CHEMISTRY COLLEGE PREPARATORY

Content Area: **Science**
Course(s): **Chemistry CP**
Time Period:
Length: **1 Academic Year**
Status: **Not Published**

Course Overview: Objectives, benchmarking and screening plan

Statement of Purpose

Chemistry College Preparatory (CP) is designed to provide students opportunities to develop skills to function as independent, critical thinkers in order to apply their understanding of chemical theory and concepts to model real world situations. Students will engage in scientific discourse and identify and research areas of technological and environmental concern. Students will learn how to apply appropriate scientific techniques and principles in making responsible decisions. The coursework is designed for the development of student-centered and inquiry-based lessons with the infusion of science literacy.

Summary of the Course: College Preparatory Chemistry provides students the opportunity to acquire a solid foundation of chemical principles and concepts. The year is devoted to topics in inorganic chemistry, including a foundation based on formula writing, the balancing of equations, stoichiometry, acids and bases, and gas laws. In conjunction with the course content, a laboratory sequence is offered. This sequence parallels the content and affords the opportunity to experience first-hand, not only the analyses and problem solving discussed in class, but also the chemical techniques associated with the course. Success in this course requires students to have a foundation in Algebra. All learning styles are addressed through instructional methods and assessments that incorporate scientific reading, writing, and computation.

In order to demonstrate a cohesive and complete implementation plan the following general suggestions are provided:

- The use of various formative assessments are encouraged in order to provide an ongoing method of determining the current level of understanding the students have of the material presented.
- The use of course-specific benchmark assessments will be used throughout the year to determine student progress.
- Homework, when assigned should be relevant and reflective of the current teaching taking place in the classroom.
- Organizational strategies should be in place that allow the students the ability to take the information gained in the classroom and put in in terms that are relevant to them.
- Instruction should be differentiated to allow students the best opportunity to learn.
- Assessments should be varied and assess topics of instruction delivered in class.
- Modifications to the curriculum should be included that address Students with Disabilities, Multilingual Learners (ML), Academically At Risk, and Gifted Students.

Course Name, Length, Date of Revision and Curriculum Writer

CHEMISTRY COLLEGE PREPARATORY (CHEMISTRY CP)
5 CREDITS
Full Year
Revised: Spring 2025
Curriculum Writers: Tyneesah Stokes and Lauren Gassman

Table of Contents

Unit 1: Introduction to Chemistry

Content Area: **Science**
Course(s): **Chemistry CP**
Time Period: **1st Semester**
Length: **5 Weeks**
Status: **Not Published**

Summary of the Unit

This unit introduces students to the requisite knowledge and laboratory techniques that must be acquired to be successful in the course. Students will have an understanding of the study of chemistry, the specialized analytical techniques utilized in a chemistry laboratory, and some ways in which matter can be categorized for further study.

Enduring Understandings

- Following safety procedures, using personal protective equipment, and selecting the appropriate equipment or tools will reduce the risk of injury
- Planning, organizing, and analyzing data are essential components of solving problems.
- Chemistry is the study of matter and all changes it undergoes.
- Everyday occurrences of changes in matter are related to energy transfer.
- Substances are classified based on their properties, which is directly related to their atomic makeup.

Essential Questions

- What does "Safety First" mean and how do we apply it in the chemistry laboratory?
- How do we organize and analyze empirical data?
- What is chemistry and why is it important in our daily life?
- What ways do we classify substances and what dictates their classification?

Unit Summative Assessment and Alternate Assessment Options

The tools used to assess the following criteria for mastery will be, but are not limited to: Quarterly exam, topic quizzes, chapter tests, projects, worksheets, and laboratory experiments.

- Students will be able to use their learning of safety and lab procedures to make informed decisions when selecting and using equipment or tools
- Students will be able to transfer their learning of the scientific method and data analysis to solve problems and identify sources of error
- Students will be able to use their learning to analyze and communicate how the main components of chemistry, matter and energy transfer, affect all components of their lives

Resources

Board approved textbook(s) and accompanying resources

Digital textbook access resources

Teacher resource binder

Student generated resources

Digital media and simulations including but not limited to the following:

- American Association for the Advancement of Science: http://www.aaas.org/programs
- American Chemical Society: http://www.acs.org/content/acs/en/education.html
- Concord Consortium: Virtual Simulations: http://concord.org/
- International Technology and Engineering Educators Association: http://www.iteaconnect.org/
- National Earth Science Teachers Association: http://www.nestanet.org/php/index.php
- National Science Digital Library: https://nsdl.oercommons.org/
- National Science Teachers Association: http://ngss.nsta.org/Classroom-Resources.aspx
- North American Association for Environmental Education: http://www.naaee.net/
- Phet: Interactive Simulations https://phet.colorado.edu/
- Science NetLinks: http://www.aaas.org/program/science-netlinks

Unit Plan

Topic/Selection Timeframe	General Objectives	Instructional Activities	Benchmarks/Assessments
What is Chemistry? (2-3 Days)	• Identify five traditional areas of study in chemistry • Relate pure chemistry to applied chemistry • Identify areas of research affected by chemistry and discuss practical applications	• Discuss chemical fields and why it is studied • Differentiate between pure and applied chemistry using prompts • View media on some areas of chemical research and identify whether they are studying macroscopic or	• Research a career in a chemical field and give a presentation or create a poster with findings • Research a current event article in chemistry and write a short summary for presentation

		microscopic views of chemical research	
The Scientific Method and Laboratory Safety (6 Days)	• Explain the importance of safety in science. • Identify laboratory equipment and its uses • Apply the knowledge of how laboratory equipment is used in the laboratory. • Implement safe laboratory procedures • Utilize the steps of the scientific method to solve practical problems inside and outside of the laboratory	• Review Scientific Method using various scenarios • View Lab Safety Media • Identify unsafe lab procedures in visual and/or printed media	• LAB Activity --Create classroom map and identify locations of safety equipment, identify lab equipment and its use, and complete simple measurements using lab equipment • Apply knowledge of laboratory safety procedures and equipment to complete lab safety quiz

Measurement, Data Collection, and Analysis (10 Days)	• Convert scientific units of measurement • Justify the importance of significant figures in measurement • Identify the appropriate SI unit to use in measurement in a laboratory setting (H,C,B) • Analyze data and interpret its meaning, identifying any sources of error • Display data using the appropriate graph • Appropriately measure quantities using the correct equipment/tools and units	Graphing Data • Students display various types of data using different types of graphs and analyze the data findings • Students find their own data online, display using an appropriate graph, and analyze the data	• LAB – Introduction to Measurement – Apply knowledge of measurement, significant figures, and error to accurately measure in a laboratory setting
Classification of Matter (8 Days)	• Identify classifications of matter (element, compound, homogenous vs. heterogeneous mixtures) • Differentiate samples of matter for the purpose of	• View media on types of mixtures and separation techniques • Given a prompt, classify mixtures as homogenous or heterogeneous	• Separation of Mixtures Lab Students design and carry out a procedure to separate a complex mixture • Chemical & Physical Changes Lab Students carry out a large number of procedures in the lab and identify whether they resulted in a chemical or physical change and explain the rationale for their

	classification • Separate matter based on differences in their physical and chemical properties • Distinguish physical changes	• Given examples of mixtures, explain how they would be separated • Create a graphic organizer differentiating elements, compounds, heterogeneous, and homogeneous mixtures • Highlight important elements on a periodic table and create flashcards with their names and symbols	decision. • Classify substances as elements or compounds and differentiate them from mixtures by completing worksheet • Apply knowledge of Chemical Symbols to complete assessment
States of Matter Due to Energy Transfer (6 Days)	• Differentiate among three states of matter • Describe the assumptions of the kinetic theory • Justify evaporation in terms of kinetic energy • Assess how equilibrium conditions are represented in a phase diagram	• Apply prior knowledge to compare and contrast the states of matter and list the main properties of each in terms of particle movement and arrangement • Read and discuss the assumptions of the kinetic theory as it applies to gases, liquids, and solids • Review phase	• Complete a blank graphic organizer comparing and contrasting the states of matter • Apply the knowledge of kinetic theory to relate how the properties of a gas, liquid, or solid make it different than the other states of matter • Justify an explanation as to how Newton's cradle demonstrates elastic collisions in a gas showing conservation of energy • Analyze phase diagram of a substance and point out triple point, solid, liquid, and gas phases, melting/freezing point, boiling/condensing point, and critical point

		changes • Look at phase diagram of water and identify specific points and phase changes • Determine examples of substances that have the ability to sublime	

Computer Science Design Thinking

CS.9-12.DA	Data & Analysis Large data sets can be transformed, generalized, simplified, and presented in different ways to influence how individuals interpret and understand the underlying information.

Standards for Course Content Area and Cross Content Standards Addressed

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
LA.RL.11-12.1	Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.
MA.K-12.4	Model with mathematics.
MA.N-Q.A	Reason quantitatively and use units to solve problems.
MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
LA.RST.11-12.4	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 11-12 texts and topics.
SCI.HS-PS1-3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

LA.WHST.11-12.1	Write arguments focused on discipline-specific content.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
SCI.HS-PS2-3	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
SCI.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Suggested Modifications for Students with Disabilities, 504 Eligible, Multilingual Learners, At Risk Students and Gifted Students

*Consistent with individual plans, when appropriate.

Students with individual learning styles can be assisted through adjustments in assessment standards and time restraints, one-to-one teacher support, extended testing time, and use of visual and auditory teaching methods. This wide variety of assessments, strategies, and hands-on evaluations complement the individual learning experience. Additional strategies are as follows:

- Restructure lessons using Universal Design for Learning (UDL) principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)
- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide English Language Learners students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

Career Readiness, Life Literacies, and Key Skills Practice

PFL.9.1.2.CR.1	Recognize ways to volunteer in the classroom, school and community.
WRK.9.2.12.CAP	Career Awareness and Planning
WRK.9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.

Unit 2: Structure and Properties of Matter

Content Area: **Science**
Course(s): **Chemistry CP (5)**
Time Period: **1st Semester**
Length: **5 Weeks**
Status: **Not Published**

Summary of the Unit

In this unit of study, students use investigations, simulations, and models to make sense of the substructure of atoms and to provide more mechanistic explanations of the properties of substances. Students will be able to explain the placement of elements on the periodic table and predict patterns in chemical and physical properties. Students will be able to transfer their learning of the current atomic model to analyze the relative structure of atoms. Students are able to use the periodic table as a tool to explain and predict the properties of elements. Students are expected to communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. The crosscutting concepts of structure and function, patterns, energy and matter, and stability and change are called out as the framework for understanding the disciplinary core ideas. Students use developing and using models, planning and conducting investigations, using matematical thinking, and constructing explanations and designing solutions. Students are also expected to use the science and engineering practices to demonstrate proficiency with the core ideas.

Enduring Understandings

- In the universe, atoms are the fundamental building blocks of all matter
- Electron movement can be explained by the duality of particles and waves
- Modern atomic theory suggests that electrons may be located in regions of high probability
- The placement of elements on the periodic table is based on specific properties and characteristics of elements, which follow a noticeable pattern when organized in order of increasing atomic number.

Essential Questions

- What does the subatomic structure of a substance tell me about its properties?
- What do the properties of a substance tell me about its subatomic makeup?
- What does an element's placement on the periodic table tell me about its subatomic structure and chemical and physical properties?

Unit Summative Assessment and Alternate Assessment Options

The tools used to assess the following criteria for mastery will be, but are not limited to:

Quarterly exam, topic quizzes, chapter tests, projects, worksheets, and laboratory experiments.

- Given an element from the periodic table, students will be able to predict atomic structure and electron arrangement
- Students will be able to explain the placement of elements on the periodic table and predict patterns in chemical and physical properties

Resources

Board approved textbook(s) and accompanying resources

Digital textbook access resources

Teacher generated/created resources

Student generated resources

Digital media and simulations including but not limited to the following:

- Internet for up-to-date resources such as journal articles (ex. Newsela, Actively Learn) and simulations (ex. YouTube, Discovery Education, CK12, PheT)
- Education focused websites, like Google Platform, to provide group forums to discuss topics
- Online programs (ex. such as Kahoot, EdPuzzle, Blooket, PearDeck)
- American Association for the Advancement of Science: http://www.aaas.org/programs
- American Chemical Society: http://www.acs.org/content/acs/en/education.html
- Concord Consortium: Virtual Simulations: http://concord.org/
- International Technology and Engineering Educators Association: http://www.iteaconnect.org/
- National Earth Science Teachers Association: http://www.nestanet.org/php/index.php
- National Science Digital Library: https://nsdl.oercommons.org/
- National Science Teachers Association: http://ngss.nsta.org/Classroom-Resources.aspx
- North American Association for Environmental Education: http://www.naaee.net/

- Phet: Interactive Simulations https://phet.colorado.edu/
- Science NetLinks: http://www.aaas.org/program/science-netlinks
- Swank: https://digitalcampus.swankmp.net/admin/ssd406061/dashboard

Unit Plan

Topic/Selection Timeframe	General Objectives	Instructional Activities	Benchmarks/Assessments
Chemical and Physical Properties (3 Days)	• Define physical property and list several common physical properties of substances • Identify properties of matter as extensive or intensive	• Classify properties of matter as intensive or extensive	• Analyze an object in the room by listing its physical properties and stating whether each property is extensive or intensive
Atomic Structure and Models (15 Days)	• Solve for non-routine problems on isotopes, calculating numbers of subatomic particles • Formulate electron configurations and by applying the Aufbau principle, Hund's rule, and the Pauli exclusion principle • Apply concepts	• Students write electron configurations (long-hand & noble gas core)	• Argue the inaccuracies of Dalton's Atomic Theory and previous models of the atom • Judge whether an electron configuration is possible given the rules that govern configuration and, if not, explain why it is incorrect • Common Assessment in which the students demonstrate their mastery of the general objectives

	about the properties of the elements to the electron configurations • Prove how the modern theory of the atom incorporates all the discoveries of the atom		
Periodic Table (8 Days)	• Connect the placement of elements on the periodic table to each other and prove the various trends • Analyze patterns in the periodic trends of atomic size, ionization energy, and electronegativity • Determine the identity of missing elements based upon the properties of other elements in the group • Construct a periodic table based upon	• Create a graphic organizer color-coding the groups and three broad classes of elements • Define all periodic trends • Create a graphic organizer with a blank periodic table illustrating the periodic trends	• Project – Rubric (Element research) • Explain the evolution of the periodic table by comparing and contrasting the old and modern periodic tables • LAB – Properties of Elements – Analyze properties of elements to determine and compare and contrast the main properties of metals, nonmetals, and metalloids to be assessed by a post-lab question worksheet • Operation Periodic Table Lab • Students create a periodic table from a list of fictional elements • Graphing Periodic Trends Lab • Students research and use Google sheets to graph values for

	chemical and physical properties and prove the reason for the placement of the elements		atomic size, ionization energy, and electronegativity

Computer Sci Design Thinking

CS.9-12.8.1.12.DA.1	Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
CS.9-12.8.1.12.DA.2	Describe the trade-offs in how and where data is organized and stored.

Suggested Modifications for Students with Disabilities, 504 Eligible, Multilingual Learners, At Risk Students, and Gifted Students

SAMPLE MODIFICATIONS

Special Education*:

- Collaboration between Content Education and Special Education teachers
- Preferential seating to minimize distractions
- Printed and highlighted notes
- Modified tests, quizzes, worksheets, and written assignments
- Repetition of directions and refocus activities
- Test, quiz, and assessment questions read aloud if needed
- Allow for extended time on assessments and assignments
- Alternative assessment formats (oral exams, project-based assessments)
- Use of assistive technology (speech-to-text, audiobooks, screen readers)
- Breaks as needed to support focus and processing
- Access to a quiet testing environment
- Organizational and time management support (checklists, graphic organizers, structured timelines)

504-Eligible Students*:

- Collaboration between teachers and support staff to ensure accommodations are met

- Preferential seating to minimize distractions
- Extended time on assessments and assignments
- Access to printed and highlighted notes
- Option for verbal or dictated responses on assignments and assessments
- Reduced workload or modified assignments as needed
- Use of assistive technology (speech-to-text, audiobooks, screen readers)
- Breaks as needed to support focus and processing
- Alternative assessment formats (oral exams, project-based assessments)
- Access to a quiet testing environment
- Organizational and time management support (checklists, graphic organizers, structured timelines)

Multilingual Language Learners (MLL):

- Collaboration between Content Education and ESL teachers
- Use of audio recordings when applicable
- Use of translation dictionaries when applicable
- Provide opportunities for oral responses and assessments
- Allow use of computer or other technological devices for assignments
- Highlight important notes and key concepts
- Use of graphic organizers to support comprehension
- Assign a peer liaison for additional support
- Incorporation of visual aids and real-world examples to reinforce concepts
- Modified assignments to focus on essential content
- Additional scaffolding such as sentence starters and guided practice

At-Risk Students:

- Small group instruction or one-on-one support when possible
- Clear, step-by-step instructions and modeling of tasks
- Use of engaging, real-world connections to make content more relevant

- Frequent feedback and progress monitoring
- Additional scaffolding (sentence starters, guided practice, visual supports)
- Peer mentoring and collaborative learning opportunities
- Encouragement of active participation through hands-on and interactive learning
- Flexible deadlines and opportunities for revision and reassessment
- Regular check-ins with teacher or counselor for academic and emotional support
- Positive reinforcement and goal-setting strategies to encourage motivation and engagement

Gifted Students:

- Provide more elaborate, complex, and in-depth study of major ideas and themes that integrate knowledge within and across the curriculum
- Incorporate outside sources (media, content, community resources) for further study that are thematic in nature
- Promote self-directed and self-initiated learning opportunities
- Allow for the development of productive thinking skills to encourage students to generate new knowledge
- Provide opportunities for leadership roles in collaborative projects
- Offer independent research projects and inquiry-based assignments
- Encourage critical analysis of multiple perspectives and interpretations of historical events

*Consistent with individual plans, when appropriate.

Standards for Course Content Area and Cross Content Standards Addressed

SCI.HS-PS1-1	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.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.7	Look for and make use of structure.
SCI.HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on

	explanations in the text.
LA.RST.11-12.4	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 11-12 texts and topics.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
SCI.HS-PS1-8	Develop models 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.
SCI.HS-PS3-5	Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
9-12.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
9-12.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
9-12.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Career Readiness, Life Literacies, and Key Skills Practice

PFL.9.1.2.CR.1	Recognize ways to volunteer in the classroom, school and community.
WRK.9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
TECH.9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
TECH.9.4.2.CT.1	Gather information about an issue, such as climate change, and collaboratively brainstorm ways to solve the problem (e.g., K-2-ETS1-1, 6.3.2.GeoGI.2).
TECH.9.4.2.IML.1	Identify a simple search term to find information in a search engine or digital resource.
TECH.9.4.2.IML.3	Use a variety of sources including multimedia sources to find information about topics such as climate change, with guidance and support from adults (e.g., 6.3.2.GeoGI.2, 6.1.2.HistorySE.3, W.2.6, 1-LSI-2).

Unit 3: Bonding and Chemical Reactions

Content Area: **Science**
Course(s): **Chemistry CP (5)**
Time Period: **1st Semester**
Length: **10 Weeks**
Status: **Not Published**

Summary of the Unit

In this unit, students will develop an understanding that the total amount of energy and matter in a closed system (including chemical reaction systems) is conserved and that changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. Using this knowledge, and knowledge of the chemical properties of elements, students should be able to describe and predict simple chemical reactions in terms of mass and energy. Students will be able to utilize learning of atomic structure to predict the formation and characteristics of ionic, covalent, and metallic compounds, in addition to utilizing their learning of elements and compounds to determine the amounts of reactants and products in chemical reactions.

Enduring Understandings

- The formation of chemical bonds can be explained by the atom's ability to satisfy the Octet Rule and achieve stability.
- The type of chemical bond an element forms can be linked to its valence electrons and its location on the periodic table.
- A compound's structure and shape can be determined through an understanding of the interactions between valence electrons while intermolecular forces determine its properties
- Chemical equations are used to represent chemical reactions and show that mass can neither be created nor destroyed.
- There are different types of chemical reactions that can be observed in everyday life
- Mass and mole ratios between different compounds in a reaction can answer quantitative questions concerning reactants and products.

Essential Questions

- Where do atoms go during a chemical reaction?
- How are ionic, covalent, and metallic bonds formed, and how are they characterized?

- How are the names and formulas of ionic and covalent compounds written?
- How can we quantify something that we can't see? How do we know that we are right?
- Why must the mass of reactants equal the mass of products in a chemical reaction?

Unit Summative Assessment and Alternate Assessment Options

- Differentiate between ionic, covalent, and metallic bonds, predict bond formation, and accurately represent a compound using chemical formulas, proper nomenclature, and shape
- Construct Lewis structures and predict molecular shape
- Compare and contrast intermolecular forces and determine when they are present
- Develop a logical argument as to how delocalized electrons explain various properties of metals
- Apply the law of conservation of mass to write balanced chemical equations
- Cite evidence of a chemical reaction
- Classify chemical reactions and predict products, writing balanced chemical equations

Resources

Board approved textbooks, Teacher resource binder, Student generated resources, Internet web resources (including, but not limited to):

- American Association for the Advancement of Science: http://www.aaas.org/programs
- American Chemical Society: http://www.acs.org/content/acs/en/education.html
- Concord Consortium: Virtual Simulations: http://concord.org/
- International Technology and Engineering Educators Association: http://www.iteaconnect.org/
- National Earth Science Teachers Association: http://www.nestanet.org/php/index.php
- National Science Digital Library: https://nsdl.oercommons.org/
- National Science Teachers Association: http://ngss.nsta.org/Classroom-Resources.aspx
- North American Association for Environmental Education: http://www.naaee.net/
- Phet: Interactive Simulations https://phet.colorado.edu/
- Science NetLinks: http://www.aaas.org/program/science-netlinks

Unit Plan

Topic/Selection Timeframe	General Objectives	Instructional Activities	Benchmarks/Assessments
Ionic Bonds (14 Days)	• Utilize learning of atomic structure to predict the formation and characteristics of ionic and metallic bonds • Differentiate between ionic, covalent, and metallic bonds in terms of valence electrons, and be able to analyze a list of formulas or names • Predict oxidation numbers based on location on periodic table • Apply concepts of ionic bonding to effectively represent compounds using chemical formulas and names (including binary and	•On an existing graphic organizer of the periodic table, write in the number of valence electrons over A groups •Draw Lewis structure to illustrate valence electrons and bonding •Apply criss-cross method for writing formulas of ionic compounds	•Complete a practice worksheet identifying the number of valence electrons an atom has and predicting what ion it will form, if any •Compare/contrast properties of ionic and covalent compounds •Write formula and name ionic and acid/base compounds •LAB – Ionic Compounds – students write formulas for and name products of a series of double replacement reactions

	oxyacids) • Develop a logical argument as to how delocalized electrons explain various properties of metals • Differentiate between the three bond types, predict bond formation, and accurately represent a compound using a chemical formula, proper nomenclature, and shape		
Covalent Bonding (12 Days)	• Utilize learning of atomic structure to predict the formation and characteristics of covalent bonds • Differentiate between ionic, covalent, and metallic bonds in terms of valence electrons, and be able to analyze a list of formulas or names • Apply	•Draw Lewis structure to illustrate valence electrons, bonding, shape, and exceptions to the octet rule •Molecular Modeling lab – ball and stick and/or computer 3-D modeling •Chart differences in polarity based on electronegativity	•Compare/contrast properties of covalent compounds •Write formula and name molecular compounds •Predict molecular shapes on VSEPR practice worksheet

	concepts of covalent bonding to effectively represent compounds using chemical formulas and names • Compare and contrast different intermolecular forces and recognize in which compounds they are present • Construct Lewis structures and predict molecular shape • Differentiate between the three bond types, predict bond formation, and accurately represent a compound using a chemical formula, proper nomenclature, and shape		
Chemical Equations and Reactions (14 Days)	• Use the fact that atoms are conserved, together with knowledge of the chemical	•Review law of mass conservation •Analyze a balanced chemical	•LAB – Who's Counting? Atoms, Mass, and Moles – Discover, by analogy, how chemists count atoms and molecules •Lab – Balancing Equations:

	properties of the elements involved, to describe and predict chemical reactions. • Utilize knowledge of elements and compounds to determine the amounts of reactants and products in chemical reactions	equation to determine the relationship of particles within the chemical reaction	Perform chemical reactions between known reactants and balance the equations of the reactions •Lab – Classification of Reactions: Analyze the reactants of a given equation and determine the classification (B)in order to correctly derive the products of the reaction •Classify reaction type based on reactant side of equation and predict products to compose a complete balanced chemical equation •Determine from unbalanced chemical equations, how a substance violates the law of mass conservation
The Mole and Stoichiometry (15 Days)	• Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction • Use mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and products and the translation of these	• Calculate atomic masses of compounds, both guided and individual practice • Convert between moles, mass, STP, and particles of a substance •Review law of mass conservation •Analyze a balanced chemical equation to determine the relationship of particles within the chemical reaction •Calculate	•LAB – The Mole – Calculate the number of moles and molecules in a given amount of material in the room •Lab – Mole Ratios: Determine the number of moles of reactants and products in the reaction of copper and silver nitrate and calculate their mole ratio

	relationships to the macroscopic scale, using the mole as the conversion from the atomic to the macroscopic scale. • Utilize knowledge of elements and compounds to determine the amounts of reactants and products in chemical reactions	stoichiometric quantities using mole ratios	

Standards for Course Content Area and Cross Content Standards Addressed

MA.K-12.1	Make sense of problems and persevere in solving them.
SCI.HS-PS1-1	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.
LA.RH.11-12.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of primary and secondary sources, connecting insights gained from specific details to develop an understanding of the text as a whole.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
SCI.HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
LA.RST.11-12.1	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.
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on

	explanations in the text.
LA.RST.11-12.4	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 11-12 texts and topics.
SCI.HS-PS1-3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
LA.WHST.11-12.1	Write arguments focused on discipline-specific content.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
SCI.HS-PS1-4	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.
SCI.HS-PS1-6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
SCI.HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Suggested Modifications for Students with Disabilities, 504 Eligible, Multilingual Learners, At Risk Students and Gifted Students

*Consistent with individual plans, when appropriate.

Students with individual learning styles can be assisted through adjustments in assessment standards and time restraints, one-to-one teacher support, extended testing time, and use of visual and auditory teaching methods. This wide variety of assessments, strategies, and hands-on evaluations complement the individual learning experience. Additional strategies are as follows:

- Restructure lessons using Universal Design for Learning (UDL) principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)
- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide English Language Learners students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

Computer Science Design Thinking

CS.9-12.8.1.12.AP.5	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.

Career Readiness, Life Literacies and Key Skills Practice

PFL.9.1.2.CR.1	Recognize ways to volunteer in the classroom, school and community.
WRK.9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT	Critical Thinking and Problem-solving
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
	With a growth mindset, failure is an important part of success.

Unit 4: Energy of Chemical Systems

Content Area: **Science**
Course(s): **Chemistry CP (5)**
Time Period: **2nd Semester**
Length: **7 Weeks**
Status: **Not Published**

Summary of the Unit

In this unit of study, students construct explanations for the role of energy in chemical reactions. They apply mathematical concepts to develop evidence to support explanations of the interactions reactants and products and develop models to communicate these explanations. 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. Specifically, students will be able to use their learning of the Kinetic Molecular Theory to explain and predict the behavior of gas under experimental conditions, identify a substance as an acid or a base using multiple evidence sources and evaluate the function based on the specific properties, and investigate the factors that affect reaction rates.

Enduring Understandings

- The behavior of gases is dependent on Kinetic Molecular Theory and can be predicted by mathematical relationships between pressure, temperature, volume, and molar quantities.
- Concentration of a solution is an important chemical quantity and maximum concentration, or solubility, is affected by many different factors
- Everyday substances can be analyzed both qualitatively and quantitatively to determine if they are an acid or a base
- Energy is conserved during all chemical and physical processes
- All reactions work towards equilibrium
- Reaction rates are influenced by several factors

Essential Questions

- How does Kinetic Molecular theory explain the behavior of all matters, including gases?
- What factors affect solubility of a solution?
- What are the qualitative and quantitative differences between acids and bases?

- How is energy involved in endothermic and exothermic processes?
- How does collision theory affect reaction rate?

Unit Summative Assessment and Alternate Assessment Options

- Explain and Predict Behavior of Gases under experimental conditions
- Prove solubility of a substance
- Identify a substance as an acid or a base using multiple evidences and evaluate the function based on specific properties
- Relate the law of conservation of energy to chemical and physical process, both in the lab and everyday life

Resources

Board approved textbook(s) and accompanying resources

Digital textbook access resources

Teacher generated/created resources

Student generated resources

Digital media and simulations including but not limited to the following:

- Internet for up-to-date resources such as journal articles (ex. Newsela, Actively Learn) and simulations (ex. YouTube, Discovery Education, CK12, PheT)
- Education focused websites, like Google Platform, to provide group forums to discuss topics
- Online programs (ex. such as Kahoot, EdPuzzle, Blooket, PearDeck)
- American Association for the Advancement of Science: http://www.aaas.org/programs
- American Chemical Society: http://www.acs.org/content/acs/en/education.html
- Concord Consortium: Virtual Simulations: http://concord.org/
- International Technology and Engineering Educators Association: http://www.iteaconnect.org/
- National Earth Science Teachers Association: http://www.nestanet.org/php/index.php
- National Science Digital Library: https://nsdl.oercommons.org/
- National Science Teachers Association: http://ngss.nsta.org/Classroom-Resources.aspx
- North American Association for Environmental Education: http://www.naaee.net/
- Phet: Interactive Simulations https://phet.colorado.edu/

- Science NetLinks: http://www.aaas.org/program/science-netlinks
- Swank: https://digitalcampus.swankmp.net/admin/ssd406061/dashboard

Unit Plan

Topic/Selection Timeframe	General Objectives	Instructional Activities	Benchmarks/Assessments
Kinematics of Gases (15 Days)	• Analyze data and graph representing the relationships between pressure, volume, and temperature of a gas • Explain how the Kinetic Molecular Theory and the behavior of gases are related to the changes observed in pressure, volume, and temperature • Understand the link between temperatures and CO2 concentrations in the atmosphere	• Presentation on the gas laws and relationships of variables • Demo – Collapsing Can: Demonstrate the relationship of pressure and temperature • Calculate missing variable utilizing algebraic expressions of gas laws with guidance • Analyze and graph data of concentration/volume of gas vs. temperature	• Lab – Alka Seltzer and the Ideal Gas Law: Measure and calculate, indirectly, the molar mass of carbon dioxide produced utilizing the ideal gas law • Calculate missing variables utilizing algebraic expressions of gas laws independently • Justify why the true volume of a gas cannot be determined • Construct graph of CO2 data vs temperature to illustrate greenhouse gas affect on global warming
Solutions (15 Days)	• Differentiate between concentrated and dilute solutions and	• Discuss units and algebraic expression associated with determining	• Lab – Preparing Solutions: Create a solution of specified molarity based on calculation of moles

	calculate concentration • Explain how to make solutions and then make them in the lab • Prove that a laboratory substance is an acid of a base based on multiple indicators such as formula of the compound, pH calculations, chemical and physical properties of the compound, and analysis with litmus and/or pH paper	concentration of a solution • • Illustrate how diluting a solution changes the number of moles of a substance • • View media on how a solution is made and the factors that affect solubility • • Create a graphic organizer comparing and contrasting properties of acids and bases, pH values, [OH-] and [H+], and examples • • View media on the strength of acids and bases • • Predict the products of a neutralization reaction and the pH of the products	of solute needed • Calculate molarity of solutions with known mass and/or moles and volume • Calculate molarity of a solution once diluted • Differentiate how percent by mass, percent by volume, and molarity of a solution measure • Complete a problem set/worksheet applying information on the pH scale • LAB – pH of Markers lab – Measure the pH of household items using indicators and determine their pOH, [H+], and [OH-]
Thermochemistry – the Energy of Phase Changes & Reactions (6 Days)	• Calculate the amount of heat absorbed or released while heating an object • Calculate enthalpy of a reaction • Relate the law of the conservation of energy to chemical and	• View demo of an endothermic and exothermic reaction • List and discuss the variables and units for determining the amount of energy absorbed or released in a chemical reaction • Utilize the equation for heat	• Plan and conduct an investigation individually or collaboratively to produce data on transfer of thermal energy in a closed system that can serve as a basis for evidence of uniform energy distribution among components of a system when two components of

	physical processes in everyday life	transfer and manipulate to solve for missing variable • View a calorimeter and discuss how it works	different temperatures are combined. • Compose a list of examples of everyday chemical reactions that are endothermic or exothermic • Calculate missing quantity in specific heat equation if other variables are known • LAB – Measuring Heat of Reaction: Calculate the heat transferred in a chemical reaction • Diagram a calorimeter and label the parts and their function
Reaction Rates and Equilibrium (3 Days)	• Describe how factors such as concentration, temperature, surface area, and agitation affect the rate of a reaction • Describe how a catalyst affects the rate of a reaction	• Create a graphic organizer that identifies the four factors that influence reaction rate and how	• Predict what would happen to the reaction rate given a specific scenario • LAB – Rates of Reactions – Manipulate the factors that influence reaction rates

Suggested Modifications for Students with Disabilities, 504 Eligible, Multilingual Learners, At-Risk Students, and Gifted StudentsSpecial Education, ELL and Gifted Students

SAMPLE MODIFICATIONS
Special Education*:

- Collaboration between Content Education and Special Education teachers
- Preferential seating to minimize distractions
- Printed and highlighted notes
- Modified tests, quizzes, worksheets, and written assignments
- Repetition of directions and refocus activities
- Test, quiz, and assessment questions read aloud if needed
- Allow for extended time on assessments and assignments
- Alternative assessment formats (oral exams, project-based assessments)
- Use of assistive technology (speech-to-text, audiobooks, screen readers)
- Breaks as needed to support focus and processing
- Access to a quiet testing environment
- Organizational and time management support (checklists, graphic organizers, structured timelines)

504-Eligible Students*:

- Collaboration between teachers and support staff to ensure accommodations are met
- Preferential seating to minimize distractions
- Extended time on assessments and assignments
- Access to printed and highlighted notes
- Option for verbal or dictated responses on assignments and assessments
- Reduced workload or modified assignments as needed
- Use of assistive technology (speech-to-text, audiobooks, screen readers)
- Breaks as needed to support focus and processing
- Alternative assessment formats (oral exams, project-based assessments)
- Access to a quiet testing environment
- Organizational and time management support (checklists, graphic organizers, structured timelines)

Multilingual Language Learners (MLL):

- Collaboration between Content Education and ESL teachers
- Use of audio recordings when applicable
- Use of translation dictionaries when applicable
- Provide opportunities for oral responses and assessments
- Allow use of computer or other technological devices for assignments
- Highlight important notes and key concepts
- Use of graphic organizers to support comprehension
- Assign a peer liaison for additional support
- Incorporation of visual aids and real-world examples to reinforce concepts
- Modified assignments to focus on essential content
- Additional scaffolding such as sentence starters and guided practice

At-Risk Students:

- Small group instruction or one-on-one support when possible
- Clear, step-by-step instructions and modeling of tasks
- Use of engaging, real-world connections to make content more relevant

- Frequent feedback and progress monitoring
- Additional scaffolding (sentence starters, guided practice, visual supports)
- Peer mentoring and collaborative learning opportunities
- Encouragement of active participation through hands-on and interactive learning
- Flexible deadlines and opportunities for revision and reassessment
- Regular check-ins with teacher or counselor for academic and emotional support
- Positive reinforcement and goal-setting strategies to encourage motivation and engagement

Gifted Students:

- Provide more elaborate, complex, and in-depth study of major ideas and themes that integrate knowledge within and across the curriculum
- Incorporate outside sources (media, content, community resources) for further study that are thematic in nature
- Promote self-directed and self-initiated learning opportunities
- Allow for the development of productive thinking skills to encourage students to generate new knowledge
- Provide opportunities for leadership roles in collaborative projects
- Offer independent research projects and inquiry-based assignments
- Encourage critical analysis of multiple perspectives and interpretations of historical events

*Consistent with individual plans, when appropriate.

Standards for Course Content Area and Cross Content Standards Addressed

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.N-Q.A	Reason quantitatively and use units to solve problems.
SCI.HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
LA.RST.11-12.4	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 11-12 texts and topics.
LA.WHST.11-12.1	Write arguments focused on discipline-specific content.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.11-12.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
SCI.HS-PS1-5	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.

SCI.HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
SCI.HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
SCI.HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.
SCI.HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

Career Readiness, Life Literacies, and Key Skills Practice

PFL.9.1.12.CFR.1	Compare and contrast the role of philanthropy, volunteer service, and charities in community development and quality of life in a variety of cultures.
WRK.9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
TECH.9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

Computer Science Design Thinking

CS.9-12.8.1.12.DA.1	Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
CS.9-12.8.1.12.DA.2	Describe the trade-offs in how and where data is organized and stored.

Unit 5: Applied Chemistry

Content Area: **Science**
Course(s): **Chemistry CP**
Time Period: **2nd Semester**
Length: **5 Weeks**
Status: **Not Published**

Summary of the Unit

In this unit of study, students will study chemistry as it applies to other sciences. First, students will study biochemistry and 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. Next, 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.

Enduring Understandings

- The process of photosynthesis converts light energy to stored energy by converting carbon dioxide plus water into sugars plus released oxygen.
- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within a system.
- As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another.
- Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems.
- Sugar molecules contain carbon, hydrogen, and oxygen: Their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells.
- Nuclear processes, including fusion, fission, and radioactive decay of unstable nuclei, involve

release or absorption of energy.

- The total number of neutrons plus protons does not change in any nuclear process. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons are conserved.
- The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. 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.

Essential Questions

- How does photosynthesis transform light energy into stored chemical energy?
- How do elements of a sugar molecule combine with other elements and what molecules are formed?
- Why is fusion considered the Holy Grail for the production of electricity?
- How do stars produce elements?

Unit Summative Assessment and Alternate Assessment Options

The tools used to assess the following criteria for mastery will be, but are not limited to:

Quarterly exam, topic quizzes, chapter tests, projects, worksheets, and laboratory experiments.

•Analyze current research in the area of biochemistry and/or nuclear chemistry and present topics for peer review

Resources

Board approved textbooks, Teacher resource binder, Student generated resources, Internet web resources (including, but not limited to the following sites):

- American Association for the Advancement of Science: http://www.aaas.org/programs
- American Chemical Society: http://www.acs.org/content/acs/en/education.html
- Concord Consortium: Virtual Simulations: http://concord.org/
- International Technology and Engineering Educators Association: http://www.iteaconnect.org/
- National Earth Science Teachers Association: http://www.nestanet.org/php/index.php
- National Science Digital Library: https://nsdl.oercommons.org/

- National Science Teachers Association: http://ngss.nsta.org/Classroom-Resources.aspx
- North American Association for Environmental Education: http://www.naaee.net/
- Phet: Interactive Simulations https://phet.colorado.edu/
- Science NetLinks: http://www.aaas.org/program/science-netlinks

Unit Plan

Topic/Selection Timeframe	General Objectives	Instructional Activities	Benchmarks/Assessments
Biochemistry - Macromolecules (6 Days)	• Illustrate the inputs and outputs of matter and the transformation of energy in photosynthesis. • Construct and revise an explanation, based on valid and reliable evidence from a variety of sources (including models, theories, simulations, peer review) and on the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future, for how carbon, hydrogen, and oxygen from sugar molecules may combine	• Create a graphic organizer that determines use and function of each type • View media on the structure and function carbohydrates, lipids, and amino acids • Demo – Saturated vs. Unsaturated Fats • Compare and contrast the 20 amino acids that exist • Determine how an amino acid is useful in building protein	• Categorize samples of macromolecules and their uses in the body • Diagram the backbone of an amino acid • Differentiate between the 20 amino acids based on "R" group

	with other elements to form amino acids and/or other large, carbon based molecules.		
Biochemistry – DNA and Genetic Research (4 Days)	• Construct and revise an explanation, based on valid and reliable evidence from a variety of sources (including models, theories, simulations, peer review) and on the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future, for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large, carbon based molecules.	• Compare structure of DNA to RNA • Determine how a codon can translate into an amino acid using simulation	• Combine the base pairs of nucleic acids to form a strand of genetic code • Determine the difference in structure and base pairs of DNA and RNA • Research disadvantage of incorrect and/or incomplete base pairing (genetic disease) • Create a peptide sequence of amino acids from a strand of genetic code
Nuclear Chemistry – Types of Radioactive Emission	• Develop models based on evidence to illustrate the changes in the composition of	• Organize information on the types of radiation products	• Differentiate between the three main types of radiation • Evaluate the decay

(5 Days)	the nucleus of the atom and the energy released during the processes of alpha, beta, and gamma radioactive decays. • Communicate scientific ideas about the way nucleosynthesis, and therefore the different elements it creates, vary as a function of the mass of a star and the stage of its lifetime.	• Identify the devices used to detect radiation and correlate the advantages and/or disadvantages for each	process (beta emission, electron capture, positron, emission, or alpha emission) based on the nuclear decay equation
Nuclear Chemistry – Radioactive Decay Process (10 Days)	• Develop models based on evidence 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 in multiple formats (including orally, graphically, textually, and mathematically) about the way stars, over their life cycles,	• Discuss how an element can undergo transmutation and determine if all elements do • Simulation on nuclear chain reaction • Differentiate between fusion and fission processes	• Calculate the amount of a substance that will remain over a specified period of time, given initial mass and half-life • Lab – Half-Life Simulation: Simulate radioactive decay by studying the probability of a random process – rolling dice • Assess and provide an example of a substance that demonstrates the two ways transmutation can occur • Explain how nuclear energy is an example of a nuclear chain

	produce elements. • Communicate scientific ideas about the way nucleosynthesis, and therefore the different elements it creates, vary as a function of the mass of a star and the stage of its lifetime. • Communicate scientific ideas about how in nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.		reaction • Justify how the energy produced from fusion reactions would suggest why it only occurs in the sun

Computer Science Design Thinking

CS.9-12.8.1.12.AP.5	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
CS.9-12.8.1.12.DA.1	Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
CS.9-12.8.1.12.DA.2	Describe the trade-offs in how and where data is organized and stored.
CS.9-12.DA	Data & Analysis

Standards for Course Content Area and Cross Content Standards Addressed

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.

LA.RST.11-12.1	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.
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
LA.WHST.11-12.1	Write arguments focused on discipline-specific content.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
SCI.HS-LS1	From Molecules to Organisms: Structures and Processes
SCI.HS-LS1-5	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
SCI.HS-LS1-6	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
SCI.HS-LS1-7	Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
SCI.HS-ESS1-1	Develop a model based on 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.
SCI.HS-ESS1-2	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.
SCI.HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.

Suggested Modifications for Students with Disabilities, 504 Eligible, Multilingual Learners, At Risk Students and Gifted Students

SAMPLE MODIFICATIONS

Special Education*:

- Collaboration between Content Education and Special Education teachers
- Preferential seating to minimize distractions
- Printed and highlighted notes
- Modified tests, quizzes, worksheets, and written assignments
- Repetition of directions and refocus activities
- Test, quiz, and assessment questions read aloud if needed

- Allow for extended time on assessments and assignments
- Alternative assessment formats (oral exams, project-based assessments)
- Use of assistive technology (speech-to-text, audiobooks, screen readers)
- Breaks as needed to support focus and processing
- Access to a quiet testing environment
- Organizational and time management support (checklists, graphic organizers, structured timelines)

504-Eligible Students*:

- Collaboration between teachers and support staff to ensure accommodations are met
- Preferential seating to minimize distractions
- Extended time on assessments and assignments
- Access to printed and highlighted notes
- Option for verbal or dictated responses on assignments and assessments
- Reduced workload or modified assignments as needed
- Use of assistive technology (speech-to-text, audiobooks, screen readers)
- Breaks as needed to support focus and processing
- Alternative assessment formats (oral exams, project-based assessments)
- Access to a quiet testing environment
- Organizational and time management support (checklists, graphic organizers, structured timelines)

Multilingual Language Learners (MLL):

- Collaboration between Content Education and ESL teachers
- Use of audio recordings when applicable
- Use of translation dictionaries when applicable
- Provide opportunities for oral responses and assessments
- Allow use of computer or other technological devices for assignments
- Highlight important notes and key concepts
- Use of graphic organizers to support comprehension

- Assign a peer liaison for additional support
- Incorporation of visual aids and real-world examples to reinforce concepts
- Modified assignments to focus on essential content
- Additional scaffolding such as sentence starters and guided practice

At-Risk Students:

- Small group instruction or one-on-one support when possible
- Clear, step-by-step instructions and modeling of tasks
- Use of engaging, real-world connections to make content more relevant
- Frequent feedback and progress monitoring
- Additional scaffolding (sentence starters, guided practice, visual supports)
- Peer mentoring and collaborative learning opportunities
- Encouragement of active participation through hands-on and interactive learning
- Flexible deadlines and opportunities for revision and reassessment
- Regular check-ins with teacher or counselor for academic and emotional support
- Positive reinforcement and goal-setting strategies to encourage motivation and engagement

Gifted Students:

- Provide more elaborate, complex, and in-depth study of major ideas and themes that integrate knowledge within and across the curriculum
- Incorporate outside sources (media, content, community resources) for further study that are thematic in nature
- Promote self-directed and self-initiated learning opportunities
- Allow for the development of productive thinking skills to encourage students to generate new knowledge
- Provide opportunities for leadership roles in collaborative projects
- Offer independent research projects and inquiry-based assignments
- Encourage critical analysis of multiple perspectives and interpretations of historical events

*Consistent with individual plans, when appropriate.

Career Readiness, Life Literacies and Key Skills Practice

PFL.9.1.2.CR.1	Recognize ways to volunteer in the classroom, school and community.
WRK.9.2.12.CAP.5	Assess and modify a personal plan to support current interests and post-secondary plans.
WRK.9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).