Chemistry
East Chicago Central High School

Units of Study

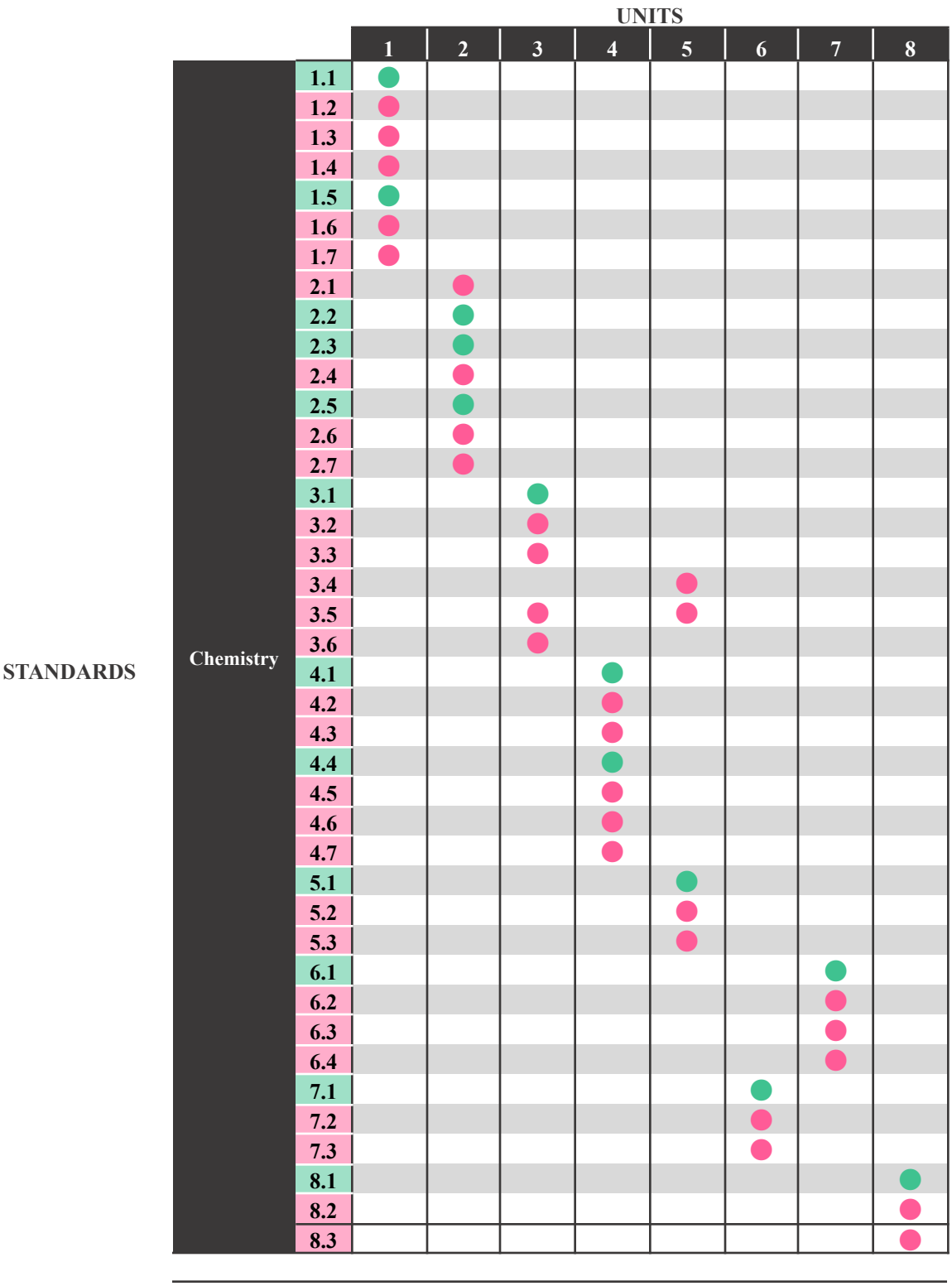
Unit 1:	Properties and States of Matter	🕓 25 Days
Unit 2:	Atomic Structure and the Periodic Table	🕓 35 Days
Unit 3:	Bonding and Molecular Structure	🕓 30 Days
Unit 4:	Reactions and Stoichiometry	🕓 25 Days
Unit 5:	Behavior of Gases	🕓 8 Days
Unit 6:	Solutions	🕓 13 Days
Unit 7:	Thermochemistry	🕓 9 Days
Unit 8:	Acids and Bases	🕓 10 Days
		total : 155 Days

Appendices

Appendix A: Curriculum Refinement Form

Standards Breakdown

Green: Priority Standards **Pink:** Supporting Standards **Gray:** Additional Standards



General Description of the Unit

The unit serves to develop a mindset that chemistry is a central science that is essential to advancements in technology. This unit will enable students to understand that matter is the foundation of all components of life and that energy transfer affects both physical and chemical properties.

Literacy Assessments:

- *Elements, Mixtures, and Compounds Teacher Document*
- *Elements, Mixtures, and Compounds Student DocumentREWORKED Chemistry..solids liquids gases-STUDENT.pdf*

- *Solids, Liquids, & Gases Teacher Document*
- *Solids, Liquids, & Gases Student Document*

Priority Standards

- **C.1.1:** Differentiate between pure substances and mixtures based on physical and chemical properties.
- **C.1.5:** Describe the characteristics of solids, liquids, and gases and changes in state at the macroscopic and microscopic levels.

Supporting Standards

- **C.1.2:** Use chemical properties, extensive, and intensive physical properties to identify substances.
- **C.1.3:** Recognize observable macroscopic indicators of chemical changes.
- **C.1.4:** Describe physical and chemical changes at the particle level.
- **C.1.6:** Demonstrate an understanding of the law of conservation of mass through the use of particle diagrams and mathematical models.
- **C.1.7:** Perform calculations involving density and distinguish among materials based on densities.

Enduring Understandings

- Following safety procedures using personal protective equipment and selecting the appropriate equipment or tools will reduce the risk of injury.
- SI and metrics are the preferred system for presenting scientific information.
- Planning, organizing and analyzing data are essential components of solving problems.
- The classification of matter is based on unique properties.
- Everyday occurrences of changes in matter are related to energy transfer.

Essential Questions

- Why is it necessary to follow safety protocol?
- How do we correctly use units of the metric system?
- Can we solve problems without the scientific method?
- How do we organize and analyze data?
- How do we classify the things in the world around us?
- What is energy/?
- How is the kinetic molecular theory used to describe the states of matter and the relationship to phase changes they can undergo?

Key Concepts

- I can differentiate between pure substances and mixtures based on physical properties. (C.1.1)
- I can differentiate between pure substances and mixtures based on chemical properties. (C.1.1)
- I can describe the characteristics of solids, liquids, and gases on the macroscopic levels. (C.1.5)
- I can describe the characteristics of solids, liquids, and gases on the microscopic levels. (C.1.5)
- I can describe the changes in state of matter at the macroscopic level. (C.1.5)
- I can describe the changes in state of matter at the microscopic level. (C.1.5)

Related Concepts

- I can use chemical properties to identify substances. (C.1.2)
- I can use extensive physical properties to identify substances. (C.1.2)
- I can use intensive physical properties to identify substances. (C.1.2)
- I can recognize chemical changes based on macroscopic observations. (C.1.3)
- I can describe physical changes at the particle level. (C.1.4)
- I can describe chemical changes at the particle level. (C.1.4)
- I can apply the law of conservation of mass through particle diagrams. (C.1.6)
- I can apply the law of conservation of mass through mathematical models. (C.1.6)

	● I can perform calculations involving density. (C.1.7) ● I can distinguish among materials based on densities. (C.1.7)

Science and Engineering Process Standards
- SEPS 2: Developing and Using Models
- SEPS 5: Using Mathematics and Computational Thinking
- SEPS 6: Constructing Explanations and Designing Solutions
- SEPS 8: Obtaining, Evaluating, and Communicating Information

Vocabulary
- Chemical Properties
- Extensive Properties
- Intensive Properties
- Physical Properties
- Density
- Law of Conservation Mass
- Particle Diagrams
- Mathematical Models
- Macroscopic Indicators
- Pure Substance Mixture
- Physical Properties
- Solid
- Liquid
- Gas
- Macroscopic Level
- Microscopic Level
- Matter

Supplemental Resources

Resources & Materials
- Lab 1.1 Laboratory technique & lab safety
- Density lab / Challenge
- Class activity - invisible ink , p. 15
- Class activity - Composition of the sun, page 11
- Properties of Matter PowerPoint https://scec.instructure.com/courses/4378/files/265974/download?wrap=1
- Kahoot - Pin # **05704236**

Texts & Articles
- Newsela - A step-by-step guide to the scientific method
- Newsela - https://scec.instructure.com/courses/4378/files/278187/download?wrap=1
- Matter, elements, and atoms - https://www.khanacademy.org/science/ap-biology/chemistry-of-life/elements-of-life/a/matter-elements-atoms-article
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Videos & Media
- Laboratory Safety Video - Accident at Jefferson High

  Lab Safety Video #1: Accident at Jefferson High
- States of Matter - Solids, Liquids, Gases & Plasma - Chemistry
- Unit Conversion using Dimensional Analysis Unit Conversion Using Dimensional Analysis Tutorial (Factor Label Method) | Crash Chemistry Academy

School Resources

Textbook

Formative Assessments

1.1 ~ The Scope of Chemistry 1.2 ~ Chemistry & You 1.3 ~ Thinking Like a Scientist 1.4 ~ Problem Solving in Chemistry 2.1 ~ Properties of Matter 2.2 ~ Mixtures 2.3 ~ Elements & Compounds 2.4 ~ Chemical Reactions 3.2 ~ Units of Measurement 3.3 ~ Solving Conversion Problems 12.3 ~ Limiting Reagent & Percent Yield	

General Description of the Unit

This unit will serve to trace the development of the atomic model from early Greeks through the current Quantum Mechanical Model. The ability to analyze the relative structure of atoms will lay the foundation for the understanding of how atoms interact. Lay the foundation for understanding chemical bonding wherein students will predict the chemical and physical properties of elements based on their location in the periodic table.

Literacy Assessments:

- *Nuclear vs. Chemical Reactions Teacher Document*
- *Nuclear vs. Chemical Reactions Student Document*

Priority Standards	Supporting Standards
● **C.2.2:** Determine the number of protons, neutrons, and electrons in isotopes and calculate the average atomic mass from isotopic abundance data. ● **C.2.3:** Write the full and noble gas electron configuration of an element, determine its valence electrons, and relate this to its position on the periodic table. ● **C.2.5:** Compare and contrast nuclear reactions with chemical reactions.	● **C.2.1:** Using available experimental data, explain how and why models of atomic structure have changed over time. ● **C.2.4:** Use the periodic table as a model to predict the relative properties of elements based on the pattern of valence electrons and periodic trends. ● **C.2.6:** Describe nuclear changes in matter, including fission, fusion, transmutations, and decays. ● **C.2.7:** Perform half-life calculations when given the appropriate information about the isotope.
Enduring Understandings	**Essential Questions**
● In the universe, atoms are the fundamental building blocks of all matter. ● Modern atomic theory is a mathematical model describing electrons having both wave and particle nature. ● Subatomic particles affect the stability of an atom and unstable atoms can emit radiation. ● The placement of elements on the periodic table is based upon specific properties and characteristics of elements. ● The characteristics of elements follow noticeable patterns and trends based upon their placement on the periodic table.	● What are the relative charge, mass and location of the three major subatomic particles? ● How does the current model of the atom explain atomic structure? ● How do current atomic models of electron arrangement compare with scientific evidence from previous models? ● How are electrons configured around the nucleus? ● What happens when an electron absorbs or releases energy? ● How can an electron exhibit both a wave and particle nature? ● What causes instability in the nucleus? ● What are the processes of fusion and fission? ● How do various properties influence the placement of elements on the periodic table? ● What is the relationship between an element's placement on the periodic table and the noticed trend? ● How can the placement of an element on the periodic table be used to predict a property when a specific trend is observed?
Key Concepts	**Related Concepts**
● I can determine the number of protons, neutrons, and electrons in isotopes. (C.2.2) ● I can calculate the average atomic mass from isotopic abundance data. (C.2.2) ● I can write the full and noble gas electron configuration of an element. (C.2.3) ● I can determine an element's valence electron count. (C.2.3) ● I can connect electron configuration and valence electron count to the element's position on the periodic table. (C.2.3)	● I can use experimental data to explain how atomic models have changed over time. (C.2.1) ● I can use experimental data to explain why atomic models have changed over time. (C.2.1) ● I can use the periodic table as a model to predict the relative properties of elements based on valence electrons. (C.2.4) ● I can use the periodic table as a model to predict the relative properties of elements based on periodic trends. (C.2.4) ● I can describe nuclear changes in matter through fission. (C.2.6)

● I can differentiate between nuclear and chemical reactions. (C.2.5)	● I can describe nuclear changes in matter through fusion. (C.2.6) ● I can describe nuclear changes in matter through transmutation. (C.2.6) ● I can describe nuclear changes in matter through decay. (C.2.6) ● I can use information about isotopes to perform half-life calculations. (C.2.7)

Science and Engineering Process Standards

- SEPS 2: Developing and Using Models
- SEPS 4: Analyzing and Interpreting Data
- SEPS 5: Using Mathematics and Computational Thinking
- SEPS 6: Constructing Explanations and Designing Solutions
- SEPS 8: Obtaining, Evaluating, and Communicating Information

Vocabulary

- Atomic mass
- Atomic structure
- Average atomic mass
- Chemical reactions
- Configuration
- Decay
- Electron
- Electron configuration
- Element
- Fission
- Fusion
- Half-life
- Isotope
- Neutrons
- Noble gas
- Nuclear changes
- Nuclear reactions
- Periodic table
- Periodic trends
- Protons
- Transmutations
- Valence electron

Supplemental Resources

Resources & Materials

- Lab - Flame test
- Pogil Activity - Electron Energy and LIght
- Lab 5 - Atomic Structure - Rutherford's Experiment
- Structure of the Nuclear Atom PowerPoint - https://scec.instructure.com/courses/4378/files/445174/download?wrap=1
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Texts & Articles

- Newsela article - Rare Earth Metals - https://scec.instructure.com/courses/4378/files/435251/download?wrap=1
- Covid 19 Newsela article - https://scec.instructure.com/courses/4378/files/470432/download?wrap=1
- Atomic structure video - https://www.khanacademy.org/science/biology/chemistry--of-life/elements-and-atoms/a/atomic-number-atomic-mass-and-isotopes-article
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Videos & Media

- History of Atomic Theory - https://youtu.be/agjG7kgixJs
- Atomic weight problems - https://youtu.be/EPvd-3712U8
- Elements and atoms video - https://youtu.be/IFKnq9QM6_A
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School Resources

Textbook

Formative Assessments

4.1 ~ Defining the Atom 4.2 ~ Structure of the Nuclear Atom 4.3 ~ Distinguishing Among Atoms 5.2 ~ Electron Arrangement in Atoms 6.2 ~ Classifying the Elements 6.3 ~ Periodic Trends 7.1 ~ Ions 11.2 ~ Types of Chemical Reactions 25.1 ~ Nuclear Radiation 25.2 ~ Nuclear Transformations 25.3 ~ Fission & Fusion 25.4 ~ Radiation in Your Life	

General Description of the Unit

This unit will set the foundation for understanding chemical reactions. Having an understanding of an element's properties lends to a student's understanding of how atoms can combine to form stable compounds.

Literacy Assessments:

- *Elements, Ionic, & Covalent Compounds Teacher Document*
- *Elements, Ionic, & Covalent Compounds Student Document*

Priority Standards	**Supporting Standards**
● **C.3.1:** Investigate the observable characteristics of elements, ionic, and covalent compounds.	● **C.3.2:** Compare and contrast how ionic and covalent compounds form. ● **C.3.3:** Draw structural formulas for simple molecules and determine their molecular shape. ● **C.3.5:** Use laboratory observations and data to compare and contrast ionic, covalent, network, metallic, polar, and non-polar substances with respect to constituent particles, strength of bonds, melting, and boiling points and conductivity; provide examples of each type. ● **C.3.6:** Use structural formulas of hydrocarbons to illustrate carbon's ability to form single and multiple bonds within a molecule.
Enduring Understandings	**Essential Questions**
● 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. ● Chemical formulas can be used to represent the ratios in which some atoms combine to form compounds. ● A compound's structure and shape can be determined through an understanding of the interactions between valence pair electrons. ● Intermolecular forces determine the properties of compounds.	● Why do elements form chemical bonds in nature and how does this determine their properties? ● How are the properties of an element determined by its electron configuration? ● 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 does VSEPR Theory allow us to predict molecular geometry? ● Why is an understanding of intermolecular forces important?
Key Concepts	**Related Concepts**
● I can analyze the characteristics of elements. (C.3.1) ● I can analyze the characteristics of ionic compounds. (C.3.1) ● I can analyze the characteristics of covalent compounds. (C.3.1)	● I can differentiate between ionic and covalent compound forms. (C.3.2) ● I can draw structural formulas for simple molecules. (C.3.3) ● I can determine the molecular shape of simple molecules from a structural formula. (C.3.3) ● I can use data to differentiate between ionic, polar covalent and non-polar covalent substances with respect to constituent particles. (C.3.5) ● I can use data to differentiate between ionic, covalent, network, and metallic solids with respect to constituent particles. (C.3.5) ● I can use data to differentiate between ionic, polar covalent and non-polar covalent substances with respect to strength of bonding. (C.3.5) ● I can use data to differentiate between ionic, covalent, network, and metallic solids with respect to strength of bonding. (C.3.5)

	● I can use data to differentiate between ionic, polar covalent and non-polar covalent substances with respect to melting and boiling points. (C.3.5) ● I can use data to differentiate between ionic, covalent, network, and metallic solids with respect to melting and boiling points. (C.3.5) ● I can use data to differentiate between ionic, polar covalent and non-polar covalent substances with respect to conductivity. (C.3.5) ● I can use data to differentiate between ionic, covalent, network, and metallic solids with respect to conductivity. (C.3.5) ● I can illustrate carbon's ability to form single bonds within a molecule using structural formulas. (C.3.6) ● I can illustrate carbon's ability to form multiple bonds within a molecule using structural formulas. (C.3.6)

Science and Engineering Process Standards

- SEPS 3: Planning and Carrying Out Investigations
- SEPS 4: Analyzing and Interpreting Data
- SEPS 8: Obtaining, Evaluating, and Communicating Information

Vocabulary

- Boiling point
- Chemical bonds
- Conductivity
- Covalent bonds
- Covalent Compound
- Covalent substance
- Dipole-dipole force
- Double bonds
- Electronegativity
- Elements
- Hydrocarbons
- Hydrogen bonds
- Intermolecular forces
- Ionic bonds
- Ionic Compound
- Ionic substance
- Lewis Structure
- London Dispersion Force
- Melting point
- Metallic solids
- Molecular geometry
- Network solid
- Non-polar substance
- Polar substance
- Single bonds
- Triple bonds
- Valence electrons
- VSEPR Theory

Supplemental Resources

Resources & Materials

- Ions PowerPoint - https://scec.instructure.com/courses/4378/files/612675?wrap=1
- Pogil Activity - Periodic Trends https://scec.instructure.com/courses/4378/files/597920/download?wrap=1
- Chemthink Ionic Bonding Activity - https://illinois.pbslearningmedia.org/resource/lsps07.sci.phys.matter.ionicbonding/ionic-bonding/

Texts & Articles

- Research Paper Guidelines - https://scec.instructure.com/courses/4378/files/648105?wrap=1
- Single and Multiple covalent bonds - https://www.khanacademy.org/science/class-11-chemistry-india/xfbb6cb8fc2bd00c8:in-in-chemical-bonding-and-molecular-structure/xfbb6cb8fc2bd00c8:in-in-kossel-lewis-approach-to-chemical-bond/a/single-and-multiple-covalent-bonds

Videos & Media

- Ions Video - https://scec.instructure.com/courses/4378/files/612675?wrap=1
- Metals video - https://youtu.be/vOuFTuvf4qk
- Metals and their properties PowerPoint - https://scec.instructure.com/courses/4378/files/641444?wrap=1
- How to draw Lewis Structure - https://phet.colorado.edu/sims/html

	● Naming ions and ionic compounds - https://www.khanacademy.org/science/ap-chemistry/atoms-compounds-ions-ap/compounds-and-ions-ap/a/naming-monatomic-ions-and-ionic-compounds ●	/molecule-shapes/latest/molecule-shapes_en.html

School Resources	
Textbook 6.1 ~ Organizing the Elements 7.2 ~ Ionic Bonds & Ionic Compounds 7.3 ~ Bonding in Metals 8.1 ~ Molecular Compounds 8.2 ~ The Nature of Covalent Bonding 8.3 ~ Bonding Theories 8.4 ~ Polar Bonds & Molecules 9.2 ~ Naming & Writing Formulas for Ionic Compounds 9.3 ~ Naming & Writing Formulas for Molecular Compounds 22.1 ~ Hydrocarbons 22.2 ~ Unsaturated Hydrocarbons 22.4 ~ Isomers	**Formative Assessments**

General Description of the Unit

This unit will help students understand how substances combine, decompose, or react to form new, and different compounds that are essential to drive the world around us. By understanding quantitative evaluations of reactions, students are able to predict the starting or ending products formed in a chemical reaction. The applications of chemistry focus largely on chemical reactions and their commercial applications require knowledge of several of its characteristics including stoichiometry, energy, and rate.

Priority Standards

- **C.4.1:** Describe, classify, and give examples of various kinds of reactions: synthesis (i.e., combination), decomposition, single displacement, double displacement, acid/base, and combustion.
- **C.4.4:** Apply the mole concept to determine the mass, moles, number of particles, or volume of a gas at STP, in any given sample, for an element or compound.

Supporting Standards

- **C.4.2:** Predict products of simple reactions as listed in C.4.1.
- **C.4.3:** Balance chemical equations and use the law of conservation of mass to explain why this must be true.
- **C.4.5:** Use a balanced chemical equation to calculate the quantities of reactants needed and products made in a chemical reaction that goes to completion.
- **C.4.6:** Perform calculations to determine the composition of a compound or mixture when given the necessary information.
- **C.4.7:** Apply lab data to determine the empirical and molecular formula of a compound.

Enduring Understandings

- 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 we observe in everyday life.
- The mole is the chemist's unit for specifying the amount of the material.
- Mass ratios between different compounds in a reaction can answer quantitative questions concerning reactants and products.
- The rate of a reaction is influenced by several factors.
- All reactions work toward equilibrium.

Essential Questions

- Why must the mass of reactants equal the mass of products in a chemical reaction?
- What characteristics are used to classify chemical reactions?
- How can we quantify something that we can't see? How do we know that we are right?
- Why is a mathematical relationship an important measurement of chemistry?
- How does collision theory explain the factors affecting reaction rate?
- How does nature correct unbalance?
- How do chemical reactions attain and maintain a state of equilibrium?

Key Concepts

- I can describe the six types of reactions. (C.4.1)
- I can classify the six types of reactions. (C.4.1)
- I can provide examples of the six types of reactions. (C.4.1)
- I can use the mole concept to determine the mass in any sample at STP. (C.4.4)
- I can use the mole concept to determine the moles in any sample at STP. (C.4.4)
- I can use the mole concept to determine the number of particles in any sample at STP. (C.4.4)
- I can use the mole concept to determine the volume of a gas in any sample at STP. (C.4.4)

Related Concepts

- I can predict the products of simple reactions listed in C.4.1. (C.4.2)
- I can balance chemical equations. (C.4.3)
- I can use the law of conservation of mass to explain why chemical equations must be balanced. (C.4.3)
- I can use a balanced chemical equation to calculate the quantities of reactants needed in a completed chemical reaction. (C.4.5)
- I can use a balanced chemical equation to calculate the products made in a completed chemical reaction. (C.4.5)
- I can determine the composition of a compound. (C.4.6)
- I can determine the composition of a mixture. (C.4.6)
- I can apply lab data to determine the empirical formula of a compound. (C.4.7)
- I can apply lab data to determine the molecular formula of a compound. (C.4.7)

Science and Engineering Process Standards

- SEPS 1: Asking Questions and Defining Problems
- SEPS 4: Analyzing and Interpreting Data

Vocabulary

- Acid/Base
- Avagadro's number

● SEPS 5: Using Mathematics and Computational Thinking ● SEPS 6: Constructing Explanations and Designing Solutions ● SEPS 8: Obtaining, Evaluating, and Communicating Information		● Coefficient ● Combustion ● Composition ● Compound ● Decomposition ● Double Displacement ● Empirical formula ● Formula unit ● Law of Conservation of Mass ● Mass ● Mixture ● Molar mass ● Mole ratio ● Molecular formula ● Molecules ● Moles ● Neutralization ● Product ● Reactant ● Single Displacement ● Standard temperature and pressure ● Stoichiometry ● Synthesis ● Volume

Supplemental Resources

Resources & Materials	Texts & Articles	Videos & Media
● Pogil Activity - Types of Reactions ● Lab 15 - Reactivity of metals ● Lab 20 - Balancing Chemical Equations ●	● Stoichiometry article - https://www.khanacademy.org/science/class-11-chemistry-india/xfbb6cb8fc2bd00c8:in-in-some-basic/xfbb6cb8fc2bd00c8:in-in-stoichiometry/a/stoichiometry-article ● Double replacement reactions - https://www.khanacademy.org/science/chemistry/chemical-reactions-stoichiome/types-of-chemical-reactions/a/double-replacement-reactions?modal=1 ● Molecular, net ionic equations - https://www.khanacademy.org/science/chemistry/chemical-reactions-stoichiome/types-of-chemical-reactions/a/complete-ionic-and-net-ionic-equations?modal=1 ●	● Types of Chemical Reactions - https://youtu.be/iIJD8RNLpS0 ● Stoichiometry - https://youtu.be/7Cfq0ilw7ps ● The Mole - https://youtu.be/H3VKLRNAQuY ●

School Resources

Textbook	Formative Assessments

10.1 ~ The Mole: A Measurement of Matter 10.2 ~ Mole-Mass & Mole-Volume Relationships 10.3 ~ Percent Composition & Chemical Formulas 11.1 ~ Describing Chemical Reactions 11.2 ~ Types of Chemical Reactions 12.1 ~ The Arithmetic of Equations 12.2 ~ Chemical Calculations 12.3 ~ Limiting Reagent & Percent Yield 19.4 ~ Neutralization Reactions	

General Description of the Unit

Students will be able to independently use their learning to explain and predict the behavior of a gas under new experimental conditions.

Priority Standards

- **C.5.1:** Use the kinetic molecular theory with the combined and ideal gas laws to explain changes in volume, pressure, moles, and temperature of a gas.

Supporting Standards

- **C.3.4:** Write chemical formulas for ionic compounds and covalent compounds given their names and vice versa.
- **C.3.5:** Use laboratory observations and data to compare and contrast ionic, covalent, network, metallic, polar, and non-polar substances with respect to constituent particles, strength of bonds, melting, and boiling points and conductivity; provide examples of each type.
- **C.5.2:** Apply the ideal gas equation (PV = nRT) to calculate the change in one variable when another variable is changed and the others are held constant.
- **C.5.3:** Use lab data and a balanced chemical equation to calculate volume of a gas at STP and non STP conditions, assuming that the reaction goes to completion and the ideal gas law holds.

Enduring Understandings

- The behavior of gases in the real world can be approximated by mathematical relations between pressure, temperature, volume and amount.
- Gas particles move in a straight line and they collide inelastically, which results in a gas pressure when confined.
- Temperature is the average kinetic energy of these particles.
- The combined gas law relates the pressure, volume and temperature of an ideal gas.
- Dalton's law of partial pressure fully describes gas mixtures.
- Stoichiometry, along with the ideal gas law, can fully describe the volume of gases produced / consumed in chemical reactions.

Essential Questions

- How do gases respond to changes in temperature, pressure and volume?
- Why is an ideal gas useful even though ideal gases do not exist?
- What is the molecular motion of gas particles and how does this motion differ from liquids and solids?
- What is temperature, and what does it measure?
- How are volume, pressure, and temperature related?
- How does the number of gas particles relate to gas pressure?
- How are mixtures of gases dealt with?
- How is stoichiometry applied to the gaseous state?

Key Concepts

- I can use the kinetic molecular theory to explain changes in volume, pressure, moles, and the temperature of a gas. (C.5.1)
- I can use the combined gas law to explain changes in volume, pressure, moles, and the temperature of a gas. (C.5.1)
- I can use the ideal gas law to explain changes in volume, pressure, moles, and the temperature of a gas. (C.5.1)

Related Concepts

- I can write chemical formulas for ionic compounds given their names. (C.3.4)
- I can name ionic compounds given their formula. (C.3.4)
- I can write chemical formulas for covalent compounds given their names. (C.3.4)
- I can name covalent compounds given their formula. (C.3.4)
- I can use data to differentiate between ionic, polar covalent and non-polar covalent substances with respect to constituent particles. (C.3.5)
- I can use data to differentiate between ionic, covalent, network, and metallic solids with respect to constituent particles. (C.3.5)
- I can use data to differentiate between ionic, polar covalent and non-polar covalent substances with respect to strength of bonding. (C.3.5)

	● I can use data to differentiate between ionic, covalent, network, and metallic solids with respect to strength of bonding. (C.3.5) ● I can use data to differentiate between ionic, polar covalent and non-polar covalent substances with respect to melting and boiling points. (C.3.5) ● I can use data to differentiate between ionic, covalent, network, and metallic solids with respect to melting and boiling points. (C.3.5) ● I can use data to differentiate between ionic, polar covalent and non-polar covalent substances with respect to conductivity. (C.3.5) ● I can use data to differentiate between ionic, covalent, network, and metallic solids with respect to conductivity. (C.3.5) ● I can calculate the pressure, volume, moles of gas, or temperature using the ideal gas equation when the other variables are held constant. (C.5.2) ● I can use lab data and a balanced chemical equation to calculate volume of a gas at STP. (C.5.3) ● I can lab data and a balanced chemical equation to calculate volume of a gas at non STP. (C.5.3)
Science and Engineering Process Standards ● SEPS 3: Planning and Carrying Out Investigations ● SEPS 4: Analyzing and Interpreting Data ● SEPS 5: Using Mathematics and Computational Thinking ● SEPS 6: Constructing Explanations and Designing Solutions ● SEPS 8: Obtaining, Evaluating, and Communicating Information	**Vocabulary** ● Anion ion ● Boiling point ● Boyles' Law ● Cation ion ● Charles' Law ● Combined Gas Law ● Conductivity ● Covalent substance ● Dipole-dipole force ● Electronegativity ● Formula unit ● Hydrogen bonds ● Ideal Gas Law ● Intermolecular forces ● Ionic substance ● Kinetic Molecular Theory ● London Dispersion Force ● Melting point ● Metallic solids ● Molecule ● Moles ● Network solid ● Non-polar ● Non-polar substance ● Polar ● Polar substance ● Pressure ● STP-standard temperature and pressure ● Subscripts ● Temperature ● Universal Gas Constant ● Volume

Supplemental Resources

Resources & Materials	Texts & Articles	Videos & Media

● Lab 23 - Pressure-Volume Relationships ● Boyle's Law Lab ● Molar Volume of H2 Lab (Mg + HCl)	● Dalton's Law of Partial Pressures - https://www.khanacademy.org/science/chemistry/gases-and-kinetic-molecular-theory/ideal-gas-laws/a/daltons-law-of-partial-pressure?modal=1 ● Non-ideal behavior of gases - https://www.khanacademy.org/science/chemistry/gases-and-kinetic-molecular-theory/non-ideal-gas-behavior/a/non-ideal-behavior-of-gases?modal=1 ●	● Gas Law problems - https://youtu.be/2ZtLDXF1V6w ● Kinetic Molecular Theory - https://youtu.be/iAsP-9m2aH0 ● Dalton's Law of Partial Pressure - https://youtu.be/J7YRwU7IV8Q ●

School Resources	
Textbook 14.1 Properties of Gases 14.2 The Gas Laws 14.3 Ideal Gases	**Formative Assessments**

General Description of the Unit

Most of the substances we encounter in daily life are mixtures. Many essential chemical reactions occur in aqueous solutions because water is capable of dissolving so many substances.

Literacy Assessments:

- *Solutions Teacher Document*
- *Solutions Student Document*

Priority Standards

- **C.7.1:** Describe the composition and properties of solutions.

Supporting Standards

- **C.7.2:** Explain how temperature, pressure, and polarity of the solvent affect the solubility of a solute.
- **C.7.3:** Describe the concentration of solutes in a solution in terms of molarity. Perform calculations using molarity, mass, and volume. Prepare a sample of given molarity provided a known solute.

Enduring Understandings

- Concentrations of a solution can be expressed in different ways.
- There are different factors that affect the solubility of a solution.

Essential Questions

- What are the various types of concentrations that are used to describe a solution?
- How can these different forms of concentrations of the solution be calculated? (Honors)
- What factors affect the solubility of a solution?

Key Concepts

- I can describe the composition of solutions. (C.7.1)
- I can describe the properties of solutions. (C.7.1)

Related Concepts

- I can explain how temperature of the solvent affects the solubility of a solute. (C.7.2)
- I can explain how pressure of the solvent affects the solubility of a solute. (C.7.2)
- I can explain how polarity of the solvent affects the solubility of a solute. (C.7.2)
- I can describe the concentration of solutes in a solution in terms of molarity. (C.7.3)
- I can calculate for an unknown based on known variables of molarity, mass, and volume. (C.7.3)
- I can prepare a sample of given molarity based on a known solute. (C.7.3)

Science and Engineering Process Standards

- SEPS 3: Planning and Carrying Out Investigations
- SEPS 5: Using Mathematics and Computational Thinking
- SEPS 8: Obtaining, Evaluating, and Communicating Information

Vocabulary

- Concentration
- Molarity
- Polarity
- Pressure
- Solute
- Solution
- Solvent
- Temperature
- Universal solvent

Supplemental Resources

Resources & Materials

- Lab 30 - Factors affecting Solubility
- POGIL - Solubility
- PhET - Salt and Sugar Solutions
- Molarity lab - Sugar Solution
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Texts & Articles

- Molarity - https://www.khanacademy.org/science/ap-chemistry/states-of-matter-and-intermolecular-forces-ap/mixtures-and-solutions-ap/a/molarity
- What is a solution? - https://www.chem.purdue.edu/gchelp/solutions/whatis.html

Videos & Media

- Solute, Solvent, and Solutions - https://youtu.be/MDHlaTHbEgM
- Solubility - https://youtu.be/KVZ_KS45rVg
- Dilution - https://youtu.be/eJbgyGHKl3c
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	● Factors that affect solubility - https://www.infoplease.com/math-science/chemistry/chemistry-factors-that-affect-solubility ●	

School Resources	
Textbook 16.1 Properties of Solutions 16.2 Concentrations of Solutions 16.3 Colligative Properties of Solutions	**Formative Assessments**

General Description of the Unit

Energy is the essence of our very existence as individuals and as a society. Students should understand that the interconversions of energy are fundamental to chemical processes.

Literacy Assessments:

- *Thermochemistry: Atoms & Molecules Teacher Document*
- *Thermochemistry: Atoms & Molecules Student Document*

- *Conservation of Energy & Chemical Reaction Teacher Document*
- *Conservation of Energy & Chemical Reaction Student Document*

Priority Standards	**Supporting Standards**
● **C.6.1:** Explain that atoms and molecules are in constant motion and that this motion increases as thermal energy increases.	● **C.6.2:** Distinguish between the concepts of temperature and heat flow in macroscopic and microscopic terms. ● **C.6.3:** Classify chemical reactions and phase changes as exothermic or endothermic based on enthalpy values. Use a graphical representation to illustrate the energy changes involved. ● **C.6.4:** Perform calculations involving heat flow, temperature changes, and phase changes by using known values of specific heat, phase change constants, or both.
Enduring Understandings	**Essential Questions**
● Energy is conserved during all chemical processes. ● Energy is a conserved quantity, which means it cannot be created or destroyed. ● Different forms of energy have to do with the motion of atoms and molecules within a substance. ● All chemical reactions require the use of energy in some way, which is why one's body has a steady temperature and mixing chemicals can cause heat to be released or require heat to react (cold).	● How is energy involved in chemical processes? ● How is exothermic and endothermic reactions defined in terms of a system and its surroundings? ● What is energy? ● How do potential and kinetic energy differ? ● How can chemical potential energy be related to the heat lost or gained in chemical reactions? ● How is the amount of heat absorbed or released by a substance calculated as its temperature changes? ● How is a calorimeter used to measure energy that is absorbed or released? ● What do enthalpy and enthalpy change mean in terms of chemical reactions and processes? ● How are thermochemical equations for chemical reactions and other processes written? ● How is energy lost or gained during changes of state? ● How is the heat that is absorbed or released in a chemical reaction calculated? ● How is Hess's law applied to calculate the enthalpy change for a reaction? ● What is the difference between spontaneous and non-spontaneous processes?
Key Concepts	**Related Concepts**
● I can explain that atoms and molecules are in constant motion. (C.6.1) ● I can explain that molecular motion increases as thermal energy increases. (C.6.1)	● I can differentiate between temperature and heat flow on the macroscopic level. (C.6.2) ● I can differentiate between temperature and heat flow on the microscopic level. (C.6.2) ● I can classify chemical reactions and phase changes as exothermic or endothermic. (C.6.3)

	● I can use graphical representations to illustrate the energy changes involved in exothermic or endothermic phase changes. (C.6.3) ● I can perform calculations of energy change during temperature changes using known values of specific heat. (C.6.4) ● I can perform calculations of energy change during phase changes using known values of phase change constants. (C.6.4) ● I can perform calculations of energy change during temperature change and phases using known values of specific heat and phase change constants. (C.6.4)

Science and Engineering Process Standards	**Vocabulary**
●	● Endothermic ● Enthalpy ● Exothermic ● Heat ● Heat of fusion ● Heat of vaporization ● Kinetic Energy ● Kinetic Molecular Theory ● Macroscopic level ● Mass ● Microscopic level ● Molar heat capacity ● Phase change ● Specific heat capacity ● Temperature ● Velocity

Supplemental Resources

Resources & Materials	**Texts & Articles**	**Videos & Media**
● Lab 34 - The specific heat of a metal ● POGIL - Bond Energies ● Handwarmer Lab ● ChemMatters - Why doesn't cold exist ●	● Endothermic vs. Exothermic reactions - https://www.khanacademy.org/test-prep/mcat/chemical-processes/thermochemistry/a/endothermic-vs-exothermic-reactions ● Thermochemistry - https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_-_The_Central_Science_(Brown_et_al.)/05._Thermochemistry ● Energy and Enthalpy - https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_-_The_Central_Science_(Brown_et_al.)/05._Thermochemistry ●	● Thermochemistry equations and problems - https://youtu.be/GL3gCBUua4c ● Specific Heat Capacity - https://youtu.be/IoHXMaiwT80 ● Enthalpy changes - https://youtu.be/Idv2C8HBbug ●

School Resources

Textbook	**Formative Assessments**
17.1 The Flow of Energy 17.2 Measuring & Expressing Enthalpy Changes 17.3 Heat in Changes of State 18.1 Rates of Reaction	

General Description of the Unit

Students will be able to independently use their learning to predict and execute neutralization reactions to determine the concentration of the acid or base in an unknown solution.

Literacy Assessments:

- *Uses of Acids, Bases, and the pH Scale Teacher Document*
- *Uses of Acids, Bases, and the pH Scale Student Document*

Priority Standards

- **C.8.1:** Classify solutions as acids or bases and describe their characteristic properties.

Supporting Standards

- **C.8.2:** Compare and contrast the strength of acids and bases in solutions.
- **C.8.3:** Given the hydronium ion and/or the hydroxide ion concentration, calculate the pH and/or the pOH of a solution. Explain the meanings of these values.

Enduring Understandings

- The pH scale is a measure of the amount of hydronium ions present in a solution.
- Just because an acid or base is labeled a “weak” acid or a “weak” base does not mean it is not dangerous. Some weak acids and bases can cause serious burns.
- Salt is a general term used to describe a substance that is created when an acid is neutralized by a base.
- Water can act as an acid and a base.
- Biologists and engineers must understand acids and bases in order to build structures that will withstand corrosive effects of acids and bases and/or maintain healthy ecosystems in nature.

Essential Questions

- What are the physical and chemical properties of acids and bases?
- How are solutions classified as acidic, basic, or neutral?
- How do the Arrhenius, Bronsted-Lowry, and Lewis models of acids and bases compare? • How is the strength of an acid or base related to its degree of ionization? • How does the strength of a weak acid compare with the strength of its conjugate base? • What are pH and pOH? • How are the pH and pOH of aqueous solutions calculated?

Key Concepts

- I can classify solutions as acids or bases. (C.8.1)
- I can describe the properties of acids and bases. (C.8.1)

Related Concepts

- I can differentiate between strong and weak acids and bases. (C.8.2)
- I can calculate the pH of a solution given the hydronium ion concentration, hydroxide ion concentration, or the pOH. (C.8.3)
- I can calculate the pOH of a solution given the hydronium ion concentration, hydroxide ion concentration, or the pH. (C.8.3)
- I can explain the meanings of hydronium ion concentration, hydroxide ion concentration, pH and pOH. (C.8.3)

Science and Engineering Process Standards

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Vocabulary

- Acid
- Base
- pH
- pOH
- Hydronium Ion
- Hydroxide Ion

Supplemental Resources

Resources & Materials

- Class Activity - using a pH meter
- Lab 40 - Estimation of pH
- Lab 42 - Neutralization Reactions
- Lab Practical 19.2 - Acids/Ba

Texts & Articles

- Acids and Bases - https://www.khanacademy.org/science/chemistry/acids-and-bases-topic/acids-and-bases/a/arrhenius-acids-and-bases?modal=1

Videos & Media

- Acids and Bases - Basic Introduction - https://youtu.be/FM2MpMbV0rw
- Acids and Bases and pH - https://youtu.be/Xeuyc55LgiY

	• Acids and Bases - https://www.sciencenewsforstudents.org/article/explainer-what-are-acids-and-bases • Acids and Bases - https://www.sciencenewsforstudents.org/article/explainer-what-are-acids-and-bases •	• Acids and Bases - https://youtu.be/mnbS56HQbaU •

School Resources	
Textbook 19.1 Acid-Base Theories 19.2 Hydrogen Ions & Acidity 19.3 Strengths of Acids & Bases 19.4 Neutralization Reactions 19.5 Salts in Solution	**Formative Assessments**