Curriculum Reference Guide

Honors Chemistry

2015-2016

SUFFOLK
PUBLIC SCHOOLS

Course OVERVIEW

Students are required to master the Virginia Standards of Learning for each course in which they are enrolled. This guide is designed to give students and parents an overview of the course requirements as well as the materials needed for each class.

A list of the objectives associated with the course and the timeline in which these objectives will be taught have been compiled in this document. Additionally, students should insert the teacher's tutoring schedule in the space provided.

Students are encouraged to keep the *Curriculum Reference Guide* for each course and to refer to the information throughout the year. It is our hope that this document will be a valuable reference that will assist parents and students in having a successful school year.

Course Description

The Biology standards are designed to provide students with a detailed understanding of living systems. Emphasis continues to be placed on the skills necessary to examine alternative scientific explanations, actively conduct controlled experiments, analyze and communicate information, and gather and use information in scientific literature. The history of biological thought and the evidence that supports it are explored, providing the foundation for investigating biochemical life processes, cellular organization, mechanisms of inheritance, dynamic relationships among organisms, and the change in organisms through time. The importance of scientific research that validates or challenges ideas is emphasized at this level. All students are expected to achieve the content of the biology standards.

The Biology standards continue to focus on student growth in understanding the nature of science. This scientific view defines the idea that explanations of nature are developed and tested using observation, experimentation, models, evidence, and systematic processes. The nature of science includes the concepts that scientific explanations are based on logical thinking; are subject to rules of evidence; are consistent with observational, inferential, and experimental evidence; are open to rational critique; and are subject to refinement and change with the addition of new scientific evidence. The nature of science includes the concept that science can provide explanations about nature and can predict potential consequences of actions, but cannot be used to answer all questions.

Course Expectations

Course Requirements:

Completion of Earth Science with a passing grade of a D or higher.

Grading Rationale:

Nine Weeks Grade

Tests will be administered after the completion of each topic as shown in the course syllabus.

Percentage of Nine Weeks Grade

Homework	10%
Class work (daily)	20%
Quizzes/ Short Term Projects	30%
Tests/Major Projects	40%

The 9 weeks grade is composed of a minimum of the following:

Tests/Major Projects	3
Quizzes/ Short Term Projects	5
Class Work	8
Homework	7

Semester Grade

The semester grade average will be calculated by adding together each nine weeks' grade three times, adding in the semester exam once, and dividing the total by seven (7). This procedure is consistent with school board policy.

Final Grade

The final grade average will be calculated by adding together the two semester grades and dividing by two (2). This procedure is consistent with school board policy.

Materials:

Students are expected to provide the following materials:

- loose leaf paper / notebooks / lab notebooks
- appropriate writing utensils (blue / black ink pens, #2 pencils)
- graph paper *(as needed)*
- colored pencils *(as needed)*
- calculator *(as needed)*
- highlighters
- standard-sized display board for Science Fair project *(optional)*
- additional class materials may be required by individual teachers

Grading Scale

According to school board policy, a ten (10) letter grading key is used to report scholastic progress in the following ranges:

		Point Value		
Letter Grade	Score Range	General	Honors and Pre-IB +(0.5)	Advanced Placement and Dual Enrollment +(1.0)
A	100-93	4.0	4.5	5
A-	92-90	3.7	4.2	4.7
B+	89-87	3.3	3.8	4.3
B	86-83	3.0	3.5	4
B-	82-80	2.7	3.2	3.7
C+	79-77	2.3	2.8	3.3
C	76-73	2.0	2.5	3
C-	72-70	1.7	2.2	2.7
D+	69-67	1.3	1.8	2.3
D	66-63	1.0	1.5	2
D-	62-60	0.3	0.8	1.3
F	below 60	0.0	0.0	0.0

Honors Chemistry Pace, Scope, and Sequence 2015-2016

MAIN CONCEPTS that must be addressed all year are **Scientific investigation and homeostasis**. See VDOE Curriculum framework for detailed essential knowledge and skills for each topic. At least three **Inquiry-based,** Scientific Investigation labs ***MUST*** be COMPLETED **EVERY** 9 WEEKS**.** Look up ***Enhanced Scope and Sequence*** for Biology on the VDOE website for a list of labs.

First Nine Weeks

SOL: CH. 1 a, b, c—Lab Safety and Equipment (2 blocks and then ongoing through the rest of the year.)

Big Idea: There are specific laboratory safety procedures and equipments that must be practiced and utilized appropriately in a chemistry laboratory. There are specific types of laboratory equipment that have specific uses in the chemistry laboratory. Chemists use the scientific method to solve problems and develop theories about the natural world.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated produce observations and verifiable data. Key concepts include: **a) Designated laboratory techniques.** •**Demonstrate** safe laboratory practices, procedures, and techniques •**Demonstrate** the following basic lab techniques: filtering, using chromatography, and lighting a gas burner	**Cognitive Level** Understand **Question (s)** •How can injuries be prevented through safety procedures and the proper use of lab equipment? •When lighting a gas burner, what color flame is the most useful and why? •Describe the proper procedure and techniques used in determining the mass and volume of a substance to find its density? •What is the technique chromatography illustrating? Sketch a filtration process for separating a mixture. (Teacher assigns components of mixture.)	*MSDS Activity* *Lab Equipment/Use Activity* Laboratory Safety and Skills (PDF) / (Word) CH.1 a, b, c, d, e, f, g, h Flinn Scientific Lab Safety Course : http://labsafety.flinnsci.com/Home.aspx

Chemistry Pace, Scope and Sequence 2015-2016

First Nine Weeks

SOL: CH. 1 a, b, c—Lab Safety and Equipment

Big Idea: There are specific laboratory safety procedures and equipments that must be practiced and utilized appropriately in a chemistry laboratory. There are specific types of laboratory equipment that have specific uses in the chemistry laboratory. Chemists use the scientific method to solve problems and develop theories about the natural world.

SOL Description	Higher Level Questioning	Resources
b) Safe use of chemicals and equipment. •**Understand** Material Safety Data Sheet (MSDS) warnings, including handling chemicals, lethal dose (LD), hazards, disposal, and chemical cleanup •**Identify** the following basic lab equipment: beaker, Erlenmeyer flask, graduated cylinder, test tube, test tube rack, test tube holder, ring stand, wire gauze, clay triangle, crucible with lid, evaporating dish, watch glass, wash bottle, and dropping pipette •**Identify**, **locate**, and know how to **use** laboratory safety equipment, including aprons, goggles, gloves, fire extinguishers, fire blanket, safety shower, eye wash, broken glass container, and fume hood	**Cognitive Level** Remember Understand Apply **Question(s)** (Either by placing actual items or illustrations) •Which of these pieces of lab equipment would you use to _____? •Explain the function of _____. •What pieces of equipment are used to measure the variables mass and volume to calculate density? •How are mass, volume, and density calculated when two of the variables are known?	http://www.msds.com/

First Nine Weeks

SOL: CH. 1 a, b, c—Lab Safety and Equipment

Big Idea: There are specific laboratory safety procedures and equipments that must be practiced and utilized appropriately in a chemistry laboratory. There are specific types of laboratory equipment that have specific uses in the chemistry laboratory. Chemists use the scientific method to solve problems and develop theories about the natural world.

SOL Description	Higher Level Questioning	Resources
c) Proper response to emergency situations. •**Understand** Material Safety Data Sheet (MSDS) warnings, including handling chemicals, lethal dose (LD), hazards, disposal, and chemical cleanup •**Identify**, **locate**, and know how to **use** laboratory safety equipment, including aprons, goggles, gloves, fire extinguishers, fire blanket, safety shower, eye wash, broken glass container, and fume hood	**Cognitive Level** Remember Understand Apply **Question(s)** •Using a given MSDS (from the teacher), what is the proper disposal and clean-up? What health hazards does this chemical have? Can you explain the reactivity of this chemical? •If acid was spilled on the table, what would be the proper emergency response? •If acid were spilled on your hand, what would be the proper emergency response? Why is there a difference in the response, even when the same type of chemical is spilled?	

Chemistry Pace, Scope and Sequence 2015-2016

First Nine Weeks

SOL: CH. 1 e, f, g, i, j— Uncertainty of Measurement, and Conversions of Data (6 blocks and then ongoing)

Big Idea: Scientists express the degree of uncertainty in their measurements and calculations by using significant figures. In general, a calculated answer cannot be more precise than the least precise measurement from which it was calculated. Dimensional analysis is a problem-solving method that involves analyzing the units of the given measurement and the unknown to plan a solution.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated produce observations and verifiable data. Key concepts include: **e) Accurate recording, organization, and analysis of data through repeated trials.** •**Read** measurements and **record** data, reporting the significant digits of the measuring equipment •**Demonstrate** precision (reproducibility) in a measurement •**Recognize** accuracy in terms of closeness to the true value of a measurement **i) Construction and defense of a scientific viewpoint.** •**Summarize** knowledge gained through gathering and appropriate processing of data in a report that documents background, objective(s), data collection, data analysis and conclusions.	**Cognitive Level** Understand Apply **Question(s)** •Compare and contrast accuracy and precision. • How is it possible to have neither or both accuracy and precision in measurements? •Explain how a series of measurements can be precise without being accurate. •How do scientific discoveries help other scientists in their research or experiments? Give an example. •What is meant by scientific collaboration?	Scientific Inquiry: Measurement/Data (PDF) / (Word) CH.1 d, e

Chemistry Pace, Scope and Sequence 2015-2016

First Nine Weeks

SOL: CH. 1 e, f, g, i, j— Uncertainty of Measurement, and Conversions of Data

Big Idea: Scientists express the degree of uncertainty in their measurements and calculations by using significant figures. In general, a calculated answer cannot be more precise than the least precise measurement from which it was calculated. Dimensional analysis is a problem-solving method that involves analyzing the units of the given measurement and the unknown to plan a solution.

SOL Description	Higher Level Questioning	Resources
f) Mathematical and procedural error analysis. •**Determine** the mean of a set of measurements •**Use** data collected to calculate percent error •**Discover** and **eliminate** procedural errors **j) The use of current applications to reinforce chemistry concepts.** •**Make** connections between components of the nature of science and their investigations and the greater body of scientific knowledge and research. •**Explain** the emergence of modern theories based on historical development. For example, students should be able to explain the origin of the atomic theory beginning with the Greek atomists and continuing through the most modern quantum models.	**Cognitive Level** Understand Apply Analyze Evaluate **Question(s)** •If a student measures the melting point of a substance to be 110 C and the actual melting point is 125 C, what is the percent error? Can percent error be a negative value and if so, how? Why is the mean of a set of data more valuable than individual measurements? •What is the correct way to read a graduated cylinder? •How is the measurement read from a graduated cylinder recorded? •Explain the rules for writing a measurement in the correct number of significant digits.	*Density of an Unknown Liquid Lab* (shared district folder) https://phet.colorado.edu/en/simulation/density

Chemistry Pace, Scope and Sequence 2015-2016

First Nine Weeks

SOL: CH. 1 e, f, g, i, j— Uncertainty of Measurement, and Conversions of Data

Big Idea: Scientists express the degree of uncertainty in their measurements and calculations by using significant figures. In general, a calculated answer cannot be more precise than the least precise measurement from which it was calculated. Dimensional analysis is a problem-solving method that involves analyzing the units of the given measurement and the unknown to plan a solution.

SOL Description	Higher Level Questioning	Resources
g) Mathematical manipulations including SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, and dimensional analysis. •**Use** common SI prefixes and their values (milli-, centi-, kilo-) in measurements and calculations •**Demonstrate** the use of scientific notation, using the correct number of significant digits with powers of ten notation for the decimal place •Graph data **utilizing** the following -independent variable (horizontal axis) -dependent variable (vertical axis) -scale and units of a graph -regression line (best fit curve) •**Calculate** mole ratios, percent composition, conversions, and average atomic mass. •**Perform** calculations according to significant digit rules •**Convert** measurements using dimensional analysis	**Cognitive Level** Understand Apply Create **Question(s)** •How many milligrams are in 56 kilograms? •Why does the number 45 and 4.5×10^1 have the same number of significant digits? •How can a graph be used to illustrate the relationship between the independent and dependent variable? •What is the product of 0.0034 and 450 to the correct number of significant digits? Determine the sum of 0.0034 and 450, to the correct number of significant figures. •How can one use dimensional analysis to determine the number of minutes in a year? •Why are significant digits important when reporting measurements?	http://www.sparknotes.com/chemistry/fundamentals/units/section1.rhtml Fudge lab activity (shared district folder)

First Nine Weeks

SOL: CH.2 h – Matter and Energy (2 blocks to include lab experience and then ongoing)

Big Idea: Matter may be made of elements or compounds. Elements and compounds are pure substances but can be physically combined to make heterogeneous or homogeneous mixtures. These different forms of matter may undergo physical or chemical changes.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for the investigations of: **h) Chemical and physical properties.** •**Distinguish** between physical and chemical properties of metals and nonmetals •**Differentiate** between pure substances, mixtures, and between homogeneous and heterogeneous mixtures	**Cognitive Level** Remember Analyze **Question (s)** •How would you compare and contrast the physical and chemical properties of metals? (Teacher will assign three different elements.) •How are physical and chemical properties of metals different from nonmetals? **Cognitive Level** Understand Analyze **Question (s)** •How would you design an experiment to separate a mixture of sand, salt, iron fillings, and water? •What are three examples of a heterogeneous mixture and homogeneous mixture?	Physical and Chemical Properties Lab (shared district folder)

Chemistry Pace, Scope and Sequence 2015-2016

First Nine Weeks

SOL: CH. 2 i, c, a, b – Atomic Structure (5 blocks and then ongoing)

Big Idea: Periodic tables may contain each element's name, symbol, atomic number, atomic mass and number of electrons in each energy level. The electron configuration of an element can be determined based on the location of an element in the periodic table.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for the investigation of **i) Historical and quantum models.** •**Identify** key contributions of principal scientists including: -atomos, initial idea of atom-Democritus -first atomic theory of matter-solid sphere model-John Dalton -discovery of electron using cathode ray tube experiment-plum pudding model-JJ Thomson -discovery of the nucleus using the gold foil experiment-nuclear model-Ernest Rutherford -discovery of charge of electron using oil drop experiment-Robert Millikan -energy levels, planetary model-Niels Bohr -quantum nature of energy-Max Planck -uncertainity principle, quantum mechanical model-Werner Heisenberg -wave theory, quantum mechanical model-Louis deBroglie •**Differentiate** between the historical and quantum models of the atom	**Cognitive Level** Apply **Question (s)** •How would a timeline be constructed for the historical and quantum model of the atom? **Cognitive Level** Understand Analyze **Question (s)** •Compare and contrast what made the historical model of the atom different from the quantum model.	Isotopes with Pennies Lab Radioactive Decay and Half-Life (PDF) / (Word) CH.2 b CH.1 h Isotopes (PDF) / (Word) CH.2 b, c, d, e, f, g, h, i CH.1 I

First Nine Weeks

SOL: CH. 2 i, c, a, b – Atomic Structure

Big Idea: Periodic tables may contain each element's name, symbol, atomic number, atomic mass and number of electrons in each energy level. The electron configuration of an element can be determined based on the location of an element in the periodic table.

SOL Description	Higher Level Questioning	Resources
c) Mass and charge characteristics of subatomic particles. •**Differentiate** between the major atom components (proton, neutron, and electron) in terms of location, size, and charge	**Cognitive Level** Remember Understand Analyze **Question(s)** •Where are each subatomic particle located in an atom? •What is the mass and charge of a proton, neutron, and electron?	Atomic Structure: Elements (PDF) / (Word) CH.2 g CH.1 i Average Atomic Masses (PDF) / (Word) CH.2 a CH.1 a, b, c, d, e, f, g, h

First Nine Weeks

SOL: CH. 2 i, c, a, b – Atomic Structure

Big Idea: Periodic tables may contain each element's name, symbol, atomic number, atomic mass and number of electrons in each energy level. The electron configuration of an element can be determined based on the location of an element in the periodic table.

SOL Description	Higher Level Questioning	Resources
a) Average atomic mass, mass number, and atomic number. •**Determine** the atomic number, atomic mass, the number of protons, and the number of electrons of any atom of a particular element using the periodic table. •**Perform** calculations to determine the weighted average atomic mass	**Cognitive Level** Evaluate **Question(s)** •What is used from the periodic table to identify an element? •Explain why the number of protons and the number of electrons are the same. •What makes up the atomic mass of an elements? •How is the mass number determine? **Cognitive Level** Apply **Question(s)** •How is the average atomic mass of an element calculated? •Illustrate an example of weighted average number (using grades). •Calculate the weighted average atomic mass of five different elements.	https://www.youtube.com/watch?v=sRPejoNktKE

First Nine Weeks

SOL: CH. 2 i, c, a, b – Atomic Structure

Big Idea: Periodic tables may contain each element's name, symbol, atomic number, atomic mass and number of electrons in each energy level. The electron configuration of an element can be determined based on the location of an element in the periodic table.

SOL Description	Higher Level Questioning	Resources
b) Isotopes, half-lives, and radioactive decay. •**Determine** the number of neutrons in an isotope given the mass number •**Perform** calculations involving the half-life of a radioactive substance •**Differentiate** between alpha, beta, and gamma radiation with respect to penetrating power, shielding, and composition.	**Cognitive Level** Evaluate **Question(s)** •How is the mass number and atomic number used to find the number of neutrons in an atom's isotope? **Cognitive Level** Apply **Question(s)** •How many days would it take for 200 g of I-131 to decay to 6.25 g if its half-life is 3.1 days? •The half-life of U-238 is 10 years, after 40 years, how much of 50 g U-238 would be left? **Cognitive Level** Understand Analyze **Question(s)** •Rank alpha, beta, and gamma from the greatest penetrating to the least penetrating. •Explain the composition and shielding of the alpha, beta, and gamma particles.	https://phet.colorado.edu/en/simulation/isotopes-and-atomic-mass

Chemistry Pace, Scope and Sequence 2015-2016

First Nine Weeks

SOL: CH.2 a, d, e, f, g– Periodic Table (4 blocks and then ongoing)

Big Idea: Atomic size, ionization energy, ionic size, and electronegativity are trends that vary across periods and groups of the periodic table. These trends can be explained by variations in atomic structure. The increase in nuclear charge within groups and across periods explain many trends. Within groups, an increase in electron shielding has a significant effect on these trends.

SOL Description	Higher Level Questioning	Resources
a) Average atomic mass, mass number, and atomic number. •**Determine** the atomic number, atomic mass, the number of protons, and the number of electrons of any atom of a particular element using a periodic table. **d) Families or groups.** •**Distinguish** between a group and a period. •**Identify** key groups, periods, and regions of elements on the periodic table.	**Cognitive Level** Evaluate **Question (s)** •How are the numbers of electrons determined in an atom? Ion? **Cognitive Level** Apply Analyze **Question(s)** •How can you identify the differences between a group and a period? •How can you identify if an element will have similar properties? •Can you classify elements in their respective groups based on their properties? •Can you organize elements in their appropriate groups based on their properties?	Atomic Structure: Periodic Table (PDF) / (Word) CH.2 d, e, f, g CH.1 h

First Nine Weeks

SOL: CH.2 a, d, e, f, g– Periodic Table

Big Idea: Atomic size, ionization energy, ionic size, and electronegativity are trends that vary across periods and groups of the periodic table. These trends can be explained by variations in atomic structure. The increase in nuclear charge within groups and across periods explain many trends. Within groups, an increase in electron shielding has a significant effect on these trends.

SOL Description	Higher Level Questioning	Resources
d) Periods. •**Distinguish** between a group and a period. •**Identify** key groups, periods, and regions of elements on the periodic table.	**Cognitive Level** Apply Analyze **Question(s)** •What is periodicity? •How can you identify if an element will have similar properties? •How are elements classified on the periodic table? •How do you identify the periods on the periodic table? •How are the properties of periods predicted? •Can you classify elements in their respective periods based on their properties? •Can you organize elements in their appropriate periods based on their properties?	http://www.sparknotes.com/chemistry/fundamentals/periodictable/

First Nine Weeks

SOL: CH.2 a, d, e, f, g– Periodic Table

Big Idea: Atomic size, ionization energy, ionic size, and electronegativity are trends that vary across periods and groups of the periodic table. These trends can be explained by variations in atomic structure. The increase in nuclear charge within groups and across periods explain many trends. Within groups, an increase in electron shielding has a significant effect on these trends.

SOL Description	Higher Level Questioning	Resources
f) Trends including atomic radii, electronegativity, shielding effect, and ionization energy. •**Identify** and **explain** trends in the periodic table as they relate to ionization energy, electronegativity, shielding effect, and relative sizes. •**Compare** an element's reactivity to the reactivity of other elements in the table.	**Cognitive Level** Understand Apply Analyze Evaluate **Question** •How would you explain the trends: ionization energy, electronegativity, shielding effect, and relative sizes? •How would you classify different elements having a greater or less than (ionization energy, electronegativity, shielding effect, and relative sizes.) according to the periodic table? •How are different elements organized on the periodic table by (ionization energy, electronegativity, shielding effect, and relative sizes.)?	http://www.flinnsci.com/media/976921/cf10480.pdf

Second Nine Weeks

SOL: CH. 2 g–Electron Configuration (3 blocks to include lab experience)

Big Idea: Periodic tables may contain each element's name, symbol, atomic number, atomic mass and number of electrons in each energy level. The electron configuration of an element can be determined based on the location of an element in the periodic table.

SOL Description	Higher Level Questioning	Resources
g) Electron configurations, valence electrons, and oxidation numbers. •**Write** the electron configuration for the first 20 elements of the periodic table. •**Relate** the position of an element on the periodic table to its electron configuration. •**Determine** the number of valence electrons and possible oxidation numbers from an element's electron configuration	**Cognitive Level** Apply Analyze Evaluate **Questions** •How can you construct the unabbreviated electron configuration using the Aufbau Principle and Hund's rule? •How can you construct the abbreviated electron configuration using the periodic table? •What does the Pauli Exclusion Principle state? •How do you determine the number of valence electrons of an element? •How do you determine the number of valence electrons of an element. •How can you tell if an atom can possibly gain or lose an electron from its outermost energy level?	Elements and Electron Configuration (PDF) / (Word) CH.2 c, d, e, f, g, h CH.2 a, b Flame test Lab (shared district folder)

Second Nine Weeks

SOL: CH.3 d, a, c, CH.2 g- Ionic Compounds (6 blocks to include lab experience)

Big Idea: Atoms form positive ions (cations) by losing valence electrons and form negative ions (anions) by gaining valence electrons. The electrostatic forces between the oppositely charged ions hole the cations and anions together in an ionic compound. Ionic compounds generally have high melting points and can conduct an electric current in solution and in the molten state.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. **d) Bonding types.** •**Predict, draw, and name** molecular shapes (bent, linear, trigonal, planar, tetrahedral, and trigonal pyramidal). •**Draw** Lewis dot diagrams to represent valence electrons in elements and **draw** Lewis dot structures to show covalent bonding. •**Use** valence shell electron pair repulsion (VSEPR) model to draw and name molecular shapes (bent, linear, trigonal planar, tetrahedral, and trigonal pyramidal). •**Recognize** polar molecules and non-polar molecules.	**Cognitive Level** Apply Create **Question (s)** •Explain why metals tend to form cations, while nonmetals tend to form anions. •Explain the importance of lattice energy in the formation of a salt. •Determine the ratios of cations to anions that are most likely in the formulas for ionic substances of the following elements: a)an alkali metals and a halogen b)an alkaline earthiest and a halogen c) an alkali metal and a member of Group 16 d) an alkaline earth metal and a member of Group 16 devise a set of criteria that you can use to classify the following substances as ionic or nonionic compounds: $CaCO_3$, Cu, H_2O, NaBr, C (graphite).	Hard Water Testing-Inquiry Lab Mystery Anions (PDF) / (Word) CH.3 a CH.1 a, b, c Mystery Iron Ions (PDF) / (Word) CH.3 a, b, c, d, e, f CH.1 a, b, c

Second Nine Weeks

SOL: CH.3 d, a, c, CH.2 g- Ionic Compounds

Big Idea: Atoms form positive ions (cations) by losing valence electrons and form negative ions (anions) by gaining valence electrons. The electrostatic forces between the oppositely charged ions hole the cations and anions together in an ionic compound. Ionic compounds generally have high melting points and can conduct an electric current in solution and in the molten state.

SOL Description	Higher Level Questioning	Resources
a) Nomenclature. •**Name** binary covalent/molecular compounds. •**Name** binary ionic compounds (using the Roman numeral system where appropriate)	**Cognitive Level** Apply **Question(s)** •Why must roman numerals be used when naming certain ionic compounds? •Name the compounds represented by the following formulas: a) FeO b) $CuCl_2$ c) MnO_2 •Explain why each of the following pairs is not likely to form an ionic bond: a) chlorine and bromine b) potassium and helium c) sodium and lithum **Cognitive Level** Apply **Question(s)** •Assign oxidation numbers to the atoms in each of the following: a) H_2SO_3 b) NO_3^- c) HSO_3^- b) d) $NaBiO_3$	Chemistry name game: http://www.acs.org/content/dam/acsorg/education/outreach/kidschemistry/the-chemistry-name-game.pdf

Second Nine Weeks

SOL: CH.3 d, a, c, CH.2 g- Ionic Compounds

Big Idea: Atoms form positive ions (cations) by losing valence electrons and form negative ions (anions) by gaining valence electrons. The electrostatic forces between the oppositely charged ions hole the cations and anions together in an ionic compound. Ionic compounds generally have high melting points and can conduct an electric current in solution and in the molten state.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for the investigations of: **2g) Oxidation numbers** •**Determine** the oxidation numbers from an element's electron configuration. **The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations.** **3c) Writing chemical formulas** •**Write** the chemical formulas for certain common substances, such as ammonia, water, carbon monoxide, carbon dioxide, sulfur dioxide, and carbon tetrafluoride. •**Use** polyatomic ions for naming and writing formulas of ionic compounds, including carbonate, sulfate, nitrate, hydroxide, phosphate, and ammonium.	**Cognitive Level** Apply **Question(s)** •Assign oxidation numbers to the atoms in each of the following: a) H_2SO_3 b) NO_3^- c) HSO_3^- d) $NaBiO_3$ **Cognitive Level** Apply **Question(s)** •Write formulas for the following polyatomic ions: a) sulfate, b) nitrate, c) acetate, d) ammonium	

Second Nine Weeks

SOL: CH.3 a, c, d, CH.6 a, b-Covalent (Molecular) Compounds and Organic Chemistry (6 blocks to include lab experience that exemplifies the versatility and importance of organic compounds, e.g. aspirin, esterfication, or polymerization)

Big Idea: In molecular compounds, bonding occurs when atoms share electrons. Shared electrons and the valence electrons that are not shared affect the shape of a molecular compound, as the valence electrons stay as far apart from each other as possible. The molecular properties of a molecule are affected by intermolecular attractions.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include: **a) Nomenclature.** •**Name** binary covalent/molecular compounds. •**Name** binary ionic compounds (using the Roman numeral system where appropriate)	**Cognitive Level** Apply **Question (s)** •How do you distinguish the difference between an ionic and covalent compound's nomenclature? •How do you name a binary covalent (molecular) compound? •Given the formulas, what are the names of the following compounds: NH_3, H_2O, CO, CO_2, SO_2, and CCl_4.	Molecular Model Building (PDF) / (Word) CH.3 c, d CH.1 a, b, c Soap, Slime, and Creative Chromatography (PDF) / (Word) CH.3 a, b, c, d, e, f CH.5 f Aspirin Analysis (PDF) / (Word) CH.3 d CH.4 a, b, c CH.1 a, b, c A Crystal Lab (PDF) / (Word) CH.3 d CH.1 a, b, c Molecular Geometry (Ball and Stick Model) Lab

Chemistry Pace, Scope and Sequence 2015-2016

Second Nine Weeks

SOL: CH.3 a, c, d, CH.6 a, b-Covalent (Molecular) Compounds and Organic Chemistry

Big Idea: In molecular compounds, bonding occurs when atoms share electrons. Shared electrons and the valence electrons that are not shared affect the shape of a molecular compound, as the valence electrons stay as far apart from each other as possible. The molecular properties of a molecule are affected by intermolecular attractions.

SOL Description	Higher Level Questioning	Resources
3c) Writing chemical formulas . •**Write** the chemical formulas for certain common substances, such as ammonia, water, carbon monoxide, carbon dioxide, sulfur dioxide, and carbon tetrafluoride. •**Use** polyatomic ions for naming and writing formulas of ionic compounds, including carbonate, sulfate, nitrate, hydroxide, phosphate, and ammonium.	**Cognitive Level** Apply **Question(s)** •How do you distinguish the difference between an ionic and covalent compound's formula? •Construct the following nomenclature of compounds, what are the formulas of the following compounds: ammonia, water, carbon monoxide, sulfur dioxide, and carbon tetra chloride? •Explain the process •in which covalent (molecular) compounds are written? • Construct the chemical formulas for the following covalent compounds: carbon tetrachloride, Dihydrogen monoxide, Sulfur dioxide, Diphophurus pentoxide.	Soap, Slime, and Creative Chromatography (PDF) / (Word) CH.3 a, b, c, d, e, f CH.5 f Aspirin Analysis (PDF) / (Word) CH.3 d CH.4 a, b, c CH.1 a, b, c A Crystal Lab (PDF) / (Word) CH.3 d CH.1 a, b, c Molecular Geometry (Ball and Stick Model) Lab

Second Nine Weeks

SOL: CH.3 a, c, d, CH.6 a, b-Covalent (Molecular) Compounds and Organic Chemistry

Big Idea: In molecular compounds, bonding occurs when atoms share electrons. Shared electrons and the valence electrons that are not shared affect the shape of a molecular compound, as the valence electrons stay as far apart from each other as possible. The molecular properties of a molecule are affected by intermolecular attractions.

SOL Description	Higher Level Questioning	Resources
d) Bonding types. •**Predict, draw, and name** molecular shapes (bent, linear, trigonal, planar, tetrahedral, and trigonal pyramidal). •**Draw** Lewis dot diagrams to represent valence electrons in elements and **draw** Lewis dot structures to show covalent bonding. •**Use** valence shell electron pair repulsion (VSEPR) model to draw and name molecular shapes (bent, linear, trigonal planar, tetrahedral, and trigonal pyramidal). •**Recognize** polar molecules and non-polar molecules.	**Cognitive Level** Apply Create **Questions** •What is a covalent bond? •What are the different molecular shapes of covalent compounds? •How do you determine the Lewis dot structure of a compound? •How do you determine the molecular shape of a covalent compound? •Create a diagram of the Lewis dot structure of the following compounds: ammonia, water, carbon monoxide, sulfur dioxide, and carbon tetra chloride. •Construct the molecular model (identifying the molecular shape) of the following molecular shapes: bent, linear, trigonal planar, tetrahedral, and trigonal pyramidal. •How do you predict if a covalent compound is polar or nonpolar?	http://phet.colorado.edu/en/simulation/build-a-molecule http://phet.colorado.edu/en/simulation/molecule-polarity

Second Nine Weeks

SOL: CH.3 a, c, d, CH.6 a, b-Covalent (Molecular) Compounds and Organic Chemistry

Big Idea: There are four main types of biological molecules. Most carbohydrates are polymers that release energy when broken down. Proteins are polymers of amino acids and are needed for most chemical reaction in cells. Catabolic reactions break down biological molecules to provide energy and build biological blocks for the cell. Anabolic reactions build biological molecules to store energy and make new cell parts.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand how basic chemical properties relate to organic chemistry and biochemistry. Key concepts include **a) Unique properties of carbon that allow multi-carbon compounds;** •**Describe** how saturation affects shape and reactivity of carbon compounds. •**Draw** Lewis dot structures, identify geometries, and describe polarities of the following molecules: CH_4, C_2H_6, C_2H_4, C_2H_2, CH_3CH_2OH, CH_2O, C_6H_6, CH_3COOH.	**Cognitive Level** Understand Apply Evaluate Create **Question** •How do you classify if a compound or molecule is organic? •Compare a contrast a saturated and unsaturated organic molecule. •Create a diagram of the Lewis dot structure of the following compounds:CH_4, C_2H_6, C_2H_2, CH_3CH_2OH, CH_2O, C_6H_6, CH_3COOH. •Construct the molecular model (identifying the molecular shape) of the following: CH_4, C_2H_6, C_2H_2, CH_3CH_2OH, CH_2O, C_6H_6, CH_3COOH. •Predict and describe the polarities of the following organic molecules: CH_4, C_2H_6, C_2H_2, CH_3CH_2OH, CH_2O, C_6H_6, CH_3COOH.	

Second Nine Weeks

SOL: CH.3 a, c, d, CH.6 a, b-Covalent (Molecular) Compounds and Organic Chemistry

Big Idea: There are four main types of biological molecules. Most carbohydrates are polymers that release energy when broken down. Proteins are polymers of amino acids and are needed for most chemical reaction in cells. Catabolic reactions break down biological molecules to provide energy and build biological blocks for the cell. Anabolic reactions build biological molecules to store energy and make new cell parts.

SOL Description	Higher Level Questioning	Resources
b) Plastics and food. •**recognize** that organic compounds play a role in natural and synthetic pharmaceuticals. •**recognize** that nucleic acids and proteins are important natural polymers. •**recognize** that plastics formed from petrochemicals are organic compounds that consist of long chains of carbons. •**conduct** a lab that exemplifies the versatility and importance of organic compounds (e.g., aspirin, an ester, a polymer).	**Cognitive Level** Apply Create •**Questions** •What is a polymer? •What are examples of natural biochemical polymers? •How do organic compounds play a role in pharmaceuticals? •What are examples of man-made or synthetic polymers? •How are plastics formed from petrochemicals? •Why are organic compounds important? •Synthesize an organic compound.	http://www.education.com/activity/article/Make_Homemade_Glue/

Second Nine Weeks

CH.3 b, c, e – Chemical Reactions (6 blocks to include lab experience)

Big Idea: An element's position in the periodic table supplies information on ion formation and bonding tendencies, which is used to write the names and formulas of ions and compounds. Ionic and molecular compounds differ in composition—ions form ionic compounds and molecules form molecular compounds.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include – **c) Writing Chemical formulas** •**Write** the chemical formulas for certain common substances, such as ammonia, water, carbon monoxide, carbon dioxide, sulfur dioxide, and carbon tetrafluoride •**Use** polyatomic ions for writing formulas of ionic compounds, including carbonate, sulfate, nitrate, hydroxide, phosphate, and ammonium	**Cognitive Level** Apply **Question(s)** •Translate the following word equation into a chemical equation: a) Calcium carbonate reacts with sodium chloride to produce calcium chloride and sodium carbonate b) Carbon dioxide and water are produced through the reaction between methane and oxygen •Translate the following chemical equation into a word equation: CH_4 (g) + $2O_2$ (g)→ CO_2 (g)+ H_2O (g)	Reading and Writing Chemical Equations Inquiry Lab http://sciencespot.net/Pages/kdzchem.html Online Balance Equations Activity Matter and Energy: Equations and Formulas (PDF) / (Word) CH.3 a, b, c CH.1 a, b, c Predicting Products and Writing Equations (PDF) / (Word) CH.3 e CH.1 a, b, c

Second Nine Weeks

CH.3 b, c, e – Chemical Reactions

Big Idea: In order to show that mass is conserved during a reaction, a chemical equation must be balanced. You can predict the products of most chemical reactions by identifying the reaction type. To determine the reaction type, consider the number of reacting elements and compounds.

SOL Description	Higher Level Questioning	Resources
b) Balancing chemical equations •**Transform** word equation into chemical equations and balance chemical equations **e) Reaction types** •**Recognize** equations for redox reactions and neutralizations reactions. •**Distinguish** between an endothermic and exothermic process.	**Cognitive Level** Create **Question(s)** How is the law of conservation of matter represented in a balanced equation? How does a coefficient affect the number of each type of atoms in a formula? Why can you change coefficients, but not subscripts, when balancing an equation? Balance the following: $\_H_2 + \_Cl_2 \rightarrow \_HCl$ $\_C_8H_{18} + \_O_2 \rightarrow \_CO_2 + \_H_2O$ **Cognitive Level** Apply Analyze **Question(s)** Compare and contrast a. synthesis and decomposition b. single replacement and double replacement reactions Predict the products for the following reactants: a) NaCl + Mg→ b) CH_4 + O2 → c) MgF_2 → d) $AgNO_3 + ZnCl_2$→	https://phet.colorado.edu/en/simulation/balancing-chemical-equations http://www.flinnsci.com/teacher-resources/chemistry/flinn-chemtopic-labs/ap6596/

Chemistry Pace, Scope and Sequence 2015-2016

Third Nine Weeks

SOL: CH.1 g. and 4 a-The Mole (5 blocks and then ongoing)

Big Idea: The mole is an important measurement in chemistry. The mole allows you to convert among the amount of representative particles in a substance, the mass of a substance and the volume of a gas at STP. The molecular formula of a compound can be determined by first finding the percent composition of the compound and determining the empirical formula. Using the empirical formula mass and the molar mass of the compound, the molecular formula can be determined.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated produce observations and verifiable data. Key concepts include- **g) mathematical manipulations including SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, and dimensional analysis** •**Use** common SI prefixes and their values (milli-, centi-, kilo-) in measurements and calculations •**Demonstrate** the use of scientific notation, using the correct number of significant digits with powers of ten notation for the decimal place •**Calculate** mole ratios, percent composition, conversions, and average atomic mass. •**Perform** calculations according to significant digit rules •**Convert** measurements using dimensional analysis **The student will investigate and understand that chemical quantities are based on molar relationships. Key concepts include-** **a) Avogadro's principle and molar volume** •**Perform** conversions between mass, volume, particles, and moles of a substance.	**Cognitive Level** Understand Apply Create **Question (s)** •Determine the percent composition of sodium carbonate. •A compound is found to contain 50.05 % sulfur and 49.95 % oxygen by mass. What is the empirical formula for this compound? The molecular weight for this compound is 64.07 g/mol. What is its molecular formula? **Cognitive Level** Apply **Question (s)** •Calculate the molar mass (formula unit) of iron (III) nitrate. Use dimensional analysis to : •Convert 15 grams of water to moles of water. •Convert 15 moles of water to atoms of water. •Convert 15 atoms of water to Liters of water.	Formulas and Percent Compositions of Ionic Compounds (PDF) / (Word) CH.4 b CH.3 c Finding the Formula and Percent Composition (PDF) / (Word) CH.4 b CH.3 e CH.4 d

Third Nine Weeks

SOL: CH.1 g, CH.3 b, CH.4 a, b.-Stoichiometry (7 blocks to include lab experience and then ongoing)

Big Idea: Balanced chemical equations are the basis for stoichiometric calculations. The coefficients of a balanced equation indicate the number of particles, moles, or volumes of a gas in the reaction. Mole ratios from the balanced equation are used to calculate the amount of a reactant or product in a chemical reaction from a given amount of one of the reactants or products.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated produce observations and verifiable data. Key concepts include- **g) mathematical manipulations including SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, and dimensional analysis** •**Use** common SI prefixes and their values (milli-, centi-, kilo-) in measurements and calculations •**Demonstrate** the use of scientific notation, using the correct number of significant digits with powers of ten notation for the decimal place •**Calculate** mole ratios, percent composition, conversions, and average atomic mass. •**Perform** calculations according to significant digit rules •**Convert** measurements using dimensional analysis	**Cognitive Level** Understand Apply Create **Question (s)** Use conversion factors and the factor-label method to calculate the number of moles of calcium to a) Grams of calcium b) Atoms of calcium c) Molecules of calcium d) Particles of calcium e) Liters of calcium	Limiting Reactants in Brownies Inquiry Lab (Shared district folder) http://phet.colorado.edu/en/simulation/reactants-products-and-leftovers

Third Nine Weeks

SOL: CH.1 g, CH.3 b, CH.4 a, b.-Stoichiometry

Big Idea: Balanced chemical equations are the basis for stoichiometric calculations. The coefficients of a balanced equation indicate the number of particles, moles, or volumes of a gas in the reaction. Mole ratios from the balanced equation are used to calculate the amount of a reactant or product in a chemical reaction from a given amount of one of the reactants or products.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include- **b) Balancing chemical equations** •**Transform** word equations into chemical equations and balance chemical equations	**Cognitive Level** Create **Question (s)** • Why does stoichiometry require a balanced equation? • Translate and balance the following word equation: a) Methane (CH_4) and oxygen reacts by combustion. b) Synthesize magnesium and chlorine. c) Decompose sodium fluoride.	http://education.jlab.org/elementbalancing/

Third Nine Weeks

SOL: CH.1 g, CH.3 b, CH.4 a, b.-Stoichiometry

Big Idea: Balanced chemical equations are the basis for stoichiometric calculations. The coefficients of a balanced equation indicate the number of particles, moles, or volumes of a gas in the reaction. Mole ratios from the balanced equation are used to calculate the amount of a reactant or product in a chemical reaction from a given amount of one of the reactants or products.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand that chemical quantities are based on molar relationships. Key concepts include- **4b) Stoichometric relationships** •**Perform** stoichiometric calculations involving the following relationships: -mole-mole -mass-mass -mole-mass -mole-volume -volume-volume -mole-particles -mass-particles; and -volume-particles •**Identify** the limiting reactant (reagent) in a reaction •**Calculate** percent yield of a reaction	**Cognitive Level** Apply Create **Question (s)** • Why are mole ratios required for all stoichiometric calculations? • Use the following reaction ($2KClO_3 \rightarrow 2KCl + 3O_2$) to: • Calculate the number of moles of oxygen when 3.0 moles of $KClO_3$ decompose completely. • Calculate the number of grams of oxygen when 3.0 grams of $KClO_3$ decompose completely. • Calculate the number of particles of oxygen when 3.0 moles of $KClO_3$ decompose completely. • Calculate the number of particles of oxygen when 3.0 grams of $KClO_3$ decompose completely. • In the reaction A + B → C + D, if the quantity of B is insufficient to react with all of A, what does this indicate about A?	https://www.khanacademy.org/science/chemistry/chemical-reactions-stoichiome/stoichiometry-ideal/v/stoichiometry

Chemistry Pace, Scope and Sequence 2015-2016

Third Nine Weeks

SOL: CH.5 d, e, f-Thermochemistry (4 blocks to include lab experience)

Big Idea: During a chemical or physical process, the energy of the universe is conserved. The heat of reaction or process can be determined experimentally through calorimetry. The heat of reaction can also be calculated by using the known heats of reaction of two or more thermochemical equations or by using standard hears of formation.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles. Key concepts include- **f) Specify heat capacity** •**Calculate** energy changes, using specific heat capacity	**Cognitive Level** Apply Create **Question (s)** •Determine the specific heat of a material if a 35 g sample of the material absorbs 48 J as it is heated from 298 K to 313 K. •How much energy is needed to raise the temperature of a 75 g sample of aluminum from 22.4°C to 94.6°C? (Specific heat of Al is 0.897 J/gK) •Energy in the amount of 420 J is added to a 35 g sample of water at a temperature of 10.0°C. What is the final temperature of the water? (Specific heat of water is 4.18 J/gK) •If the molar heat capacity and the temperature change of a substance are known, why is the mass of a substance not needed to calculate its molar enthalpy change?	Calorimetry with Probeware Lab Heat Capacity Lab Thermochemistry: Heat and Chemical Changes (PDF) / (Word) CH.5 a, b, c, d, e, f, g CH.1 a, b, c, e, g, h Heat Transfer and Heat Capacity (PDF) / (Word) CH.5 d, e, f CH.1 a, b, g Molar Heat of Fusion for Water (PDF) / (Word) CH.5 e CH.1 a, b, e

Third Nine Weeks

SOL: CH.5 d, e, f-Thermochemistry

Big Idea: During a chemical or physical process, the energy of the universe is conserved. The heat of reaction or process can be determined experimentally through calorimetry. The heat of reaction can also be calculated by using the known heats of reaction of two or more thermochemical equations or by using standard hears of formation.

SOL Description	Higher Level Questioning	Resources
d) Phase changes •**Graph** and **interpret** a heating curve (temperature vs. time) •**Interpret** a phase diagram of water	**Cognitive Level** Understand Apply Evaluate Create **Question(s)** • Given a heating curve, predict the parts of a heating curve that illustrates the phase change. **Cognitive Level** Understand Evaluate **Question(s)** • Why is the triple point near the normal freezing point of a substance? • The triple point of sulfur dioxide is a at -73°C and 0.17 kPa. The critical point is a t 158°C and 7.87 x 10^3 kPa. The normal boiling point of sulfur dioxide is -10°C. Solid sulfur dioxide is denser than liquid sulfur dioxide. • Sketch the phase diagram of sulfur dioxide.	https://www.youtube.com/watch?v=-QqTwJzi7Wo http://phet.colorado.edu/en/simulation/states-of-matter

Third Nine Weeks

SOL: CH.5 d, e, f-Thermochemistry

Big Idea: During a chemical or physical process, the energy of the universe is conserved. The heat of reaction or process can be determined experimentally through calorimetry. The heat of reaction can also be calculated by using the known heats of reaction of two or more thermochemical equations or by using standard hears of formation.

SOL Description	Higher Level Questioning	Resources
e) Molar heats of fusion and vaporization •**Calculate** energy changes, using molar heat of fusion and molar heat of vaporization	**Cognitive Level** Apply Create **Question(s)** • Why is the molar enthalpy of vaporization of a substance much higher than the molar enthalpy of fusion? • The enthalpy of fusion of bromine is 10.57 kJ/mol. The entropy of fusion is 39.8 J/molK. Calculate the freezing point.	http://www.carolina.com/pdf/care-sheets/Determining-Mlar-E-fusion.pdf (can be changed to include probeware in your building)

Chemistry Pace, Scope and Sequence 2015-2016

Third Nine Weeks

SOL: CH.5 (a, b, c), CH.4 (a-b)-Kinetic Molecular Theory of Gases (5 blocks to include lab experience)

Big Idea: Ideal gases conform to the assumptions of kinetic theory. The behavior of ideal gases can be predicted by the gas laws. With the ideal gas law, the number of moles of a gas in a fixed volume at a known temperature and pressure can be calculated.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles. Key concepts include: **a) Pressure , temperature , and volume;** •**Explain** the behavior of gases and the relationship between pressure and volume (Boyle's Law), and volume and temperature (Charles' Law).	**Cognitive Level** Understand Evaluate **Question (s)** • How are Boyle's and Charles' Law related? • What are the mathematical formulas to solve for pressure, temperature, and volume of a gas according to Boyle's and Charles' Law? • Explain how the phase of a substance is related to temperature and pressure. • How do pressure, temperature, and volume affect each other? • How do you calculate the temperature and/or volume using Charles' Law? • How do you calculate the pressure and/or volume using Boyle's Law?	Gas Laws Lab Molar Volume of a Gas Lab Charles' Law (PDF) / (Word) CH.5 a CH.1 a, b, e, f, g, h Partial Pressure (PDF) / (Word) CH.5 a, b, c, d, e, f, g CH.1 a, b, c, f, g, h CH.3 a, b, c, e CH.4 a, b Molar Volume of a Gas (PDF) / (Word) CH.4 a, b CH.1 a, b, f, g CH.2 h CH.3 b CH.5 a, b, c

Third Nine Weeks

SOL: CH.5 (a, b, c), CH.4 (a-b)-Kinetic Molecular Theory of Gases

Big Idea: Ideal gases conform to the assumptions of kinetic theory. The behavior of ideal gases can be predicted by the gas laws. With the ideal gas law, the number of moles of a gas in a fixed volume at a known temperature and pressure can be calculated.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles. Key concepts include: **b) Partial pressure and gas laws**. •**Solve** problems and **interpret** graphs involving the gas laws.	**Cognitive Level** Understand Apply Evaluate Create **Question(s)** • How is temperature related to kinetic energy? • What are the characteristics of gases? • What would happen to the temperature of a gas if the volume id doubled? • What happens to the temperature of a gas if the pressure is doubled? • What happens to the pressure of your tires when it is cold outside? • Compare and contrast combined and ideal gas. • Explain how the total partial pressure is determined in a mixture of gases.	https://www.teachervision.com/graphs-and-charts/science/54828.html http://phet.colorado.edu/en/simulation/gas-properties

Fourth Nine Weeks

SOL: CH.3 d, CH.4 c, d and CH.5 g- Solutions (2 blocks to include lab experience)

Big Idea: Solubility, miscibility, concentration, and colligative properties are used to describe and characterize solutions. Solution concentration can be quantified in terms of molarity (moles of solute per liter of solution), percent by volume, and percent by mass.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand how conversation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include: **3d) Bonding types.** •**Predict, draw, and name** molecular shapes (bent, linear, trigonal, planar, tetrahedral, and trigonal pyramidal). •**Draw** Lewis dot diagrams to represent valence electrons in elements and **draw** Lewis dot structures to show covalent bonding. •**Use** valence shell electron pair repulsion (VSEPR) model to draw and name molecular shapes (bent, linear, trigonal planar, tetrahedral, and trigonal pyramidal). •**Recognize** polar molecules and non-polar molecules.	**Cognitive Level** Apply Create **Question (s)** Classify each of the following compounds as polar or nonpolar: a. Sulfur dioxide b. $SiCl_4$ c. Oxygen gas	Molar Concentration Inquiry Lab Solution Concentrations (PDF) / (Word) CH.4 c CH.1 b, f, g, h CH.2 h CH.3 a, b, d Vapor Pressure and Colligative Properties (PDF) / (Word) CH.4 a, b, c, d CH.5 a, b, c, d, e, f, g CH.1 a, b, c, e, g, h States of Matter (PDF) / (Word) CH.4 a, b, c, d CH.5 a, b, c, d, e, f, g CH.1 a, b, c, e, g, h The Colligative Properties of Solutions (PDF) / (Word) CH.5 g CH.1 h

Fourth Nine Weeks

SOL: CH.3 d, CH.4 c, d and CH.5 g- Solutions

Big Idea: Solubility, miscibility, concentration, and colligative properties are used to describe and characterize solutions. Solution concentration can be quantified in terms of molarity (moles of solute per liter of solution), percent by volume, and percent by mass.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand how conversation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include: **c) solution concentrations** •**Perform** calculations involving the molarity of a solution; including dilutions. •**Interpret** solubility curves	**Cognitive Level** Apply Evaluate Create **Question (s)** Vinegar contains 5.0 grams of acetic acid, CH_3COOH, in 100.0 mL of solution. Calculate the molarity of acetic acid in vinegar. • A standard solution of NaOH is 1.00 M. What mass of sodium hydroxide is present in 100.0 mL of solution? • Given a solubility curve, determine the temperature with the optimum solubility of KCl. • Predict the solubility of a solution at a given temperature, using a solubility curve. • Illustrate a saturated, unsaturated, and supersaturated solution. • Differentiate between a solute and solvent and give examples of each.	http://phet.colorado.edu/en/simulation/concentration http://phet.colorado.edu/en/simulation/soluble-salts

Fourth Nine Weeks

SOL: CH.3 d, CH.4 c, d and CH.5 g- Solutions

Big Idea: Solubility, miscibility, concentration, and colligative properties are used to describe and characterize solutions. Solution concentration can be quantified in terms of molarity (moles of solute per liter of solution), percent by volume, and percent by mass.

SOL Description	Higher Level Questioning	Resources
d) acid/base theory; strong electrolytes, weak electrolytes, and nonelectrolytes; dissociation and ionization; pH and pOH; and the titration process •**Compare and contrast** the differences between strong, weak, and non-electrolytes. **g) colligative properties** •**Examine** the polarity of various solutes and solvents in solution formation.	**Cognitive Level** Understand Apply Analyze Evaluate Create **Question (s)** • Justify why acetic acid is considered a weak electrolyte and why HCl is considered a strong electrolyte. • Explain a solution of salt in water conducts electricity, but a solution of sugar does not.	http://www.sparknotes.com/chemistry/solutions/colligative/section1.rhtml http://phet.colorado.edu/en/simulation/acid-base-solutions

Fourth Nine Weeks

SOL: CH.4 d. Acids and Bases (2 blocks to include lab experience)

Big Idea: Chemists define acids and bases according to the ions they yield in aqueous solution. Chemists also define acids and bases based on whether they accept or donate hydrogen ions, and whether they are electron-pair donors or acceptors. The pH of a solution reflect the hydrogen-ion concentration. Chemists use acid-base reactions to determine the concentration of an acid or a base in solution.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand that chemical quantities are based on molar relationships. Key concepts include: **d) acid/base theory; strong electrolytes, weak electrolytes, and nonelectrolytes; dissociation and ionization; pH and pOH; and the titration process**. •**Differentiate** between the defining characteristics of the Arrhenius theory of acids and bases and the Bronsted-Lowry theory of acids and bases. •**Identify** common examples of acids and bases, including vinegar and ammonia. •**Compare and contrast** the differences between strong, weak, and non-electrolytes. •**Relate** the hydronium ion concentrate to the pH scale. •**Perform** titrations in a laboratory setting using indicators.	**Cognitive Level** Understand Apply Analyze Evaluate Create **Question (s)** Compare and Contrast Arrehnius and Bronsted–Lowry definition of acids and bases. What is the formula to solve for pH and POH? Illustrate an acid base equation and identify the conjugate acid and base pairs. Construct a list of common acids and bases and their pH's. Explain what pH is and how the hydronium ion relates to it. Construct a graph of a titration in lab. Predict the possible titration curve of a strong acid, base, and a weak acid, base. Predict the correct indicator for specific pHs.	Acid/Base Titration Inquiry Lab Acids and Bases (PDF) / (Word) CH.3 e CH.1 a, b, c Acid-Base Theory (PDF) / (Word) CH.4 d CH.1 a, b, c, d, e, f, g, h, i, j http://phet.colorado.edu/en/simulation/ph-scale

Chemistry Pace, Scope and Sequence 2015-2016

Fourth Nine Weeks

SOL: CH.3 f-Kinetics, f-Equilibrium (1 block)

Big Idea: The rate of a chemical reaction can be controlled by adjusting temperature, concentration, or particle size. Adding a catalyst seeds up a reaction by lowering the activation energy. Energy is released in some reactions and absorbed in others. Changes in enthalpy and entropy can be used to explain why some reactions occur naturally and others do not.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand how conversation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include: **f) reaction rates, kinetics, and equilibrium** •**Recognize** that there is a natural tendency for systems to move in a direction of randomness (entropy) •**Identify** and **explain** the effect the following factors have on the rate of a chemical reaction: catalyst, temperature, concentration, size of particles. •**Interpret** reaction rate diagrams.	**Cognitive Level** Understand Apply Evaluate **Question (s)** • Give examples of situations in which a) entropy is low b) entropy is high • Draw a diagram that illustrates why a catalyzed reaction pathway has lower activation energy than an uncatalyzed reaction. • Defend why an increase in the frequency of collisions is not an adequate explanation of the effect of temperature on reaction rate. • Given a graph of reactant concentration versus time, how can you measure reaction rate?	The Rate of a Chemical Reaction (PDF) / (Word) CH.3 f CH.1 a, b, c http://phet.colorado.edu/en/simulation/reactions-and-rates

Fourth Nine Weeks

SOL: CH.3 f-Kinetics, f-Equilibrium

Big Idea: The rate of a chemical reaction can be controlled by adjusting temperature, concentration, or particle size. Adding a catalyst seeds up a reaction by lowering the activation energy. Energy is released in some reactions and absorbed in others. Changes in enthalpy and entropy can be used to explain why some reactions occur naturally and others do not.

SOL Description	Higher Level Questioning	Resources
The student will investigate and understand how conversation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include: **f) reaction rates, kinetics, and equilibrium** •**Distinguish** between irreversible reactions and those at equilibrium •**Predict** the shift in equilibrium when a system is subjected to a stress (Le Chatelier's Principle) and **identify** the factors that can cause a shift in equilibrium (temperature, pressure, and concentration).	**Cognitive Level** Apply Analyze Create **Question(s)** • In what way are the numbers of players on the ice in a hockey game *not* like chemical equilibrium? • How does an equilibrium reaction respond to the addition of extra reactant? Extra product? • Predict the effect of each of the following on the indicated equilibrium system in terms of which reaction (forward, reverse, or neither) will be favored. H_2 (g) + Cl_2(g) ←→ 2HCl (g) + 184 kJ a) Addition of Cl_2 b) Removal of HCl c) Removal of H_2 d) Increased pressure e) Decreased pressure f) Decreased temperature g) Increased temperature	Equilibrium and Le Chatelier's Principle (PDF) / (Word) CH.3 f CH.1 a, b, c