Blackhawk School District

CURRICULUM

Course Title:	**Chemistry Connections**
Grade Level(s):	**Tenth-Twelfth**
Length of Course:	**Daily (42 minutes)**
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. Chemistry Connections is a general study of science that covers the basics of chemistry with a strong emphasis on relating chemistry to everyday situations and with less emphasis on the use of mathematical computations.

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. **Why does a large cruise ship or 100-ton iceberg float?**
7. **How do we know atoms exist?**
8. **How can light and electrons be both particles and waves at the same time?**
9. **Where are electrons in an atom?**
10. **If you were an electron, how would someone find you in your atom?**
11. **What do I know if I have a Periodic Table in my hands?**
12. **How can periodic trends be used to make predictions?**
13. **Why is electron sharing not always equal?**
14. **Why bond?**
15. **How would molecules be viewed in 3 dimensions?**
16. **Why do some atoms/molecules stick together?**
17. **What's in a name?**
18. **How can you apply the law of Conservation of Matter to balance chemical reactions?**
19. **How can you predict the product of reactions?**
20. **How do changes in temperature, pressure, and volume affect the properties of gas?**
21. **How does particle movement differ in solids, liquids, and gases?**
22. **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).

Unit 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

EQ: Why does a large cruise ship or 100-ton iceberg float?
- Assessment: Hands-On Experiment / Chapter Assessment

Unit 2

EQ: How can I think like a scientist?
- Assessment: Lab/ Chapter Assessment
- DI: Discovery Experiment

EQ: How do we know atoms exist?
- Assessment: Reading Project or Chapter Assessment
- DI: Research Activity

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

Unit 3

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

Unit 4

EQ: Why bond?

Assessment: Homework / Hands-On Experiment / Chapter Assessment

DI: Tiered lesson on Lewis Structures

EQ: What's in a name?

Assessment: Quizzes / Homework / Chapter Assessment

EQ: Why is electron sharing not always equal?

Assessment: Homework / Chapter Assessment

Unit 5

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 certain reactions?

Assessment: Homework / Hands-On Experiment / Chapter Assessment

Unit 6:

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

Unit 7:

EQ: How do changes in temperature, pressure, and volume affect the properties of gas?

Assessment: Homework / Hands-On Experiment / Chapter Assessment

EQ: How does particle movement differ in solids, liquids, and gases?

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 a. What is Chemistry? b. Matter and Its Properties 1. Physical and Chemical Properties and Changes 2. Classification of Matter c. Density *Suggested Laboratory Activities:* Chemical and Physical Changes Classification of Matter Density	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.	15 Days	*Chemistry: Concepts and Applications* Glencoe, 2002 General Lab Supplies Consumables (Chemicals and Supplies) Electronic Balance	
UNIT TWO: ATOMIC THEORY a. Scientific Method b. History of Atomic Theory c. Quantum Model of the Atom d. Electron Configurations *Suggested Laboratory Activities:* Scientific Method Rutherford Scattering Atomic Models Line Spectrums Flame Tests	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.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.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.	25 Days	*Chemistry: Concepts and Applications* Glencoe, 2002 General Lab Supplies Consumables (Chemicals and Supplies) Rutherford Targets High Voltage Power Supplies Line Spectrum Element Samples	

COURSE OUTLINE	**OBJECTIVES** (PA Anchors)	PROPOSED TIME	RESOURCES	LESSON REFLECTION (for future revisions)
	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.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). 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, waves). 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.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 motions).			
UNIT THREE: PERIODIC TABLE a. History of the Periodic Table b. Electron Configuration and Periodic Properties c. Metals vs. Nonmetals vs. Metalloids d. Semiconductors e. 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, 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.	25 Days	*Chemistry: Concepts and Applications* Glencoe, 2002 General Lab Supplies Consumables (Chemicals and Supplies) Electronic Balances Element Samples	

COURSE OUTLINE	**OBJECTIVES** (PA Anchors)	PROPOSED TIME	RESOURCES	LESSON REFLECTION (for future revisions)
UNIT FOUR: CHEMICAL BONDING AND CHEMICAL FORMULAS a. Types of Chemical Bonds b. Octet Rule c. Covalent Bonding and Compounds d. Ionic Bonding and Compounds e. Nomenclature 1. Monatomic and Polyatomic Ions 2. Ionic Compounds 3. Molecules 4. Acids 5. Hydrates *Suggested Laboratory Activities:* ➢ Covalent vs. Ionic	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, 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.	25 Days	*Chemistry: Concepts and Applications* Glencoe, 2002 General Lab Supplies Consumables (Chemicals and Supplies) Conductivity Tester	
UNIT FIVE: 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.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.C.2.1.2 Describe energy changes in chemical reactions.	25 Days	*Chemistry: Concepts and Applications* Glencoe, 2002 General Lab Supplies Consumables (Chemicals and Supplies)	
UNIT SIX: CHEMICAL BONDING a. Molecular Geometry b. Intermolecular Forces *Suggested Laboratory Activities:* ➢ Molecule Building ➢ Intermolecular Forces	S11.B.1.1.1 Explain how structure determines function at multiple levels of organization (e.g. chemical, cellular, anatomical). S11.C.1.1.2 Explain the relationship between the physical properties of a substance and its molecular or atomic structure.	20 Days	*Chemistry: Concepts and Applications* Glencoe, 2002 General Lab Supplies	

COURSE OUTLINE	**OBJECTIVES** (PA Anchors)	PROPOSED TIME	RESOURCES	LESSON REFLECTION (for future revisions)
			Consumables (Chemicals and Supplies) Molecule Building Kits Conductivity Indicators	
UNIT SEVEN: 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.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). S11.D.2.1.2 Compare the transmission, reflection, absorption, and radiation of solar energy to and by Earth's surface under different environmental conditions (e.g. major volcanic eruptions, greenhouse effect, reduction of ozone layer, increased global cloud cover).	20 Days	*Chemistry: Concepts and Applications* Glencoe, 2002 General Lab Supplies Consumables (Chemicals and Supplies) Absolute Zero Device Boyle's Law Apparatus Syringe	
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 e. 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.		*Chemistry: Concepts and Applications* Glencoe, 2002 General Lab Supplies Consumables (Chemicals and Supplies)	

COURSE OUTLINE	**OBJECTIVES** (PA Anchors)	PROPOSED TIME	RESOURCES	LESSON REFLECTION (for future revisions)
	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, 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, 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).			