Blackhawk School District

CURRICULUM

Course Title:	**Lab Chemistry**
Grade Level(s):	**Tenth-Twelfth**
Periods per week:	**7.5**
Length of Period:	**42 minutes**
Length of Course:	**Daily**
Credits:	**1.5 credits**
Faculty Author(s):	**Darren Fecich, Kim Baker, Nate Lowery**
Date:	**Fall 2008 / Revised October 2012**

MISSION STATEMENT:

The goal of science education is to develop within students an understanding of the world around us by fostering curiosity, developing inquiry skills, and creating an excitement for learning science.

COURSE DESCRIPTION:

This course is designed to adequately meet the needs of all high school students, whether you intend to pursue this field or just live within the midst of everyday change. Lab Chemistry is a general study of science that deals with the characteristics of elements and other simple substances. The scientific principles of their combination and behavior under various conditions are investigated on the theoretical as well as experimental level.

PA Common Core Standards for Reading and Writing in Science and Technical Subjects:

Pennsylvania Department of Education has released standards that describe what students in the science and technical subjects' classrooms should know and be able to do with the English language in reading and writing, grade 6 through 12. The standards provide the targets for instruction and student learning essentials for success in all academic areas, not just language arts classrooms. Although the standards are not a curriculum or a prescribed series of activities, Blackhawk School District has used them to develop this science curriculum.

The standards for Reading are available at:

http://static.pdesas.org/content/documents/PA_Common_Core_Standards_for_Reading_in_Science_And_Technical_Subjects_8-7-12.pdf

The standards for Writing are available at:

http://static.pdesas.org/content/documents/PA_Common_Core_Standards_for_Writing_in_Science_and_Technical_Subjects_8-7-12_rev_2.pdf

ESSENTIAL QUESTIONS:

Essential questions are the heart of the curriculum. Essential questions are conceptual commitments that teachers will use to guide instructional decision-making. In addition, they are kid friendly so that students can easily understand them. Essential questions are meant to be shared with students in either discussion or posting in the classroom. Essential questions provide the focus for teaching and learning. The following are the Essential Questions for this class:

1. **How can chemistry impact what I want to do in life?**
2. **How can matter exist in an enormous variety of forms?**
3. **How can properties reveal the identity of a mystery substance?**
4. **What clues can indicate a chemical change?**
5. **How can I think like a scientist?**
6. **What are the advantages of using the metric system?**
7. **How can someone be precise but not accurate?**
8. **Why does a large cruise ship or 100-ton iceberg float?**
9. **How do we know atoms exist?**
10. **How many molecules, grams, moles, and atoms are in a cube of sugar?**
11. **How many atoms thick is a piece of aluminum foil?**
12. **How can light and electrons be both particles and waves at the same time?**
13. **Where are electrons in an atom?**
14. **If you were an electron, how would someone find you in your atom?**
15. **What do I know if I have a Periodic Table in my hands?**
16. **How can periodic trends be used to make predictions?**
17. **Why is electron sharing not always equal?**
18. **Why bond?**
19. **How would molecules be viewed in 3 dimensions?**
20. **Why do some atoms/molecules stick together?**
21. **What's in a name?**
22. **How can you apply the law of Conservation of Matter to balance chemical reactions?**
23. **How can you predict the product of reactions?**
24. **How can you evaluate the accuracy of an experiment?**
25. **Why is the reactant with smaller amount not always the limiting reactant in a reaction?**
26. **How do changes in temperature, pressure, and volume affect the properties of gas?**
27. **How does particle movement differ in solids, liquids, and gases?**
28. **How can you determine the different characteristics of a gas?**

Assessing Essential questions is key to a robust curriculum. If Essential Questions are the focal point of learning, how then do we assess students? The following is an overview of recommended assessments to the Essential Questions. In addition, Differentiated learning opportunities are embedded as well (noted by DI).

Ch. 1
EQ: How can chemistry impact what I want to do in life?
Assessment: Exit Slip
EQ: How can matter exist in an enormous variety of forms?
Assessment: Chapter Assessment
EQ: How can properties reveal the identity of a mystery substance?
Assessment: Hands-On Experiment
EQ: What clues can indicate a chemical change?
Assessment: Hands-On Experiment / Chapter Assessment

Ch. 2
EQ: How can I think like a scientist?
Assessment: Lab/ Chapter Assessment
DI: Discovery Experiment
EQ: What are the advantages of using the metric system?
Assessment: QWA/ Chapter Assessment
DI: The Great Metric Scavenger Hunt
EQ: How can someone be precise but not accurate?
Assessment: Hands-On Experiment
EQ: Why does a large cruise ship or 100-ton iceberg float?
Assessment: Hands-On Experiment / Chapter Assessment

Ch. 3
EQ: How do we know atoms exist?
Assessment: Reading Project or Chapter Assessment
DI: Research Activity
EQ: How many molecules, grams, moles, and atoms are in a cube of sugar?
Assessment: Chapter Assessment / Homework / Hands-On Experiment
EQ: How many atoms thick is a piece of aluminum foil?
Assessment: Hands-On Experiment

Ch. 4
EQ: How can light and e- be both particles and waves at the same time?
Assessment: Hands-On Experiment
EQ: Where are electrons in an atom?
Assessment: Homework / Chapter Assessment
EQ: If you were an e-, how would someone find you in your atom?
Assessment: Homework / Chapter Assessment

Ch. 5
EQ: What do I know if I have a P.T. in my hands?
Assessment: Chapter Assessment
EQ: How can periodic trends be used to make predictions?
Assessment: Hands on Experimentation / Chapter Assessment

Ch. 6:
EQ: Why is electron sharing not always equal?
Assessment: Homework / Chapter Assessment
EQ: Why bond?
Assessment: Homework / Hands-On Experiment / Chapter Assessment
DI: Tiered lesson on Lewis Structures
EQ: How would molecules be viewed in 3 dimensions?
Assessment: Homework / Hands-on Experimentation / Chapter Assessment
EQ: Why do some atoms/molecules stick together?
Assessment: Chapter Assessment

Ch. 7:
EQ: What's in a name?
Assessment: Quizzes / Homework / Chapter Assessment

Ch. 8
EQ: How can you apply the law of Conservation of Matter to balance chemical reactions?
Assessment: Homework / Chapter Assessment
EQ: How can you predict the product of reactions?
Assessment: Homework / Hands-On Experiment / Chapter Assessment

Ch. 9
EQ: How can you evaluate the accuracy of an experiment?
Assessment: Hands-On Experiment
EQ: Explain how conversion factors can relate reactants and product?
Assessment: Homework / Chapter Assessment / Hands-On Experiment
EQ: Why is the reactant with smaller amount not always the limiting reactant in a reaction?
Assessment: Homework / Hands-On Experiment / Chapter Assessment

Ch. 10
EQ: How do changes in temperature, pressure, and volume affect the properties of gas?
Assessment: Homework / Hands-On Experiment / Chapter Assessment

Ch. 11
EQ: How does particle movement differ in solids, liquids, and gases?
Assessment: Homework / Chapter Assessment
EQ: How can you determine the different characteristics of a gas?
Assessment: Homework / Chapter Assessment

ROBUST VOCABULARY:
Robust vocabulary words are Tier 2 words, meaning that they are complex, powerful, and generalizable. Robust vocabulary words support language development of both lower and high level learners. In addition, robust vocabulary instruction helps prepare students for SATs, upper level high school classes, and college. "Studies showed that robust instruction was quite effective not only for learning the meanings of words but also for affecting reading comprehension." (p. 2 *Bringing Words to Life)*

Teachers are asked to commit to teaching and students USING these words throughout the entire year. Using a variety of instructional strategies, students will learn the meaning of these words in a deep and meaningful way in this content and across other content areas.

The Robust Vocabulary for this class are: **Interpret, Evaluate, Physical, Hypothesis, Ratio, Accuracy, Chemical, Inspect, Theory, Integrity**

COURSE OUTLINE	**OBJECTIVES** (PA Anchors)	PROPOSED TIME	RESOURCES	LESSON REFLECTION (for future revisions)
UNIT ONE: INTRODUCTION TO CHEMISTRY AND MATTER (Chapters 1&2) **Chapter 1: Matter and Change** a. What is Chemistry? b. Matter and Its Properties 1. Physical and Chemical Properties and Changes 2. Classification of Matter c. Introduction to the Periodic Table 1. Metals vs. Nonmetals vs. Metalloids *Suggested Laboratory Activities:* ➢ Chemical and Physical Changes ➢ Classification of Matter	S11.A.3.3.2 Compare stationary physical patterns (e.g. crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties. S11.C.2.1.2 Describe energy changes in chemical reactions.	10 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables (Chemicals and Supplies)	
Chapter 2: Measurements and Calculations a. Scientific Method b. Units of Measurement 1. Metric System 2. Conversion Factors 3. Density c. Using Scientific Measurements 1. Accuracy vs. Precision 2. Significant Figures 3. Scientific Notation *Suggested Laboratory Activities:* ➢ Scientific Method	S11.A.1.1.1 Compare and contrast scientific theories, scientific laws, and beliefs. S11.A.1.1.2 Analyze and explain the accuracy of scientific facts, principles, theories, and laws. S11.A.1.1.3 Evaluate the appropriateness of research questions (i.e. testable vs. non-testable). S11.A.2.1.1 Critique the elements of an experimental design (e.g. raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data and drawing conclusions) applicable to a specific experimental design. S11.A.2.1.2 Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a	16 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables (Chemicals and Supplies) Buret	

COURSE OUTLINE	OBJECTIVES (PA Anchors)	PROPOSED TIME	RESOURCES	LESSON REFLECTION (for future revisions)
➢ Accuracy vs. Precision ➢ Significant Figures ➢ Density ➢ Conversions	specific technological design. S11.A.2.1.3 Use data to make inferences and predictions, or to draw conclusions, demonstrating understand of experimental limits. S11.A.2.1.4 Critique the results and conclusions of scientific inquiry for consistency and logic. S11.A.2.2.1 Evaluate appropriate methods, instruments, and scales for precise quantitative and qualitative observations (e.g. to compare properties of materials, water quality).		Electronic Balance	
UNIT TWO: ORGANIZATION OF MATTER (Chapters 3-6) **Chapter 3: Atoms – The Building Blocks of Matter** a. History of Atomic Theory b. Structure of the Atom c. Counting Atoms 1. Isotopes 2. Composition Stoichiometry *Suggested Laboratory Activities:* ➢ Rutherford Scattering ➢ Atomic Models ➢ Stoichiometry	S11.A.1.1.1 Compare and contrast scientific theories, scientific laws, and beliefs. S11.A.1.1.2 Analyze and explain the accuracy of scientific facts, principles, theories, and laws. S11.A.1.1.5 Analyze or compare the use of both direct and indirect observation as means to study the world and the universe (e.g. behavior of atoms, functions of cells, birth of stars). S11.C.1.1.1 Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g. protons, neutrons, electrons). S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g. dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps).	12 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables (Chemicals and Supplies) Rutherford Targets Electronic Balances	
Chapter 4: Arrangement of Electrons in Atoms a. Properties of Light b. Quantum Model 1. Wave-Particle Duality 2. Quantization 3. Quantum Numbers c. Electron Configurations *Suggested Laboratory Activities:*	S11.A.1.1.1 Compare and contrast scientific theories, scientific laws, and beliefs. S11.A.1.1.2 Analyze and explain the accuracy of scientific facts, principles, theories, and laws. S11.A.3.3.3 Analyze physical patterns of motion to make predictions or draw conclusions (e.g. solar system, tectonic plates, weather systems, atomic motion, and waves). S11.C.2.1.1 Compare or analyze waves in the electromagnetic spectrum (e.g. ultraviolet, infrared, visible light, X-rays, microwaves) as well as their properties, energy levels, and	16 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables	

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➢ Line Spectrums ➢ Flame Tests	motions). S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g. dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps).		(Chemicals and Supplies) High Voltage Power Supplies Line Spectrum Element Samples	
Chapter 5: The Periodic Law a. History of the Periodic Table b. Electron Configuration and Periodic Properties c. Periodic Trends *Suggested Laboratory Activities:* ➢ Periodic Law ➢ Periodic Trends ➢ Element Observations	S11.A.1.1.1 Compare and contrast scientific theories, scientific laws, and beliefs. S11.A.1.1.2 Analyze and explain the accuracy of scientific facts, principles, theories, and laws. S11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order. S11.B.1.1.1 Explain how structure determines function at multiple levels of organization (e.g. chemical, cellular, and anatomical). S11.C.1.1.2 Explain the relationship between the physical properties of a substance and its molecular or atomic structure. S11.C.1.1.4 Explain how the relationships of chemical properties of elements are represented in the repeating patterns within the periodic table.	12 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables (Chemicals and Supplies) Electronic Balances Element Samples	
Chapter 6: Chemical Bonding a. Types of Chemical Bonds b. Octet Rule c. Covalent Bonding and Compounds d. Ionic Bonding and Compounds e. Molecular Geometry f. Intermolecular Forces *Suggested Laboratory Activities:*	S11.A.3.3.2 Compare stationary physical patterns (e.g. crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties. S11.B.1.1.1 Explain how structure determines function at multiple levels of organization (e.g. chemical, cellular, and anatomical). S11.C.1.1.2 Explain the relationship between the physical properties of a substance and its molecular or atomic structure. S11.C.1.1.3 Explain the formation of compounds (ionic and covalent) and their resulting properties using bonding theories.	12 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables	

COURSE OUTLINE	OBJECTIVES (PA Anchors)	PROPOSED TIME	RESOURCES	LESSON REFLECTION (for future revisions)
➢ Molecule Building ➢ Covalent vs. Ionic ➢ Intermolecular Forces			(Chemicals and Supplies) Molecule Building Kit Conductivity Tester	
UNIT THREE: LANGUAGE OF CHEMISTRY (Chapters 7-9) **Chapter 7: Chemical Formulas and Chemical Compounds** a. Nomenclature 1. Monatomic and Polyatomic Ions 2. Ionic Compounds 3. Molecules 4. Acids 5. Hydrates b. Oxidation Numbers c. Composition Stoichiometry	S11.C.1.1.3 Explain the formation of compounds (ionic and covalent) and their resulting properties using bonding theories.	16 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables (Chemicals and Supplies) Electronic Balances Crucibles	
Chapter 8: Chemical Equations and Reactions a. Word and Chemical Equations b. Balancing Chemical Equations c. Types of Chemical Reactions d. Activity Series *Suggested Laboratory Activities:* ➢ Chemical Reactions ➢ Activity Series	S11.C.2.1.2 Describe energy changes in chemical reactions.	15 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables (Chemicals and Supplies)	

COURSE OUTLINE	OBJECTIVES (PA Anchors)	PROPOSED TIME	RESOURCES	LESSON REFLECTION (for future revisions)
Chapter 9: Reaction Stoichiometry a. Reaction Stoichiometry b. Limiting Reactants c. Percent Yield *Suggested Laboratory Activities:* ➢ Limiting Reactants ➢ Percent Yield	S11.A.1.1.4 Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g. momentum, Newton's universal law of gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, ideal gas laws).	12 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables (Chemicals and Supplies) Electronic Balances	
UNIT FOUR: PHASES OF MATTER (Chapters 10-12) **Chapter 10: Physical Characteristics of Gases** a. Kinetic-Molecular Theory b. Pressure c. Gas Laws *Suggested Laboratory Activities:* ➢ Pressure ➢ Gas Laws	S11.A.1.1.1 Compare and contrast scientific theories, scientific laws, and beliefs. S11.A.1.1.2 Analyze and explain the accuracy of scientific facts, principles, theories, and laws. S11.A.1.1.4 Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g. momentum, Newton's universal law of gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, ideal gas laws). S11.A.3.3.2 Compare stationary physical patterns (e.g. crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties. S11.C.1.1.5 Predict the behavior of gases through the application of laws (e.g. Boyle's law, Charles' law, or ideal gas law).	15 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables (Chemicals and Supplies) Absolute Zero Device Boyle's Law Apparatus Syringe	

COURSE OUTLINE	**OBJECTIVES** (PA Anchors)	PROPOSED TIME	RESOURCES	LESSON REFLECTION (for future revisions)
Chapter 11: Molecular Composition of Gases a. Volume-Mass Relationships of Gases b. Ideal Gas Law c. Gas Stoichiometry	S11.A.1.1.4 Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g. momentum, Newton's universal law of gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, ideal gas laws). S11.C.1.1.5 Predict the behavior of gases through the application of laws (e.g. Boyle's law, Charles' law, or ideal gas law).	10 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables (Chemicals and Supplies)	
***The following material (Ch 12, 13, and 17) is important for AP Chemistry. This material should be incorporated into the Curriculum at some point during the school year.** **Chapter 12: Liquids and Solids** a. Equilibrium b. Phase Diagrams	S11.C.1.1.6 Describe factors that influence the frequency of collisions during chemical reactions that might affect the reaction rates (e.g. surface area, concentration, catalysis, temperature). S11.A.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole.	5 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables (Chemicals and Supplies)	
Chapter 13: Solutions a. Types of Solutions b. Concentration of Solutions		5 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables (Chemicals and Supplies)	

COURSE OUTLINE	**OBJECTIVES** (PA Anchors)	PROPOSED TIME	RESOURCES	LESSON REFLECTION (for future revisions)
Chapter 17: Thermo chemistry a. Heat Capacity and Specific Heat *Suggested Laboratory Activities:* ➢ Specific Heat		5 Days	*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables (Chemicals and Supplies) Calorimeter	
LABORATORY SKILLS AND TECHNIQUES a. Safety / Emergency Procedures b. Measurement 1. Ruler 2. Electronic Balance 3. Graduated Cylinder 4. Thermometer c. Water Displacement d. Laboratory Burners Other	*The following anchors are addressed in the Laboratory part of this course:* S11.A.2.1.1 Critique the elements of an experimental design (e.g. raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data and drawing conclusions) applicable to a specific experimental design. S11.A.2.1.2 Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design. S11.A.2.1.3 Use data to make inferences and predictions, or to draw conclusions, demonstrating understand of experimental limits. S11.A.2.1.4 Critique the results and conclusions of scientific inquiry for consistency and logic. S11.A.2.1.5 Communicate results of investigations using multiple representations. S11.A.2.2.1 Evaluate appropriate methods, instruments, and scales for precise quantitative and qualitative observations (e.g. to compare properties of materials, water quality). S11.A.2.2.2 Explain how technology (e.g. GPS, spectroscope,		*Modern Chemistry* Holt, Rinehart, and Winston, 2002 General Lab Supplies Consumables (Chemicals and Supplies)	

COURSE OUTLINE	**OBJECTIVES** (PA Anchors)	PROPOSED TIME	RESOURCES	LESSON REFLECTION (for future revisions)
	scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision. S11.A.3.1.1 Apply systems analysis, showing relationships (e.g. flowcharts, concept maps), input and output, and measurements to explain a system and its parts. S11.A.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole. S11.A.3.1.3 Use appropriate quantitative data to describe or interpret a system (e.g. biological indices, electrical circuit data, and automobile diagnostic systems data). S11.A.3.2.1 Compare the accuracy of predictions represented in a model to actual observations and behavior. S11.A.3.2.2 Describe advantages and disadvantages of using models to simulate processes and outcomes. S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g. dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps).			