CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
CHEMISTRY/HONORS CHEMISTRY

Chemistry / Honors Chemistry Curriculum Guide

Pacing Guide **Honors Chemistry is a full year course that meets on a rotating basis for three (3) 55-minute blocks and one (1) 40-minute block for every five (5) day cycle.**	**Unit 1: Scientific Foundations (Introduction to Chemistry) – 3-4 weeks** **Unit 2: Structure and Properties of Matter – 6 weeks** **Unit 3: Bonding and Chemical Reactions – 8 weeks** **Unit 4: Matter and Energy in Living Systems – 6-8 weeks** **Unit 5: Nuclear Chemistry – 8 weeks**

NJSLS Career Ready Practices – These practices are demonstrated throughout the curriculum	CRP2. Apply appropriate academic and technical skills. CRP4. Communicate clearly and effectively and with reason. CRP5. Consider the environmental, social and economic impacts of decisions. CRP6. Demonstrate creativity and innovation. CRP7. Employ valid and reliable research strategies. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP10. Plan education and career paths aligned to personal goals. CRP11. Use technology to enhance productivity. CRP12. Work productively in teams while using cultural global competence.

Interdisciplinary Connections	Math HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities HSA.SSE.A.1: Interpret expressions that represent a quantity in terms of its context HSA.CED.A.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. ELA RST.9-10.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions. RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics. RST.9-10.5. Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). RST.9-10.6. Determine the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. RST.9-10.8. Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. RST.9-10.9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. RST.9-10.10. By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

	WHST.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence. A. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. B. Develop claim(s) and counterclaims using sound reasoning, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns. WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. D. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers. WHST.9-10.6. Use technology, including the Internet, to produce, share, and update writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. WHST.9-10.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
21st Century Life and Careers:	9.2.12.C.1 Review career goals and determine steps necessary for attainment. 9.2.12.C.3 Identify transferable career skills and design alternate career plans.
Technology Standards	8.2.12.B.2 Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product. 8.2.12.B.4 Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants. 8.2.12.B.5 Research the historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product, and present the competing viewpoints to peers for review. 8.2.12.C.4 Explain and identify interdependent systems and their functions.

Differentiation/Accommodations/Modifications

Gifted and Talented	English Language Learners	Students with Disabilities	Students at Risk of School Failure
Extension Activities • Conduct research and provide presentation of mathematical topics. • Design surveys to generate and analyze data to be used in discussion. • Use of higher level questioning techniques. • Provide assessments at a higher level of thinking.	**Modifications for Homework/Assignments** • Modified assignments. • Extended time for assignment completion as needed. • Use graphing calculator. • Highlight formulas.	*(appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team)* **Modifications for Classroom** • Ask students to restate information, directions, and assignments. • Repetition and practice. • Model skills / techniques to be mastered. • Extended time to complete class work. • Provide copy of class notes. • Preferential seating to be mutually determined by the student and teacher. • Students may request books online, on tape/CD, as available and appropriate. • Assign peer helper in the class setting. • Provide regular parent / school communication • Provide oral reminders and check student work during independent work time. • Assist student with long and short term planning of assignments	**Modifications for Classroom** • Ask students to restate information, directions, and assignments. • Repetition and practice. • Model skills / techniques to be mastered. • Extended time to complete class work. • Provide copy of class notes. • Preferential seating to be mutually determined by the student and teacher. • Students may request books online, on tape/CD, as available and appropriate. • Assign peer helper in the class setting. • Provide oral reminders and check student work during independent work time. • Assist student with long and short term planning of assignments • Provide regular parent / school communication. • Assign peer helper in the class setting.

		Modifications for Homework • Extended time to complete assignments. • Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases. • Provide the student with clearly stated (written) expectations and grading criteria for assignments. **Modifications for Assessments** • Extended time on classroom tests and quizzes. • Student may take / complete tests in an alternate setting as needed. • Restate, reread, and clarify directions/questions. • Distribute study guide for classroom tests. • Establish procedures for accommodations / modifications for assessments.	• Provide oral reminders and check student work during independent work time. • Assist student with long and short term planning of assignments **Modifications for Homework** • Extended time to complete assignments. • Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases. • Provide the student with clearly stated (written) expectations and grading criteria for assignments. **Modification for Assessments** • Extended time on classroom tests and quizzes. • Student may take / complete tests in an alternate setting as needed. • Restate, reread, and clarify directions/questions. • Distribute study guide for classroom tests. • Establish procedures for accommodations / modifications for assessments.

Unit 1: Scientific Foundations (Introduction to Chemistry)

Content: Measurements and Calculations

Essential Questions: How are mathematical and computational tools used to make predictions and solve problems in chemistry?

Standards: Math.Practices.(1, 2, 3, 4, 5, 7)

Time Frame: 4 Weeks------Honors Chemistry: 3 weeks

Materials:
Textbook: Modern Chemistry
Smart board, internet research and activities, graph papers, color pencils.

Content: *As a result of this learning segment, students will know…*

In this unit of study, students *develop and use models*, *plan and carry out investigations*, *analyze and interpret data,* Students are expected to demonstrate proficiency in *developing and using models*, *planning and carrying out investigations*, *analyzing and interpreting data*, *engaging in argument from evidence*, and using these practices to demonstrate understanding of core mathematical ideas.. This unit is based on **NJSLS:** Math.Practice.(MP1,MP2, MP3,MP4, MP5, MP7)

- Units of Measurement
- Lab techniques
- Metric conversions, accuracy/precision, dimensional analysis, graphing

Student Learning Objective (SLO): *As a result of this learning segment, students will be able to…*

- Use metric measurements and conversions
- Use significant figures in calculations
- Differentiate between precision, accuracy

HONORS CHEMISTRY: (additional SLO)

- Calculate significant figures with multiplication, division, addition and subtraction
- Derive conversion factors
- Perform addition, subtraction, multiplication and division with scientific notation

Engage: *Anticipatory Set*

Introduce the ancient unit of cubit (length from elbow to tip of middle finger) to establish the importance of standards in measurement
Students will measure the length of their lab stations with their cubit. Class will then compare results with other groups. Students will realize that not all "cubits" are the same. Hence, a standard unit of measurement became necessary.

Atomic Structure of an Alloy
In this video excerpt from NOVA: "Hunting the Elements," New York Times technology columnist David Pogue visits The Verdin Company, a manufacturer of bells, to learn about bronze. Find out how copper is typically alloyed with tin to make bronze—a metal alloy widely used in tools and weapons during the Bronze Age and still in use today. Learn how to make a bell and why bronze is still the manufacturer's material of choice. Explore how the atomic structure of a metal determines its properties, such as conductivity and malleability, and how combining metals can create a new material with different properties.
http://nj.pbslearningmedia.org/resource/nvhe.sci.chemistry.alloy/atomic-structure-of-an-alloy/

Article- Graphene: The Next Wonder Material?
http://www.acs.org/content/acs/en/education/resources/highschool/chemmatters/past-issues/archive-2012-2013/graphene.html?_ga=1.111599428.1330968908.1461338522

Exploration: *Student Inquiry*

- **Measurement**
- Notes packet – Measurement in Science
- Lab Activities: Heights of students in class, Measuring in Metric (Solids, liquids, gases,) Using Metric Lab Equipment , Density Lab, (includes graphing of recorded data)
- Worksheets: measuring in metric, converting in metric, significant figure and precision, accuracy and precision, scientific notation, dimensional analysis, density, percent error,
- Video: history of measurement; dimensional analysis,

Explanation: *Concepts and Practices*

- Quantitative analysis is an integral part of Chemistry
- Dimensional analysis allows scientists to calculate quantities at the atomic level

Elaboration: *Extension Activity*
Graphing scientific data interactives
http://www.internet4classrooms.com/grade_level_help/embedded_inquiry_interpret_data_eighth_8th_grade_science.htm

The tools below can be used to **better understand science and math**, to **practice math skills**, or simply to **explore and experiment**. Most of these tools are **developed and maintained by students**, working as interns or apprentices at Shodor.
http://www.shodor.org/students/activities/

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*

- Homework
- Warm up exercises
- Exit Tickets
- Group activities
- Section quizzes
- Chapter tests
- Cumulative tests
- Projects / Presentations
- Midterm exam
- Final Exam

Unit 2: Structure and Properties of Matter

Content: Atoms, Arrangement of Electrons in Atoms, The Periodic Law,

Essential Questions:
How can one explain the structure and properties of matter?
How can we use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms?

Standards: HS-PS1-1, PS-PS1-2, HS-PS1-3, HS-PS2-6

Time Frame: 6 Weeks

Materials:
Textbook: Modern Chemistry
Smart board, internet research and activities, graph papers, color pencils.

Content: *As a result of this learning segment, students will know…*

In this unit of study, students *develop and use models*, *plan and carry out investigations*, *analyze and interpret data,* and *engage in argument from evidence* to make sense of energy as a quantitative property of a system—a property that depends on the motion and interactions of matter and radiation within that system. They will also use the findings of investigations to provide a mechanistic explanation for the core idea that total change of energy in any system is always equal to the total energy transferred into or out of the system. Additionally, students develop an understanding that energy, at both the macroscopic and the atomic scales, can be accounted for as motions of particles or as energy associated with the configurations (relative positions) of particles. Students apply their understanding of energy to explain the role that water plays in affecting weather. Students examine the ways that human activities cause feedback that create changes to other systems. Students are expected to demonstrate proficiency in *developing and using models*, *planning and carrying out investigations*, *analyzing and interpreting data*, *engaging in argument from evidence*, and using these practices to demonstrate understanding of core ideas. Students also develop possible solutions for major global problems. They begin by breaking these problems into smaller problems that can be tackled with engineering methods. To evaluate potential solutions, students are expected not only to consider a wide range of criteria, but also to recognize that criteria need to be prioritized. This unit is based on HS-PS3-4, HS-ESS2-5, HS-ESS3-2, and HS-ETS1-3.

Student Learning Objective (SLO): *As a result of this learning segment, students will be able to…*

- Use the periodic table as a tool to explain and predict the properties of elements
- Explain how elements are formed
- Explain how bonds form in reactions
- Classify matter
- Distinguish between physical and chemical properties and changes
- Explain the mathematical relationship among the speed, wavelength and frequency of electromagnetic radiation
- Identify the periodic trends of atomic radii, ionization energy and electronegativity and explain the reasons for any variations
- Explain VSEPR theory
- Calculate average atomic mass

HONORS CHEMISTRY (additional SLO)

- Solve problems involving mass in grams, amount in moles and number of atoms of an element
- Explain the significance of the photo electric effect and the line-emission spectrum of hydrogen to the development of the atomic model
- Explain how the Heisenberg uncertainty principle and the Schrodinger wave equation led to the idea of atomic orbitals
- Explain the significance of the four quantum numbers
- Explain how the shapes of molecules are accounted for by hybridization

Engage: *Anticipatory Set*

Bohr's Model:
http://betterlesson.com/lesson/614383/bohr-s-model-and-valence-electrons

Build an Atom
http://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html

Properties of Ionic and Covalent Substances Lab
In this lab, students we will examine certain physical properties of three compounds to try to determine if they are ionic or covalent, and if they are covalent if they are polar or non-polar.
http://www.myips.org/cms/lib8/IN01906626/Centricity/Domain/8123/Properties_of_Ionic_and_Covalent_Substances_Lab.pdf

Changing Matter
http://www.bgfl.org/bgfl/custom/resources_ftp/client_ftp/ks3/science/changing_matter/index.htm

Exploration: *Student Inquiry*

- Students will do introductory activities in which they will create and label the structure of the atom.
- Atomic Theory Timeline---Poster Project
- Design your own periodic table activity, Modern Chemistry textbook pg. 137
- Mendeleev Lab of 1869, Modern Chemistry textbook pg. 172
- Students will do an introductory activity in which they identify and label the different types of elements found in the periodic table
- http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwj5-f6A3fLMAhUMMz4KHZbLAgMQFggcMAA&url=http%3A%2F%2Fschoolwires.henry.k12.ga.us%2Fcms%2Flib08%2FGA01000549%2FCentricity%2FDomain%2F6341%2Fget_organized_a_periodic_table_webquest.docx&usg=AFQjCNFwqfSVhfQNbDid6qCCgASoGXOl_g
- http://crescentok.com/staff/jaskew/isr/tigerchem/periodic_table/element_ball.htm
- Students will use the Bohr diagram of energy to relate it to the energy levels of the periodic table.
  http://schools.shorelineschools.org/staff/abagley/IPS/IPS%20notes/Fall%20Semester/Bohr%20model%20activity.pdf

- Students will be introduced to orbitals and the s,p,d,f blocks of the periodic table. They will draw and label diagrams and locate them on the periodic table
- https://www.learner.org/interactives/periodic/building/

Students will calculate the electron configuration for elements of the periodic table

- **Mendeleev Periodic Table Lab**
- http://www.nwasco.k12.or.us/cms/lib04/OR01001464/Centricity/Domain/97/Mendeleev%20Periodic%20Table%20Lab%20Assignment.pdf

Students will conduct lab activities which will demonstrate and reinforce these concepts

- **Exploring the Periodic Table**
- http://betterlesson.com/lesson/629234/exploring-the-periodic-table
- **Flame Test Lab**
- Demonstrates colors of different energy levels in atoms
- http://www.barbertonschools.org/Downloads/flame_test_lab.doc.
- **Electron Configuration**
- http://betterlesson.com/lesson/631736/electron-configuration
- **Electron Configuration- Part 1**
- Complete an inquiry-style paper.
- http://betterlesson.com/lesson/619481/electron-configuration-part-i
- Electron Configuration- Part 2
- take notes, watching videos, and doing an activity.
- http://betterlesson.com/lesson/619482/electron-configuration-part-ii
- perform an activity, taking notes, and doing practice questions.
- https://betterlesson.com/lesson/619487/periodic-table-trends
- Types of Chemical Reactions Lab
- During any chemical reaction, the Law of Conservation of Matter must be satisfied, meaning that there must be the same kind and number of atoms on each side of the chemical equation. Recognizing and using categories of reactions can make determining the reactants and products much easier. The five general types of reactions that you will study in this lab activity are: combination, decomposition, combustion (or burning), single replacement (or displacement), and double replacement (or ionic).
- http://www.kentschools.net/ccarman/files/2009/08/1-5-Types-of-Chemical-Reactions-stations-lab-fy11.pdf
- Types of Reactions- 3 Day Lab
- http://betterlesson.com/lesson/637764/types-of-reactions-concept-attainment-day-1
- http://betterlesson.com/lesson/639071/types-of-reactions-concept-attainment-day-2
- http://betterlesson.com/lesson/637776/now-it-s-your-turn-to-identify-the-reaction

- Introduction to Bonding In this multi-day lab, students will be able to use electronegativity values to decide if a bond is ionic or molecular, and describe differences in physical characteristics for substances with each type of bond. Includes Ionic vs. Molecular Properties Lab. http://betterlesson.com/lesson/633250/introduction-to-bonding

Boiling Point Lab:
In this lab, students will determine what happens to the properties of liquids as they reach the boiling point.
http://www.chsd.us/~tthompson/assignments/trimester3/Physical%20Science/boiling%20point%20lab.pdf

What Makes a Good Conductor?
http://www.fofweb.com/onfiles/seof/chemistry_experiments/4-08.pdf

Fun Look at Material Science
In this activity, students are introduced to the multidisciplinary field of material science. Through a class demo and PowerPoint® presentation, they learn the basic classes of materials (metals, ceramics, polymers, composites) and how they differ from one another, considering concepts such as stress, strain, ductile, brittle, deformation and fracture. Practical examples help students understand how the materials are applied, and further information about specific research illustrates how materials and material science are useful in space exploration. A worksheet and quiz are provided.https://www.teachengineering.org/view_lesson.php?url=collection/uoh_/lessons/uoh_matlsci/uoh_matlsci_lesson01.xml

Explanation: *Concepts and Practices*
PS1.A: Structure and Properties of Matter
The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.

PS1.B: Chemical Reactions
The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.

Elaboration: *Extension Activity*
Ionic Bonding

This interactive activity from ChemThink discusses ionic bonding—a type of chemical bond formed between two ions with opposite charges. Investigate how the transfer of electrons between atoms creates ions and how the mutual attraction of these charged particles forms ionic bonds. Also learn about trends in the periodic table of elements, and explore how the structure of an ionic compound relates to its formula.

http://www.pbslearningmedia.org/resource/lsps07.sci.phys.matter.ionicbonding/ionic-bonding/

Covalent Bonding
This interactive activity from ChemThink describes covalent bonding—a type of chemical bond that involves the sharing of electrons. Investigate the attractive and repulsive forces that act on atomic particles and how the sharing of electrons can keep atoms together. See how two hydrogen atoms interact with each other to create a covalent bond. Learn about trends in the periodic table and how electrostatic potential energy determines the bond length. Also, learn about naming conventions for covalent compounds.
http://www.pbslearningmedia.org/resource/lsps07.sci.phys.matter.covalentbond/covalent-bonding/

An animated and interactive video clip which recaps atomic structure.
http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/fundamentals/atomsact.shtml

An informative and engaging cartoon which summarizes the key points about transition metals
http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_gateway/periodic_table/transitionact.shtml

This webpage links to revision notes, multiple choice questions and exam-style questions, all focused on the periodic table.
http://www.s-cool.co.uk/gcse/chemistry/the-periodic-table/revise-it/placing-elements-in-order

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*

- Homework
- Warm up exercises
- Exit Tickets
- Group activities
- Section quizzes
- Chapter tests
- Cumulative tests
- Projects / Presentations
- Final Exam

Unit 3: Bonding and Chemical Reactions

Content: Chemical Bonding, Chemical Equations and Reactions, Stoichiometry, States of Matter

Essential Questions:
How does the conservation of atoms in chemical reactions lead to the ability to calculate the mass of products and reactants using the mole concept?
To what extent do limiting reactants affect a chemical reaction
How do substances combine or change (react) to make new substances?

Standards:
HS-PS1-4
HS-PS1-5
HS-PS1-6
HS-PS1-7

Time Frame: 8 Weeks

Materials:
Textbook: Modern Chemistry
Smart board, internet research and activities, graph papers, color pencils.

Content: *As a result of this learning segment, students will know…*
In this unit of study, students *develop and using models*, *plan and conduct investigations*, *use mathematical thinking*, and *construct explanations and design solutions* as they develop an understanding of the substructure of atoms and to provide more mechanistic explanations of the properties of substances. Chemical reactions, including rates of reactions and energy changes, can be understood by students at this level in terms of the collisions of molecules and the rearrangements of atoms. Students also apply an understanding of the process of *optimization and engineering design* to chemical reaction systems. The crosscutting concepts of *patterns*, *energy and matter*, and *stability and change* are the organizing concepts for these disciplinary core ideas. Students are expected to demonstrate proficiency in *developing and using models*, *planning and conducting investigations*, *using mathematical thinking*, and *constructing explanations and designing solutions*. This unit is based on standards HS-PS1-4, HS-PS1-5, HS-PS1-6, HS-PS1-7

Student Learning Objective (SLO): *As a result of this learning segment, students will be able to…*

- Explain the octet rule
- Describe ionic and covalent bonding
- Recognize which elements will form ionic or covalent bonds
- Draw Lewis structures for elements in covalent compounds
- Describe metallic bonding
- Explain and use VSEPR theory to predict the shape of molecules
- Construct molecular models based on their bonding arrangement
- Write and balance equations of chemical reactions

- Classify a chemical reaction based on the reactants and products involved
- Calculate the molar mass of an element and compound
- Recognize that the total mass is conserved in a chemical reaction
- Name chemical compounds

HONORS CHEMISTRY (additional SLO):

- Assign oxidation numbers to elements and compounds to predict formulas of molecular compounds
- Explain how intermolecular forces affect properties of matter such as boiling point and melting points
- Balance a formula equation by inspection
- Explain the significance of an activity series
- Use and activity series to predict whether a given reaction will occur and what the products will be
- Describe the importance of the mole ratio in stoichiometric calculations

Engage: *Anticipatory Set*
Name Game (naming compounds)
http://www.nclark.net/Compounds

Balancing Chemical Equations - Use mathematics and visual representations to balance chemical equations.
https://phet.colorado.edu/en/simulation/legacy/balancing-chemical-equations
http://phet.colorado.edu/en/simulation/balancing-chemical-equations

Reactions and Rates - See that atoms are conserved in an equilibrium situation where there are unreacted particles.
https://phet.colorado.edu/en/simulation/legacy/reactions-and-rates

Reactants, Products, and Leftovers
https://phet.colorado.edu/en/simulation/legacy/reactants-products-and-leftovers

Exploration: *Student Inquiry*

- Types of Bonding in Solids, Modern Chemistry textbook pg. 216
- Determining the Empirical Formula of Magnesium Oxide Lab, Modern Chemistry textbook pg. 259
- Flame Test Lab, Modern Chemistry textbook pg. 130

Stoichiometry Lab
http://misterguch.brinkster.net/MLX039.doc.
Limiting Reactants Lab
http://my-ecoach.com/online/resources/3709/Stoichiometry_of_Smores_Lab1.pdf

Limiting Reactants:
http://chemwiki.ucdavis.edu/Worksheets/Worksheets%3A_General_Chemistry/Worksheet%3A_Limiting_Reagents_2

Moles:
http://chemwiki.ucdavis.edu/Worksheets/Worksheets%3A_General_Chemistry/Worksheet%3A_Moles

Introduction to Chemical Equilibrium
http://betterlesson.com/lesson/639059/introduction-to-chemical-equilibrium?from=cc_lesson_title

- Activity Series Lab
- Percent Yield Lab
- Boyles' Law lab
- Heating Curve Lab
- Properties of Water Lab

Explanation: *Concepts and Practices*

- Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
- Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
- Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Elaboration: *Extension Activity*
Interactive Activity- Dissolving Salts in Water
Foods With Superpowers

Evaluation: *Assessment (Both formative and summative measures of authentic performance tasks and formal assessments*

- Homework
- Warm up exercises
- Exit Tickets
- Group activities
- Section quizzes
- Chapter tests
- Projects / Presentations
- Midterm exam and Final Exam

Unit 4: Matter and Energy in Living Systems

Content: Biological Chemistry, chemistry of metabolism

Essential Questions:
How can changes of energy and matter in a system be described a flow of energy into, out of and within a system
What happens to energy if it is not created or destroyed?

Standards:
HS-PS1-6
HS-PS1-7

Time Frame: 8 Weeks----Honors Chemistry: 6 weeks

Materials:
Textbook: Modern Chemistry
Smart board, internet research and activities, graph papers, color pencils.

Content: *As a result of this learning segment, students will know…*
In this unit of study, students construct explanations for the role of energy in the cycling of matter in organisms. They apply mathematical concepts to develop evidence to support explanations of the interactions of photosynthesis and cellular respiration and develop models to communicate these explanations. The crosscutting concept of *matter and energy* provides students with insights into the structures and processes of organisms. Students are expected to *develop and use models*, *plan and conduct investigations*, *use mathematical thinking*, and *construct explanations and design solutions* as they demonstrate proficiency with the disciplinary core ideas.

Student Learning Objective (SLO): *As a result of this learning segment, students will be able to…*

- Explain how energy is released by: metabolic reactions
- Explain how the chemical process of breaking bonds is involved photosynthesis and cellular respiration occurs
- Discuss Kinetic Molecular Theory and how it relates to the behavior of gases.
- Describe the postulates of the Kinetic Molecular Theory (KMT) as it applies to gases.
- Explain the principles of diffusion and effusion.
- Differentiate between ideal gas and real gas
- Explain the motion of molecules in liquids and solids
- Differentiate between the different types of crystal symmetry

HONORS CHEMISTRY (additional SLO)

- Explain the relationship between equilibrium and changes of state
- Explain equilibrium vapor pressure
- Analyze and interpret phase diagrams
- Explain the relationship between gas and pressure

- Use Dalton's Law to calculate partial pressures and total pressures
- Use Kinetic Molecular Theory to calculate volume and pressure changes
- Use Charles Law, Gay-Lussac's Law and Boyles' Law to calculate pressure, temperature and volume
- Use the solubility rules to predict precipitates in reactions
- Explain the difference between unsaturated and saturated solutions
- Describe energy changes observed during solution processes

Engage: *Anticipatory Set*
Dancing elements animation:
https://www.youtube.com/watch?v=z1gjah_R_go

Exploration: *Student Inquiry*
Types of reactions lesson:
http://betterlesson.com/lesson/637764/types-of-reactions-concept-attainment-day-1

Evaluating Chemical expressions
http://betterlesson.com/lesson/634596/evaluating-chemical-expressions

Identify the Reaction Lesson
http://betterlesson.com/lesson/637776/now-it-s-your-turn-to-identify-the-reaction

What is Equilibrium?:
http://betterlesson.com/lesson/639907/what-is-equilibrium

Introduction to Chemical Equilibrium
http://betterlesson.com/lesson/639059/introduction-to-chemical-equilibrium

Applying Equilibrium Concepts
http://betterlesson.com/lesson/640178/applying-equilibrium-concepts

Shifting Equilibrium
http://betterlesson.com/lesson/640179/shifting-equilibrium

Explanation: *Concepts and Practices*

PS3.A: Definitions of Energy

Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms

PS3.B: Conservation of Energy and Energy Transfer

- Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system.
- Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems.
- Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior.
- The availability of energy limits what can occur in any system.

Elaboration: *Extension Activity*

Graphing Equilibrium

http://betterlesson.com/lesson/639908/graphing-equilibrium-reactions

3-D Phase Diagram Interactive

http://biomodel.uah.es/Jmol/plots/phase-diagrams/

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*

- Homework
- Warm up exercises
- Exit Tickets
- Group activities
- Section quizzes
- Chapter tests
- Cumulative tests
- Projects / Presentations
- Midterm exam
- Final Exam

Unit 5: Nuclear Chemistry

Content: The Nucleus, Radioactive decay, Nuclear Radiation, Nuclear Fission and Nuclear Fusion

Essential Questions:
How do nuclear reactions (fission and fusion) convert very small amounts of matter into energy**?**
How can nuclear reactions be both beneficial and dangerous?

Standards:
HS-PS1-8
HS-ESS1-1
HS-ESS1-2
HS-ESS1-3
HS-ESS1-6

Time Frame: 8 Weeks

Materials:
Textbook: Modern Chemistry
Smart board, internet research and activities, graph papers, color pencils.

Content: *As a result of this learning segment, students will know…*

In this unit of study, energy and matter are studied further by investigating the processes of nuclear fusion and fission that govern the formation, evolution, and workings of the solar system in the universe. Some concepts studied are fundamental to science and demonstrate *scale, proportion, and quantity*, such as understanding how the matter of the world formed during the Big Bang and within the cores of stars over the cycle of their lives.

In addition, an important aspect of Earth and space sciences involves understanding the concept *of stability and change* while making inferences about events in Earth's history based on a data record that is increasingly incomplete the farther one goes back in time. A mathematical analysis of radiometric dating is used to comprehend how absolute ages are obtained for the geologic record.
The crosscutting concepts of *energy and matter*; *scale, proportion, and quantity*; and *stability and change* are called out as organizing concepts for this unit. Students are expected to demonstrate proficiency in *developing and using models*; *constructing explanations and designing solutions; using mathematical and computational thinking; and obtaining, evaluating, and communicating information*; and they are expected to use these practices to demonstrate understanding of the core ideas

Student Learning Objective (SLO): *As a result of this learning segment, students will be able to…*

- Illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
- Communicate scientific ideas about the way stars, over their life cycle, produce elements.
- Use evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.

- Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
- Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.
- Write and balance nuclear equations
- Identify the types of radioactive decay
- Calculate the half-life of isotopes
- Compare the penetrating ability and shielding requirements of alpha particles, beta particles and gamma rays
- Differentiate between nuclear fission and nuclear fusion

Honor Chemistry (additional SLO)

- Explain the relationship between mass defect and nuclear stability
- Explain nuclear binding energy

Engage: *Anticipatory Set*

- Nuclear survey
  http://betterlesson.com/lesson/resource/3157872/nuclear-survey?from=lessonsection_narrative
- Kahn Academy introduction to nuclear chemistry clip
  https://www.youtube.com/watch?v=KWAsz59F8gA
- Bill Nye "Nuclear Power" video

Exploration: *Student Inquiry*

I See Radiation in the Clouds lesson
http://betterlesson.com/lesson/633290/i-see-radiation-in-the-clouds

Fission vs. Fusion lesson
http://betterlesson.com/lesson/635378/fission-vs-fusion

Exploring Radioactivity
http://betterlesson.com/lesson/635373/exploring-radioactivity

Simulation of Nuclear Using Pennies and Paper Lab, Modern Chemistry textbook pg. 708
Alpha Decay activity
http://betterlesson.com/lesson/635374/alpha-decay
Beta Decay activity

http://betterlesson.com/lesson/635375/beta-decay

Will All Radioactive Material Harm You?
http://betterlesson.com/lesson/632689/will-all-radioactive-material-harm-you

Taking A Stand On Nuclear Power
http://betterlesson.com/lesson/633089/taking-a-stand-on-nuclear-power

Argumentation Should The United States Continue to Use Nuclear Power?
http://betterlesson.com/lesson/639977/argumentation-should-the-united-states-continue-to-use-nuclear-power

Balancing Nuclear Equations
http://betterlesson.com/lesson/637820/balancing-nuclear-equations

Half Life
http://betterlesson.com/lesson/635863/half-life

Simulated-Stimulated fission computer activity
http://betterlesson.com/lesson/635372/simulated-stimulated-fission

Comparison between fission and fusion lesson
http://betterlesson.com/lesson/633091/day-1-comparison-between-fission-and-fusion

Growing irradiated bean seeds
http://www.nuclearconnect.org/in-the-classroom/for-teachers/growing-irradiated-bean-seeds

Explanation: *Concepts and Practices*
PS1.C Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process.
PS1.C: Nuclear Processes Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials.(secondary)
ESS1.A: The Universe and Its Stars

Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode.
ESS1.A: The Universe and Its Stars
The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years.
The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe.
PS3.D: Energy in Chemical Processes and Everyday Life
Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. (secondary)
ESS1.C: The History of Planet Earth
Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history.

Elaboration: *Extension Activity*
In these lessons, we will learn, Nuclear Stability, Transmutation, Half-life, Nuclear Fission,Nuclear Fusion, Nuclear Stability
Nuclear stability is what makes certain isotopes radioactive. An isotope is unstable if it has a ratio of protons to neutrons that isn't within what is called the band of stability. Elements with atomic numbers greater than 70 are never stable. Unstable isotopes generally undergo transmutation, alpha decay or beta decay.
How the ratio of protons to neutrons affects a nucleus' stability.
http://www.onlinemathlearning.com/nuclear-reaction-chemistry.html
Computer Activity: Balancing Equations
http://www.sciencegeek.net/Chemistry/taters/Unit1NuclearEquations.htm

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*

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- Chapter tests
- Projects / Presentations
- Final Exam