Platte County

HOME OF THE PIRATES

SCIENCE CURRICULUM

CHEMISTRY

Board Approval Date: pending
May 2024

Chemistry: Unit 1 Properties of Matter

Overview

Quarter(s): 1

Pacing: 2.5 Weeks

Unit Power Standard(s) Code	Unit Power Standard(s) Description
9-12.PS1.A.1	USE the organization of the periodic table to PREDICT the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
9-12.PS1.A.3	PLAN and CONDUCT an INVESTIGATION to GATHER EVIDENCE to COMPARE physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tension, and chemical reactivity to INFER the relative strength of attractive forces between particles

Below Grade/Course Connected Standard(s)	Above Grade/Course Connected Standard(s)
Middle School Students were previously engaged with 6-8.PS1.A.1 Students who took Physical Science previously engaged with 9-12.PS1.A.2 & 9-12.PS1.A.3	*N/A*

Unit Supporting Standards Code	Unit Supporting Standards Description
9-12.PS1.A.4	Apply the concepts of bonding and crystalline/molecular structure to explain the macroscopic properties of various categories of structural materials (i.e., metals, ionic [ceramics], and polymers).

Unpacked Standard(s)

Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
9-12.PS1.A.1	Use the organization of the periodic table to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms	3	SCIENCE AND ENGINEERING PRACTICES Developing and Using Models ● Use a model to predict the relationships between systems or between components of a system. DISCIPLINARY CORE IDEAS Structure and Properties of Matter ● Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. ● 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.
9-12.PS1.A.3	Plan and conduct an investigation to gather evidence to	3	SCIENCE AND ENGINEERING PRACTICES Planning and Carrying Out Investigations ● Plan and conduct an investigation individually and collaboratively to produce

	compare physical and chemical properties of substances such as melting point,boiling point, vapor pressure, surface tension, and chemical reactivity to infer the relative strength of attractive forces between particles		data to serve as the basis for evidence, and in the design, decide on types, quantity, and accuracy of data needed to produce reliable measurements; consider limitations on the precision of the data (e.g., number of trials, cost, risk, time); and refine the design accordingly. DISCIPLINARY CORE IDEAS Structure and Properties of Matter ● The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.

DESE Questions Examples:	1. What distinguishes a pure substance from a mixture? 2. Read the following paragraph and identify the intensive and extensive properties that were described. *Shelia found a rock on her property. It had a mass of 2.1 grams, a volume of 21 milliliters, and was cold to the touch. It was brownish red, soft, and malleable.*

"Unwrapped" Content (nouns) (students need to know)	**"Unwrapped" Skills (VERBS) (students need to be able to do & DOK)**	**"Unwrapped" Understanding (students need to understand)**
• Investigation • Chemical and physical properties • Melting point • Boiling point • Vapor pressure • Surface tension • Chemical reactivity • Particle forces • Ions • Atoms • Molecules • Networked materials	• Predict (3) • Use the periodic table (2) • Compare properties (2) • Plan & conduct an investigation (4)	• Students will understand that matter can be scientifically classified into different states and properties. Those properties can change based on chemical or physical changes. • Matter is conserved

New Academic Vocabulary	**Scaffolded (Review) Academic Vocabulary**
• pure substance, mixture, heterogeneous, homogeneous, intensive/extensive properties, mass, moles, gasses, density	• Atom, proton, neutron, electron, periodic table

Assessment

Common Summative Assessment/Demonstration of Understanding

- **Common Unit Assessment to be completed in the 2024-2025 School Year.**

Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale

4	**Student has mastered understanding of the entire standard(s) and makes little to no errors when asked to demonstrate and apply their learning.**
3	**Student consistently shows understanding for most components of the standard(s) with few errors when asked to demonstrate and apply their learning.**
2	**Student can sometimes show understanding for some of the components of the standard(s), yet there are a few aspects that they are still learning and improving upon.**
1	**Student rarely shows understanding for any component of the standard(s) and are still needing significant teaching to apply their learning.**

Additional Information

Professional Resource Suggestions	Instructional Resources
• American Chemical Society (ACS): The ACS offers a wide range of resources for chemistry educators, including lesson plans, activities, webinars, and professional development opportunities. • National Science Teachers Association (NSTA): NSTA provides resources specifically tailored to science educators, including lesson plans, articles, professional development events, and access to a community of fellow educators. • Chemical Education Research Group (CERG): CERG offers research-based resources and strategies for teaching chemistry, including curriculum materials, assessment tools, and professional development workshops. • ChemEd X: ChemEd X is an online community and resource hub for chemistry educators. It offers lesson plans, lab activities, demonstrations, and articles on best practices in chemistry teaching. • ChemCollective: ChemCollective provides virtual labs, simulations, and interactive activities for teaching chemistry. These resources can supplement hands-on laboratory experiences and engage students in virtual experiments. • Chemistry Education Digital Library (ChemEd DL): ChemEd DL is a digital library of chemistry resources	Chemistry Process-oriented Guided Inquiry Learning (POGIL) activities are used as supplementary materials aligned with the unit. Other resources utilized within this curriculum have been designed by the teaching staff and supplemented with free online resources. **Other Resources:** • Instructional videos created by teachers • Utilization of YouTube instructional videos for phenomenon demonstration and additional topic instruction • EdPuzzle • PhET Interactive Simulations • Kahoot- used as a review tool

Curriculum Designer Notes:	Unit topic analysis includes information on the integration of phenomena for introduction and teaching purposes, identification of topics incorporating mathematical concepts, and considerations for laboratory implementation where applicable. Areas incorporating math concepts and calculations are included below.. ● Chemical vs Physical Properties and Changes ● Extensive vs Intensive Properties ● States of Matter ● Pure Substances vs Mixtures ● Density - ○ Phenomenon - density column, ○ lab - Identify and unknown metal by measuring and calculating density ● Conversions throughout

Chemistry: Unit 2 Periodic Table and Atomic Structure

Overview

Quarter(s): 1

Pacing: 3 Weeks

Unit Power Standard(s) Code	Unit Power Standard(s) Description
9-12.PS1.A.1	USE the organization of the periodic table to PREDICT the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
9-12.PS1.A.2	CONSTRUCT and REVISE an explanation for the products 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.
9-12.PS1.C.1	USE symbolic representations 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.

Below Grade/Course Connected Standard(s)	Above Grade/Course Connected Standard(s)
Middle School Students were previously engaged with 6-8.PS1.A.1	*N/A*

Unit Supporting Standards Code	Unit Supporting Standards Description
9-12.PS1.A.5	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.

Unpacked Standard(s)

Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
9-12.PS1.A.1	Use the organization of the periodic table to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms	3	SCIENCE AND ENGINEERING PRACTICES Developing and Using Models ● Use a model to predict the relationships between systems or between components of a system. DISCIPLINARY CORE IDEAS Structure and Properties of Matter ● Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. ● 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.
9-12.PS1.A.2	Construct and revise an explanation for the products of a simple chemical reaction based on the outermost	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions ● Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and the assumption that theories and laws that describe the natural world operate today as they did

	electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties		in the past and will continue to do so in the future. DISCIPLINARY CORE IDEAS 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.
9-12.PS1.C.1	Use symbolic representations 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	3	SCIENCE AND ENGINEERING PRACTICES Developing and Using Models ● Develop a model based on evidence to illustrate the relationships between systems or between components of a system. DISCIPLINARY CORE IDEAS Nuclear Processes ● 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.

DESE Questions Examples:

1. For each pair of elements circle the one that has a larger electronegativity.
   F or B Mg or Ba Cs or As

2. Draw a Bohr model of an atom that has 13 protons, 12 electrons, and 15 neutrons. You can abbreviate the nucleus. Answer the following questions based on the model you drew.

   a. How many shielding electrons does the "atom" have?
   b. How many valence electrons does the "atom" have?
   c. What element does this "atom" represent?
   d. What ionic charge would this "atom" have?

"Unwrapped" Content (nouns) (students need to know)	**"Unwrapped" Skills (VERBS) (students need to be able to do & DOK)**	**"Unwrapped" Understanding (students need to understand)**
● Periodic table ● Properties ● Elements ● Patterns of electrons ● Outermost energy level ● Patterns/trends ● Reactivity ● Metals ● Bonds ● Reactions with oxygen	● Predict (3) ● Use the periodic table (2)	● Students will understand that elements are organized on the Periodic Table based on the elements' subatomic particles ● Similar substances follow similar patterns in regards to properties and characteristics based on electron arrangement ● Periodic Table can be used to predict the properties and characteristics of those substances due to electron configurations

New Academic Vocabulary	**Scaffolded (Review) Academic Vocabulary**

• Isotope, atomic number, atomic mass, average atomic mass, Valence Electrons, atomic radius, electronegativity, ion, ionization energy, atomic radius, fusion/fission, decay	• metals, non-metals, metalloids, group, periods, families, atomic number, atomic mass

Assessment

Common Summative Assessment/Demonstration of Understanding

- **Common Unit Assessment to be completed in the 2024-2025 School Year.**

Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale

4	**Student has mastered understanding of the entire standard(s) and makes little to no errors when asked to demonstrate and apply their learning.**
3	**Student consistently shows understanding for most components of the standard(s) with few errors when asked to demonstrate and apply their learning.**
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Additional Information

Professional Resource Suggestions	Instructional Resources
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professional development workshops. ● ChemEd X: ChemEd X is an online community and resource hub for chemistry educators. It offers lesson plans, lab activities, demonstrations, and articles on best practices in chemistry teaching. ● ChemCollective: ChemCollective provides virtual labs, simulations, and interactive activities for teaching chemistry. These resources can supplement hands-on laboratory experiences and engage students in virtual experiments. ● Chemistry Education Digital Library (ChemEd DL): ChemEd DL is a digital library of chemistry resources	

Curriculum Designer Notes:	Unit topic analysis includes information on the integration of phenomena for introduction and teaching purposes, identification of topics incorporating mathematical concepts, and considerations for laboratory implementation where applicable.
	
	Areas incorporating math concepts and calculations are included below.
	
	- Basic Atomic Structure (protons, electrons, neutrons)
	- Isotopes and Average Atomic Mass
	- Define Fusion/Fission/Decay
	  - Phenomenon - Nuclear decay in atomic reactors
	- Periodic Table
	  - Properties of Groups
	  - Trends

CHEMISTRY: UNIT 3 QUANTUM ATOMIC MODEL

Overview

Quarter(s): 2

Pacing: 4 Weeks

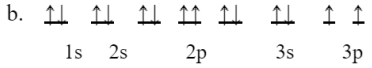
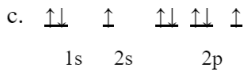
Unit Power Standard(s) Code	Unit Power Standard(s) Description
9-12.PS1.A.2	CONSTRUCT and REVISE an explanation for the products of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
9-12.PS4.A.1	USE mathematical representations to SUPPORT a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
9-12.PS4.A.2	EVALUATE the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the others.

Below Grade/Course Connected Standard(s)	Above Grade/Course Connected Standard(s)
Middle School Students were previously engaged with 6-8.PS1.A.2 as a Supporting Standard in Grade 8. Students who took Physical Science previously engaged with 9-12.PS1.A.2, 9-12.PS4.A.1, and 9-12.PS4.A.2.	*N/A*

Unit Supporting Standards Code	Unit Supporting Standards Description
9-12.PS3.C.1	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

Unpacked Standard(s)

Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
9-12.PS1.A.2	Construct and revise an explanation for the products of a simple chemical reaction based on the outermost electron states	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions ● Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and the assumption that theories and laws that describe the natural world operate

	of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties		today as they did in the past and will continue to do so in the future. DISCIPLINARY CORE IDEAS 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.
9-12.PS4.A.1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.	3	SCIENCE AND ENGINEERING PRACTICES Using Mathematics and Computational Thinking ● Use mathematical representations of phenomena or design solutions to describe and/or support claims and/or explanations. DISCIPLINARY CORE IDEAS Wave Properties ● The wavelength and frequency of a wave are related to one another by the speed at which the wave travels, which depends on the type of wave and the medium through which it is passing.
9-12.PS4.A.2	Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the others.	3	SCIENCE AND ENGINEERING PRACTICES Engaging in Argument from Evidence ● Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. DISCIPLINARY CORE IDEAS Wave Properties ● Waves can add or cancel one another as they cross, depending on their relative phase (i.e., relative position of peaks and troughs of the waves), but they emerge unaffected by each other. Electromagnetic Radiation ● Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features.
DESE Questions Examples:	1. A microwave emits radiation with a wavelength of 3.25×10^{-2} m. What is the frequency of this microwave radiation? 2. *Circle the errors in the following orbital box diagrams & identify the rule or law not followed:* a.  1s 2s 2p _____ b.  1s 2s 2p 3s 3p _____ c.  1s 2s 2p _____		

"Unwrapped" Content (nouns) (students need to know)	"Unwrapped" Skills (VERBS) (students need to be able to do & DOK)	"Unwrapped" Understanding (students need to understand)
• Periodic table • Properties • Elements • Patterns of electrons • Outermost energy level • Patterns/trends • Reactivity • Metals • Bonds • Reactions with oxygen	• Predict (3) • Use the periodic table (2)	• Students will understand that elements are organized on the Periodic Table based on the elements' subatomic particles • Similar substances follow similar patterns in regards to properties and characteristics based on electron arrangement • Periodic Table can be used to predict the properties and characteristics of those substances due to electron configurations

New Academic Vocabulary	Scaffolded (Review) Academic Vocabulary
• EMR, energy, wavelength, frequency, calculate protons/neutrons/electrons, electron configuration, atomic spectra	• Atomic Model, Valence Electrons, metals, non-metals, metalloids, atomic radius, electronegativity, ion, ionization energy, atomic radius, group, periods, families, atomic number, atomic mass

Assessment

Common Summative Assessment/Demonstration of Understanding

- **Common Unit Assessment to be completed in the 2024-2025 School Year.**

Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale

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	- Atomic History (experiments and models - Dalton, Thompson, Rutherford, Bohr, Quantum) - Wave Properties and Electromagnetic Spectrum - Phenomenon - James Webb Space Telescope - Atomic Spectra - Electron Configurations

CHEMISTRY: UNIT 4 COVALENT BONDING

Overview

Quarter(s): 2

Pacing: 3/4 Weeks

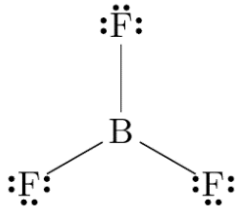
Unit Power Standard(s) Code	Unit Power Standard(s) Description
9-12.PS1.A.1	USE the organization of the periodic table to PREDICT the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
9-12.PS1.A.2	CONSTRUCT and REVISE an explanation for the products 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.
9-12.PS1.A.3	PLAN and CONDUCT an investigation to GATHER evidence to COMPARE physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tension, and chemical reactivity to INFER the relative strength of attractive forces between particles.

Below Grade/Course Connected Standard(s)	Above Grade/Course Connected Standard(s)
Middle School Students were previously engaged with 6-8.PS1.A.1	*N/A*

Unit Supporting Standards Code	Unit Supporting Standards Description
9-12.ETS1.A.1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

Unpacked Standard(s)

Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
9-12.PS1.A.1	Use the organization of the periodic table to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.	3	SCIENCE AND ENGINEERING PRACTICES Developing and Using Models ● Use a model to predict the relationships between systems or between components of a system. DISCIPLINARY CORE IDEAS Structure and Properties of Matter ● Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. ● 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.

9-12.PS1.A.2	Construct and revise an explanation for the products 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.	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions ● Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and 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. DISCIPLINARY CORE IDEAS 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.
9-12.PS1.A.3	Plan and conduct an investigation to gather evidence to compare physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tension, and chemical reactivity to infer the relative strength of attractive forces between particles.	3	SCIENCE AND ENGINEERING PRACTICES Planning and Carrying Out Investigations ● Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design, decide on types, quantity, and accuracy of data needed to produce reliable measurements; consider limitations on the precision of the data (e.g., number of trials, cost, risk, time); and refine the design accordingly. DISCIPLINARY CORE IDEAS Structure and Properties of Matter ● The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.
DESE Questions Examples:	*For each of the following molecules, using the provided Lewis structure to determine the electron pair geometry, molecular geometry, and molecular polarity (Circle Polar or Nonpolar. (3pts each)* **28.** ***EG:***_____ ***MG:*** _____ ***Polar*** ***Nonpolar***  *Write the correct chemical formula or name for each of the following compounds.* 31. nitrogen trichloride _____ 32. PBr_5_____		

cation, anion, octet rule, single/ double/ triple bonds, ionic/ covalent, VSEPR, Polarity	

Assessment

Common Summative Assessment/Demonstration of Understanding

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Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale

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"Unwrapped" Content (nouns) (students need to know)	"Unwrapped" Skills (VERBS) (students need to be able to do & DOK)	"Unwrapped" Understanding (students need to understand)
• Periodic table • Properties of elements • Electrons • Outermost Electron • Physical and chemical properties (contains examples of each) • Bonding • Crystalline/molecular structure • Macroscopic properties • Structural materials	• Predict (2) • Plan and Conduct an investigation (4) • Gather evidence (2) • Apply (2) • Explain (1)	• Students will understand that atoms can combine, separate or rearrange to create new substances • Combinations formed depend on electrons and other properties of the atoms • Bonds can be predicted based on properties • Being able to predict the way atoms bond allows you to predict the substances that will form due to a reaction • Chemical Names are used to describe the way in which atoms bond and are specific to the type of bonds formed. In order to properly describe the substance students must understand the proper naming rules for elements, covalent bonds and ionic bonds • The ability to name chemical substances is required to effectively communicate in science

New Academic Vocabulary	Scaffolded (Review) Academic Vocabulary
• ionic, binary, polyatomic, ion, criss-cross method, transition metal, hydrates, metal/nonmetal, covalent compound, binary acid, polyatomic acid, nonmetal/nonmetal, valence electrons,	• Isotope, atomic number, atomic mass, EMR, energy, wavelength, frequency, average atomic mass, calculate protons/neutrons/electrons

community and resource hub for chemistry educators. It offers lesson plans, lab activities, demonstrations, and articles on best practices in chemistry teaching. ● ChemCollective: ChemCollective provides virtual labs, simulations, and interactive activities for teaching chemistry. These resources can supplement hands-on laboratory experiences and engage students in virtual experiments. ● Chemistry Education Digital Library (ChemEd DL): ChemEd DL is a digital library of chemistry resources	

Curriculum Designer Notes:	Unit topic analysis includes information on the integration of phenomena for introduction and teaching purposes, identification of topics incorporating mathematical concepts, and considerations for laboratory implementation where applicable.
	
	Areas incorporating math concepts and calculations are included below.
	
	- Lewis Structures
	- Molar Masses
	- VSEPR
	  - Molecular Modeling Lab
	- Polarity
	  - Phenomenon - Trying to mix polar and nonpolar substances
	- Intermolecular Forces

CHEMISTRY: UNIT 5 IONIC BONDING

Overview

Quarter(s): 2-3

Pacing: 3 Weeks

Unit Power Standard(s) Code	Unit Power Standard(s) Description
9-12.PS1.A.1	USE the organization of the periodic table to PREDICT the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
9-12.PS1.A.2	CONSTRUCT and REVISE an explanation for the products 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.
9-12.PS1.A.3	PLAN and CONDUCT an investigation to GATHER evidence to COMPARE physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tension, and chemical reactivity to INFER the relative strength of attractive forces between particles

Below Grade/Course Connected Standard(s)	Above Grade/Course Connected Standard(s)
Middle School Students were previously engaged with 6-8.PS1.A.1	*N/A*

Unit Supporting Standards Code	Unit Supporting Standards Description
9-12.ESS1.A.1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

Unpacked Standard(s)

Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
9-12.PS1.A.1	Use the organization of the periodic table to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.	3	SCIENCE AND ENGINEERING PRACTICES Developing and Using Models ● Use a model to predict the relationships between systems or between components of a system. DISCIPLINARY CORE IDEAS Structure and Properties of Matter ● Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. ● 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.

9-12.PS1.A.2	Construct and revise an explanation for the products 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	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions ● Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and 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. DISCIPLINARY CORE IDEAS 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.
9-12.PS1.A.3	Plan and conduct an investigation to gather evidence to compare physical and chemical properties of substances such as melting point,boiling point, vapor pressure, surface tension, and chemical reactivity to infer the relative strength of attractive forces between particles	3	SCIENCE AND ENGINEERING PRACTICES Planning and Carrying Out Investigations ● Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design, decide on types, quantity, and accuracy of data needed to produce reliable measurements; consider limitations on the precision of the data (e.g., number of trials, cost, risk, time); and refine the design accordingly. DISCIPLINARY CORE IDEAS Structure and Properties of Matter ● The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.
DESE Questions Examples:	*For each of the compounds, write the chemical formula or name.* 1. Cadmium hypochlorite 2. $Zn(C_2H_3O_2)_2$ In an ionic bond, oxygen is most likely to _____, making it a(n) _____. a. Gain 2 electrons; cation b. Gain 2 electrons; anion c. Lose 6 electrons; cation		

	d. Lose 6 electrons; anion _____ Which of the following best describes ionic compounds? e. Brittle, low melting points, weak bonds f. Malleable, low melting points, strong bonds g. Malleable, high melting points, weak bonds h. Brittle, high melting points, strong bonds

"Unwrapped" Content (nouns) (students need to know)	**"Unwrapped" Skills (VERBS) (students need to be able to do & DOK)**	**"Unwrapped" Understanding (students need to understand)**
• Periodic table • Properties of elements • Electrons • Outermost Electron • Physical and chemical properties (contains examples of each) • Bonding • Crystalline/molecular structure • Macroscopic properties • Structural materials	• Predict (2) • Plan and Conduct an investigation (4) • Gather evidence (2) • Apply (2) • Explain (1)	• Students will understand that atoms can combine, separate or rearrange to create new substances • Combinations formed depend on electrons and other properties of the atoms • Bonds can be predicted based on properties • Being able to predict the way atoms bond allows you to predict the substances that will form due to a reaction • Chemical names are used to describe the way in which atoms bond and are specific to the type of bonds formed. In order to properly describe the substance students must understand the proper naming rules for elements, covalent bonds and ionic bonds • The ability to name chemical substances is required to

		effectively communicate in science

New Academic Vocabulary	Scaffolded (Review) Academic Vocabulary
• ionic, binary, polyatomic, ion, criss-cross method, transition metal, hydrates, metal/nonmetal, covalent compound, binary acid, polyatomic acid, nonmetal/nonmetal, valence electrons, cation, anion, octet rule, single/ double/ triple bonds, ionic/ covalent, VSEPR, Polarity	• Isotope, atomic number, atomic mass, EMR, energy, wavelength, frequency, average atomic mass, calculate protons/neutrons/electrons

Assessment

Common Summative Assessment/Demonstration of Understanding

- **Common Unit Assessment to be completed in the 2024-2025 School Year.**

Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale

4	**Student has mastered understanding of the entire standard(s) and makes little to no errors when asked to demonstrate and apply their learning.**
	•
3	**Student consistently shows understanding for most components of the standard(s) with few errors when asked to demonstrate and apply their learning.**
	•
2	**Student can sometimes show understanding for some of the components of the standard(s), yet there are a few aspects that they are still learning and improving upon.**
	•
1	**Student rarely shows understanding for any component of the standard(s) and are still needing significant teaching to apply their learning.**
	•

Additional Information

Professional Resource Suggestions	Instructional Resources
• American Chemical Society (ACS): The ACS offers a wide range of resources for chemistry educators, including lesson plans, activities, webinars, and professional development opportunities. • National Science Teachers Association (NSTA): NSTA provides resources specifically tailored to science	Chemistry Process-oriented Guided Inquiry Learning (POGIL) activities are used as supplementary materials aligned with the unit. Other resources utilized within this curriculum have been designed by the teaching staff and supplemented with free online resources.

<table>
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<td>educators, including lesson plans, articles, professional development events, and access to a community of fellow educators.
● Chemical Education Research Group (CERG): CERG offers research-based resources and strategies for teaching chemistry, including curriculum materials, assessment tools, and professional development workshops.
● ChemEd X: ChemEd X is an online community and resource hub for chemistry educators. It offers lesson plans, lab activities, demonstrations, and articles on best practices in chemistry teaching.
● ChemCollective: ChemCollective provides virtual labs, simulations, and interactive activities for teaching chemistry. These resources can supplement hands-on laboratory experiences and engage students in virtual experiments.
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● Instructional videos created by teachers
● Utilization of YouTube instructional videos for phenomenon demonstration and additional topic instruction
● EdPuzzle
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● Kahoot- used as a review tool</td>
</tr>
<tr>
<td>Curriculum Designer Notes:</td>
<td colspan="2">Unit topic analysis includes information on the integration of phenomena for introduction and teaching purposes, identification of topics incorporating mathematical concepts, and considerations for laboratory implementation where applicable.

Areas incorporating math concepts and calculations are included below.

- Naming/Formula Writing
- Electron Dot Structures (charges)
- Phenomenon - Video of sodium & chlorine reaction
- Electron Configuration of ions
- Molar Masses
- Combined Naming</td>
</tr>
</table>

CHEMISTRY: UNIT 6 CHEMICAL REACTIONS

Overview

Quarter(s): 3

Pacing: 3 Weeks

Unit Power Standard(s) Code	Unit Power Standard(s) Description
9-12.PS1.B.3	Use symbolic representations and mathematical calculations to SUPPORT the claim that atoms, and therefore mass, are conserved during a chemical reaction.
9-12.PS1.A.2	CONSTRUCT and REVISE an explanation for the products 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.
9-12.PS1.B.2	REFINE the design of a chemical system by specifying a change in conditions that would ALTER the amount of products at equilibrium.

Below Grade/Course Connected Standard(s)	Above Grade/Course Connected Standard(s)
Middle School Students were previously engaged with 6-8.PS1.B.1	*N/A*

Unit Supporting Standards Code	Unit Supporting Standards Description
9-12.ESS1.A.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.

Unpacked Standard(s)

Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
9-12.PS1.B.3	Use symbolic representations and mathematical calculations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	3	SCIENCE AND ENGINEERING PRACTICES Using Mathematics and Computational Thinking ● Use mathematical representations of phenomena to support claims. DISCIPLINARY CORE IDEAS 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
9-12.PS1.A.2	Construct and revise an explanation for	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions ● Construct and revise an

	the products 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.		explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and 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. DISCIPLINARY CORE IDEAS 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.
9-12.PS1.B.2	Refine the design of a chemical system by specifying a change in conditions that would alter the amount of products at equilibrium.	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions • Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade-off considerations. DISCIPLINARY CORE IDEAS Chemical Reactions ● In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. Optimizing the Design Solution ● Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.
DESE Questions Examples:	1. In balancing a chemical equation, which of the following are you allowed to do? (A) change subscripts (B) write coefficients (C) change superscripts (D) add new substances Write *balanced* equations for each of the following 1. Combustion of propane (C_3H_8). 2. Decomposition of water 3. Reaction between calcium and hydrochloric acid		
"Unwrapped" Content (<u>nouns</u>) (students need to know)		**"Unwrapped" Skills (VERBS) (students need to be able to do & DOK)**	**"Unwrapped" Understanding (students need to understand)**

Chemical reactions • Electrons states of atoms • Periodic table • Chemical properties • Scientific principles • Temperature • Concentration • Atoms • Mass	• Construct and Revise an explanation (3) • Apply scientific principles and evidence (2) • Use evidence to support a claim (3)	• Students will understand that chemical reactions occur due to outer electrons • Changes in Temperature and concentration change the rate of chemical reactions • Atoms/mass is conserved in a reaction

New Academic Vocabulary	Scaffolded (Review) Academic Vocabulary
• synthesis, decomposition, single displacement, double displacement, combustion, activity series, coefficient, law of conservation, subscript, Molar mass; Avogadro's number; mole; molar ratio; molecule; formula unit; percent composition, moles, grams, liters, mole ratio, limiting reactant, excess reactant, percent yield, actual yield, theoretical yield	• ionic, binary, polyatomic, ion, criss-cross method, transition metal, hydrates, metal/nonmetal, covalent compound, binary acid, polyatomic acid, nonmetal/nonmetal, valence electrons, cation, anion, octet rule, single/ double/ triple bonds, ionic/ covalent, VSEPR, Polarity

Assessment

Common Summative Assessment/Demonstration of Understanding

- **Common Unit Assessment to be completed in the 2024-2025 School Year.**

Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale

4	**Student has mastered understanding of the entire standard(s) and makes little to no errors when asked to demonstrate and apply their learning.**
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3	**Student consistently shows understanding for most components of the standard(s) with few errors when asked to demonstrate and apply their learning.**
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Additional Information

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Curriculum Designer Notes:	Unit topic analysis includes information on the integration of phenomena for introduction and teaching purposes, identification of topics incorporating mathematical concepts, and considerations for laboratory implementation where applicable.
	
	Areas incorporating math concepts and calculations are included below.
	
	- Types
	  - Lab - Types of reactions lab
	- Balancing Equations (Law of Conservation of Mass)
	  - Phenomenon - video of balanced and unbalanced hydrogen & oxygen reaction

	- Mole concepts
	  - Grams to moles to atoms using Avogadro's Number
	  - Mole-to-mole stoichiometry

CHEMISTRY: UNIT 7 STOICHIOMETRY

Overview

Quarter(s): 4

Pacing: 4 weeks

Unit Power Standard(s) Code	Unit Power Standard(s) Description
9-12.PS1.B.3	Use symbolic representations and mathematical calculations to SUPPORT the claim that atoms, and therefore mass, are conserved during a chemical reaction.
9-12.PS1.A.2	CONSTRUCT and REVISE an explanation for the products 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.
9-12.PS1.B.2	REFINE the design of a chemical system by specifying a change in conditions that would alter the amount of products at equilibrium

Below Grade/Course Connected Standard(s)	Above Grade/Course Connected Standard(s)
6-8.PS1.A.1	*N/A*

Unit Supporting Standards Code	Unit Supporting Standards Description
9-12.ESS1.A.3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.

Unpacked Standard(s)

Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
9-12.PS1.B.3	Use symbolic representations and mathematical calculations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	3	SCIENCE AND ENGINEERING PRACTICES Using Mathematics and Computational Thinking ● Use mathematical representations of phenomena to support claims. DISCIPLINARY CORE IDEAS 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
9-12.PS1.A.2	Construct and revise an explanation for the products 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.	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions ● Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and 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. DISCIPLINARY CORE IDEAS 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.
9-12.PS1.B.2	Refine the design of a chemical system by specifying a change in conditions that would alter the amount of products at equilibrium.	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions • Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade-off considerations. DISCIPLINARY CORE IDEAS Chemical Reactions ● In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. Optimizing the Design Solution ● Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.

DESE Questions Examples:	1. For the reaction $CS_2 + 3O_2 \rightarrow CO_2 + 2SO_2$, how many moles of oxygen are needed to produce 80.0 grams of carbon dioxide? 2. For the reaction How many grams of water are produced from the combustion of 200. g of methane (CH_4)? $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$,

"Unwrapped" Content (<u>nouns</u>) (students need to know)	**"Unwrapped" Skills (VERBS) (students need to be able to do & DOK)**	**"Unwrapped" Understanding (students need to understand)**
Chemical reactions ● Electrons states of atoms ● Periodic table ● Chemical properties ● Scientific principles ● Temperature ● Concentration ● Atoms ● Mass	● Construct and Revise an explanation (3) ● Apply scientific principles and evidence (2) ● Use evidence to support a claim (3)	● Students will understand that chemical reactions occur due to outer electrons ● Changes in temperature and concentration change the rate of chemical reactions ● Atoms/mass is conserved in a reaction

New Academic Vocabulary	**Scaffolded (Review) Academic Vocabulary**
● synthesis, decomposition, single displacement, double displacement, combustion, activity series, coefficient, law of conservation, subscript, Molar mass; Avogadro's number; mole; molar ratio; molecule; formula unit; percent composition, moles, grams, liters, mole ratio, limiting reactant, excess reactant, percent yield, actual yield, theoretical yield	● ionic, binary, polyatomic, ion, criss-cross method, transition metal, hydrates, metal/nonmetal, covalent compound, binary acid, polyatomic acid, nonmetal/nonmetal, valence electrons, cation, anion, octet rule, single/ double/ triple bonds, ionic/ covalent, VSEPR, Polarity

Assessment

Common Summative Assessment/Demonstration of Understanding

- **Common Unit Assessment to be completed in the 2024-2025 School Year.**

Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale

4	**Student has mastered understanding of the entire standard(s) and makes little to no errors when asked to demonstrate and apply their learning.**
	•
3	**Student consistently shows understanding for most components of the standard(s) with few errors when asked to demonstrate and apply their learning.**
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Additional Information

Professional Resource Suggestions

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- ChemEd X: ChemEd X is an online community and resource hub for chemistry educators. It offers lesson plans, lab activities, demonstrations, and articles on best practices in chemistry teaching.
- ChemCollective: ChemCollective provides

Instructional Resources

Chemistry Process-oriented Guided Inquiry Learning (POGIL) activities are used as supplementary materials aligned with the unit.

Other resources utilized within this curriculum have been designed by the teaching staff and supplemented with free online resources.

Other Resources:

- Instructional videos created by teachers
- Utilization of YouTube instructional videos for phenomenon demonstration and additional topic instruction
- EdPuzzle
- PhET Interactive Simulations
- Kahoot- used as a review tool

virtual labs, simulations, and interactive activities for teaching chemistry. These resources can supplement hands-on laboratory experiences and engage students in virtual experiments. • Chemistry Education Digital Library (ChemEd DL): ChemEd DL is a digital library of chemistry resources •	

Curriculum Designer Notes:	Unit topic analysis includes information on the integration of phenomena for introduction and teaching purposes, identification of topics incorporating mathematical concepts, and considerations for laboratory implementation where applicable.
	
	Areas incorporating math concepts and calculations are included below:
	
	- Percent composition of compounds
	- Empirical/Molecular Formulas
	- Mole to gram, gram to mole, gram to gram
	  - Phenomenon - Breakfast Equations
	- Limiting Reactants & Percent Yield
	  - Lab - Limiting Reactant Lab

CHEMISTRY: UNIT 8 SOLUTIONS

Overview

Quarter(s): 4

Pacing: 3 Weeks

Unit Power Standard(s) Code	Unit Power Standard(s) Description
9-12.PS1.A.3	PLAN and CONDUCT an INVESTIGATION to GATHER EVIDENCE to COMPARE physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tension, and chemical reactivity to INFER the relative strength of attractive forces between particles.
9-12.PS1.B.2	REFINE the design of a chemical system by specifying a change in conditions that would alter the amount of products at equilibrium.
9-12.PS1.B.3	USE symbolic representations and mathematical calculations to SUPPORT the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Below Grade/Course Connected Standard(s)	Above Grade/Course Connected Standard(s)
6-8.PS1.A.1	*N/A*

Unit Supporting Standards Code	Unit Supporting Standards Description
9-12.PS1.A.4	Apply the concepts of bonding and crystalline/molecular structure to explain the macroscopic properties of various categories of structural materials (i.e., metals, ionic [ceramics], and polymers).

Unpacked Standard(s)

Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
9-12.PS1.A.3	Plan and conduct an investigation to gather evidence to compare physical and chemical properties of substances such as melting point,boiling point, vapor pressure, surface tension, and chemical reactivity to infer the relative strength of attractive forces between particles	3	SCIENCE AND ENGINEERING PRACTICES Planning and Carrying Out Investigations ● Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design, decide on types, quantity, and accuracy of data needed to produce reliable measurements; consider limitations on the precision of the data (e.g., number of trials, cost, risk, time); and refine the design accordingly. DISCIPLINARY CORE IDEAS Structure and Properties of Matter ● The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.
9-12.PS1.B.2	Refine the design of a chemical system	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions

	by specifying a change in conditions that would alter the amount of products at equilibrium		• Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade-off considerations. DISCIPLINARY CORE IDEAS Chemical Reactions • In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. Optimizing the Design Solution • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.
9-12.PS1.B.3	Use symbolic representations and mathematical calculations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	3	SCIENCE AND ENGINEERING PRACTICES Using Mathematics and Computational Thinking • Use mathematical representations of phenomena to support claims. DISCIPLINARY CORE IDEAS 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.

DESE Questions Examples:

1. 32 mL of concentrated 16 M sulfuric acid are diluted to create a 1.2 M sulfuric acid solution. What is the volume of the diluted solution? (5pts, 5 step method)

2. 0.45 L of 18 M Sulfuric acid (H_2SO_4) and excess Aluminum hydroxide solution ($Al(OH)_3$) react to form solid aluminum sulfate ($Al_2(SO_4)_3$) and water. Theoretically what mass of solid aluminum sulfate would be created? (6 points)

   ___ H_2SO_4 (aq) + ___ $Al(OH)_3$ (aq) → ___ $Al_2(SO_4)_3$ (s) + ___ H_2O (l)

"Unwrapped" Content (nouns) (students need to know)	**"Unwrapped" Skills (VERBS) (students need to be able to do & DOK)**	**"Unwrapped" Understanding (students need to understand)**
• Technological solutions • Impacts of human activities • Natural systems • Stability • Biodiversity • Ecosystems	• Evaluate or refine a technological solution (4)	• Students will understand solubility of substance is dependent on type of substance • Substances are classified based on properties and characteristics • Solubility is also affected by temperature, agitation, and surface area

		• Reactions in solutions can be classified as acid/base, redox and precipitation • Solutions and solubilities have environmental and human impacts including ocean acidification, acid rain, pollution, body functions/ health, and more.

New Academic Vocabulary	Scaffolded (Review) Academic Vocabulary
• Solubility, electrolyte, non-electrolyte, acid/base reactions, redox reactions, pH, molarity	• synthesis, decomposition, single displacement, double displacement, combustion, activity series, coefficient, law of conservation, subscript, Molar mass; Avogadro's number; mole; molar ratio; molecule; formula unit; percent composition, moles, grams, liters, mole ratio, limiting reactant, excess reactant, percent yield, actual yield, theoretical yield

Assessment

Common Summative Assessment/Demonstration of Understanding

- **Common Unit Assessment to be completed in the 2024-2025 School Year.**

Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale

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Additional Information

Professional Resource Suggestions	Instructional Resources
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Other Resources:

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Areas incorporating math concepts and calculations are included below.

- Solution Solubility
  - Phenomenon - Supersaturated solutions (hand warmers)
  - Lab - Borax Supersaturated Solutions Lab
- Solution concentrations
- Solution stoichiometry
- Acids/Bases (w pH calculations)
- Titrations</td>
</tr>
</table>

CHEMISTRY: UNIT 9 NUCLEAR CHEMISTRY

Overview

Quarter(s): 4

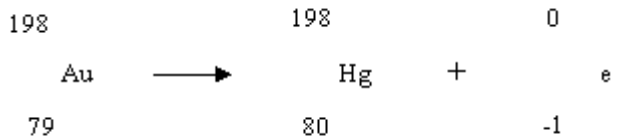
Pacing: 2 Weeks

Unit Power Standard(s) Code	Unit Power Standard(s) Description
9-12.PS1.C.1	USE symbolic representations 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.

Below Grade/Course Connected Standard(s)	Above Grade/Course Connected Standard(s)
6-8.PS1.A.1	*N/A*

Unit Supporting Standards Code	Unit Supporting Standards Description
9-12.ESS1.A.1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
9-12.ESS1.A.3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.

Unpacked Standard(s)

Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
9-12.PS1.C.1	Use symbolic representations 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	3	SCIENCE AND ENGINEERING PRACTICES Developing and Using Models ● Develop a model based on evidence to illustrate the relationships between systems or between components of a system. DISCIPLINARY CORE IDEAS Nuclear Processes ● 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.
DESE Questions Examples:	1. Which type of decay is represented by the nuclear equation to the right? a. Alpha decay		

b. Beta decay
c. Gamma decay
d. Delta decay

2. Paper would be strong enough to stop a(n) _____.
   a. Alpha particle
   b. Beta particle
   c. Gamma ray
   d. All of the above
   e.

1. Write the nuclear equation for gold-198 when it undergoes **beta** decay.

"Unwrapped" Content (nouns) (students need to know)	"Unwrapped" Skills (VERBS) (students need to be able to do & DOK)	"Unwrapped" Understanding (students need to understand)
• Symbolic representation • Composition of nucleus • Atom • Energy • Fission • Fusion • Radioactive decay • Qualitative models • Nuclear process • Transformations	• Use and illustrate (2)	• The nucleus of an atom can change • Changes must be of a specific type (alpha, beta, gamma) • Changes release energy of a specific wavelength, frequency, and energy • Nucleus splits in fission and combines in fusion • Understand the applications of fission/fusion/ radioactive decay. • These reactions are essential to their daily lives- the sun, power plants

New Academic Vocabulary	Scaffolded (Review) Academic Vocabulary
• Alpha, beta, gamma, EMR radio-gamma; frequency, wavelength, nuclear equations; fission, fusion	• Isotope, atomic number, atomic mass, EMR, energy, wavelength, frequency, average atomic mass, calculate protons/neutrons/electrons

Assessment

Common Summative Assessment/Demonstration of Understanding

- **Common Unit Assessment to be completed in the 2024-2025 School Year.**

Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1

Example	Example	Example	Example

Proficiency Scale

4	**Student has mastered understanding of the entire standard(s) and makes little to no errors when asked to demonstrate and apply their learning.**
	•
3	**Student consistently shows understanding for most components of the standard(s) with few errors when asked to demonstrate and apply their learning.**
	•
2	**Student can sometimes show understanding for some of the components of the standard(s), yet there are a few aspects that they are still learning and improving upon.**
	•
1	**Student rarely shows understanding for any component of the standard(s) and are still needing significant teaching to apply their learning.**
	•

Additional Information

Professional Resource Suggestions	Instructional Resources
• American Chemical Society (ACS): The ACS offers a wide range of resources for chemistry educators, including lesson plans, activities, webinars, and professional development opportunities. • National Science Teachers Association (NSTA): NSTA provides resources specifically tailored to science educators, including lesson plans, articles, professional development events, and access to a community of fellow educators. • Chemical Education Research Group (CERG): CERG offers research-based resources and strategies for teaching chemistry, including curriculum materials, assessment tools, and professional development workshops. • ChemEd X: ChemEd X is an online community and resource hub for chemistry educators. It offers lesson plans, lab activities, demonstrations, and articles on best practices in chemistry teaching. • ChemCollective: ChemCollective provides virtual labs, simulations, and interactive activities for teaching chemistry. These resources can	Chemistry Process-oriented Guided Inquiry Learning (POGIL) activities are used as supplementary materials aligned with the unit. Other resources utilized within this curriculum have been designed by the teaching staff and supplemented with free online resources. **Other Resources:** • Instructional videos created by teachers • Utilization of YouTube instructional videos for phenomenon demonstration and additional topic instruction • EdPuzzle • PhET Interactive Simulations • Kahoot- used as a review tool

supplement hands-on laboratory experiences and engage students in virtual experiments. ● Chemistry Education Digital Library (ChemEd DL): ChemEd DL is a digital library of chemistry resources	

Curriculum Designer Notes:	Unit topic analysis includes information on the integration of phenomena for introduction and teaching purposes, identification of topics incorporating mathematical concepts, and considerations for laboratory implementation where applicable.
	
	Areas incorporating math concepts and calculations are included below.
	
	- Alpha, beta, gamma decay
	- Nuclear Equations
	- Fission vs fusion
	  - Phenomenon - fission and fusion reactions
	- Radioactivity
	  - Phenomenon - Radium Girls Article