function of the f	om ΔG° , knowing all p	ressures and/or concentrations.
	7. Relate ΔG° to K		
	8. Calculate ΔG° for	or coupled reactions.	

Assessments	Performance Tasks	Other Evidence
	Tests HW set Class notes	

Unit of Study:	Nuclear Reactions		Resources that will support instruction
major topics			Text, overheads, practice test, Hw
			answer key
Illinois Looming	11 4 50	Formulate hypotheses	referencing prior recearch
Standards	11.A.Ja	and knowledge	referencing prior research
Benchmarks	11 A 5h	Design procedures to test the selected	
Denemiarki,	11.71.00	hypotheses.	
National Standards	11.A.5d	Apply statistical meth	ods to make predictions
Assessment		and to test the accurac	cy of results
Frameworks, or	11.A.5e	Report, display, and d	efend the results of
other standards		investigations to audie	ences that may include
that will be taught		professionals and tech	inical experts.
in this unit	11.B.5a	Identify a design prob	lem that has practical
		applications and propo	ose possible solutions,
		considering such cons	traints as available tools,
	11 P 5b	Salact criteria for a su	uses of the second s
	11.D.30	the identified problem	
	11 B 5e	Apply established criteria to evaluate the	
	11.0.00	suitability acceptability benefits drawbacks and	
		consequences for the t	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	g., nuclear reactions,
		burning of fuel, decon	nposition of waste) in
		natural and man-made	e energy systems.
	12.C.5b	Analyze the properties	s of materials (e.g., mass,
		boiling point, melting	point, hardness) in relation
	12 D 5h	to their physical and/o	or chemical structures.
	12.D.30	Analyze the effects of	gravitational,
		system.	luciear forces on a physicar
	12.E.5	Analyze the processes involved in naturally	
		occurring short-term a	and long-term Earth events
		(e.g., floods, ice ages,	temperature, sea-level
		fluctuations).	
	13.A.5a	Design procedures and	d policies to eliminate or
		reduce risk in potentia	ally hazardous science
		activities.	
	13.A.5b	Explain criteria that so	cientists use to evaluate the
		validity of scientific claims and theories.	

	1			
	13.A.5c	Explain the strengths, research methodologi	, weaknesses, and uses of es including observational	
		studies, controlled lab	poratory experiments,	
		computer modeling, a	and statistical studies.	
	13.B.5b	Analyze and describe	the processes and effects of	
		scientific and technol	ogical breakthroughs.	
	13.B.5c	Design and conduct and environmental impact		
		study, analyze finding	gs, and justify	
		recommendations.		
	13.B.5d	Analyze the costs, be	nefits, and effects of	
		scientific and technol	ogical policies at the local,	
		state, national, and gl	obal levels (e.g., genetic	
	12 D 5	research, Internet acc		
	13.B.3e	Assess now scientific	and technological progress	
		markets and aspects of	of everyday life	
Objectives	1 Write bala	ned nuclear equations	si everyddy me.	
\circ Concentual	2 Relate activ	vity to rate constant and	number of atoms	
\circ Factual	3 Relate activ	vity to age of organic obj	iects	
• Procedural	4 Relate Δm	to ΔE in a nuclear reaction	on	
	5. Calculate b	ate binding energies.		
		6 6		
Assessments	Performance Tas	ks	Other Evidence	
	The second se			
	1 ests			
	H w set			
	Class notes			
	1			

Unit of Study:	Electrochemistry		Resources that will support instruction	
major topics	·		Text, lab, overheads, practice test, Hw	
			answer key	
			-	
Illinois Learning	11.A.5a	Formulate hypotheses	referencing prior research	
Standards,		and knowledge.	and knowledge.	
Benchmarks,	11.A.5b	Design procedures to hypotheses	test the selected	
National Standards	11 A 5c	Conduct systematic co	ontrolled experiments to	
Assessment	11.11.00	test the selected hypot	theses.	
Frameworks, or	11.A.5d	Apply statistical meth	ods to make predictions	
other standards		and to test the accurac	cy of results	
that will be taught	11.A.5e	Report, display, and d	efend the results of	
in this unit		investigations to audie	ences that may include	
		professionals and tech	inical experts.	
	11.B.5b	Select criteria for a su	ccessful design solution to	
		the identified problem	1.	
	11.B.5e	Apply established crit	eria to evaluate the	
		suitability, acceptabili	ty, 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, decon	nposition 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	
	12 4 5	to their physical and/o	or chemical structures.	
	13.A.5a	Design procedures and	a policies to eliminate or	
		reduce risk in potentia	illy nazardous science	
	12 A 5h	Explain oritoria that a	piontists use to evaluate the	
	15.A.50	validity of scientific c	laims and theories	
	$13 \wedge 5c$	Explain the strengths	weaknesses and uses of	
	15.71.50	research methodologie	es including observational	
		studies controlled lab	oratory experiments	
		computer modeling a	nd 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	1. Draw a diagr	am for a voltaic cell, la	beling electrodes and direction of current	
• Conceptual	flow.	,	-	
o Factual	2. Use standard	potentials (Table 18.1)) to: compare the relative strengths of	
 Procedural 	different oxidiz	ing 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 o	f electricity (coulombs) or amount of	
	energy (joules) used in electrolysis rea	actions.	
	6. Write balanced equations to represe	nt: metallurgical processes, reactions of	
-	Group 1 and Group 2 metals, redox re	actions of transition metals.	
Assessments	Performance Tasks	Other Evidence	
	Tests		
	HW set		
	Lab		
	Class notes		

Unit of Study:	Complex Ions		Resources that will support instruction	
major topics			Text, overheads	
Illinois Learning	11.A.5a	Formulate hypotheses referencing prior research		
Standards,		and knowledge.		
Benchmarks,	11.A.5e	Report, display, and defend the results of		
		investigations to audiences that may include		
National Standards		professionals and technical experts.		
Assessment	12.C.5a	Analyze reactions (e.g., nuclear reactions,		
Frameworks, or		burning of fuel, decomposition of waste) in		
other standards		natural and man-made energy systems.		
that will be taught	12.C.5b	Analyze the properties of materials (e.g., mass,		
in this unit		boiling point, melting point, hardness) in relation		
	12 4 51	to their physical and/or chemical structures.		
	13.A.5b	Explain criteria that scientists use to evaluate the		
	12 4 5 -	validity of scientific claims and theories.		
	13.A.50	sc Explain the strengths, weaknesses, and uses of		
		studies, controlled laboratory experiments		
		computer modeling, and statistical studies		
Ohiectives	1. Relate the composition of a complex ion to its charge coordination number and			
\circ Concentual	the oxidation number of the central metal			
• Factual	2. Sketch the geometry of a complex ion and identify geometric isomers.			
• Procedural	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 Task	S	Other Evidence	
	Class notes			