

HS CP Chemistry 1

Huntingdon Area School District

UNITS (10/10 SELECTED)

SUGGESTED DURATION

| | |
|--|-------------------|
|  Unit 1: The Central Science | <i>14 lessons</i> |
|  Unit 2: Matter---Properties and Changes | <i>15 lessons</i> |
|  Unit 3: The Structure of the Atom | <i>14 lessons</i> |
|  Unit 4: Electrons in Atoms | <i>12 lessons</i> |
|  Unit 5: The Periodic Table and Periodic Law | <i>19 lessons</i> |
|  Unit 6: Ionic Compounds and Metals | <i>13 lessons</i> |
|  Unit 7: Covalent Bonding | <i>23 lessons</i> |
|  Unit 8: Chemical Reactions | <i>12 lessons</i> |
|  Unit 9: The Mole | <i>18 lessons</i> |
|  Unit 10: Stoichiometry | <i>21 lessons</i> |

Unit 1: The Central Science

HS CP Chemistry 1

UNIT OVERVIEW

Provides students with a review of the nature of science and the practices of science investigation and the engineering design process. It also provides review and practice of basic computational and graphing skills.

STANDARDS/EXPECTATIONS

Pennsylvania - Grade 9-12 - Science, Technology & Engineering, And Environmental Literacy & Sustainability Standards (STEELS) (2023)

3.2.9-12.L

3.2.9-12.V

BIG IDEAS

Big Ideas

- What is Chemistry?
- Measurement
- Uncertainty in Data
- Representing Data

ESSENTIAL QUESTIONS

Essential Questions

- What do plants and buildings have in common?
- How can chemistry help you to understand the world?
- Why do scientists use standardized units?
- Why are significant figures important?
- How can displaying data help you interpret it?

Unit 1: The Central Science

HS CP Chemistry 1

LEARNING TARGETS: KNOWLEDGE & SKILLS

| Knowledge | Skills |
|--|--|
| Students will know (Acquired Knowledge) | Students can do (Acquired Skill) |
| Students will define chemistry as a discipline. | Students will understand the role of chemistry as a science central to a wide variety of questions. |
| Students will learn about the base units for scientific measurements | Students will be able to calculate basic operations with units of measurements to build a foundation for quantifying their investigations. |
| Students will learn about accuracy and precision. | Students will learn how significant figures reflect the precision of a measurement, further developing their ability to analyze data. |
| Students will analyze graph. | Students will be able to use graphs to support their ability to communicate the results of their investigations. |
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EVIDENCE OF LEARNING & ASSESSMENT

| Name of Assessment | Type (formative, summative, project-based, diagnostic) | Description |
|--------------------------|--|---|
| What is Chemistry? Quiz | Formative | Lesson check-in |
| Measurement Quiz | Formative | Lesson check-in |
| Uncertainty in Data Quiz | Formative | Lesson check-in |
| Representing Data Quiz | Formative | Lesson check-in |
| Central Science Test | Summative | Assesses student knowledge, understanding, and application of module concepts |

Unit 2: Matter---Properties and Changes

HS CP Chemistry 1

UNIT OVERVIEW

Students will learn that everything is made of matter, and this matter can undergo physical and chemical changes.

STANDARDS/EXPECTATIONS

Pennsylvania - Grade 9-12 - Science, Technology & Engineering, And Environmental Literacy & Sustainability Standards (STEELS) (2023)

3.2.9-12.A

3.2.9-12.C

3.2.9-12.G

BIG IDEAS

Big Ideas

- Properties of Matter
- Changes in Matter
- Elements and Compounds
- Mixtures of Matter

ESSENTIAL QUESTIONS

Essential Questions

- Why is this volcano spewing bright blue flames?
- What are the differences between physical and chemical properties?
- How does a substance change when it burns?
- What are elements and compounds?
- Would the substance still burn blue if it was mixed with another substance?

Unit 2: Matter---Properties and Changes

HS CP Chemistry 1

LEARNING TARGETS: KNOWLEDGE & SKILLS

| Knowledge | Skills |
|--|---|
| Students will know (Acquired Knowledge) | Students can do (Acquired Skill) |
| Students will explore basic properties of matter. | Students can identify physical and chemical properties of matter. |
| Students will understand the different changes that matter undergoes. | Students can identify physical and chemical changes and how that relates to the color of flame coming out of the volcano. |
| Students will know how elements combine to form compounds. | Students can relate elements and compounds to the understanding of how volcanoes transform matter. |
| Students will know the difference between homogeneous and heterogenous mixtures. | Students can separate mixtures based on the type of mixture. |
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EVIDENCE OF LEARNING & ASSESSMENT

| Name of Assessment | Type (formative, summative, project-based, diagnostic) | Description |
|--------------------------------------|--|---|
| Properties of Matter Quiz | Formative | Lesson check-in |
| Changes in Matter Quiz | Formative | Lesson check-in |
| Elements and Compounds Quiz | Formative | Lesson check-in |
| Mixtures of Matter Quiz | Formative | Lesson check-in |
| Matter---Properties and Changes Test | Summative | Assess student knowledge, understanding, and application of module concepts |

Unit 3: The Structure of the Atom

HS CP Chemistry 1

UNIT OVERVIEW

Students will learn that the atom is the fundamental building block of matter.

STANDARDS/EXPECTATIONS

Pennsylvania - Grade 9-12 - Science, Technology & Engineering, And Environmental Literacy & Sustainability Standards (STEELS) (2023)

3.2.9-12.A

3.2.9-12.C

3.2.9-12.B

3.2.9-12.H

3.2.9-12.L

3.2.9-12.S

BIG IDEAS

Big Ideas

- Early Ideas About Matter
- Defining the Atom
- How Atoms Differ
- Unstable Nuclei and Radioactive Decay

ESSENTIAL QUESTIONS

Essential Questions

- What is matter made of?
- How has our understanding of matter changed over time?
- What does an atom look like?
- Are all atoms identical?
- How can atoms change?

Unit 3: The Structure of the Atom

HS CP Chemistry 1

LEARNING TARGETS: KNOWLEDGE & SKILLS

| Knowledge | Skills |
|--|--|
| Students will know (Acquired Knowledge) | Students can do (Acquired Skill) |
| Student will summarize the early theories of the nature of matter. | Students can relate the modern atomic theory to the law of conservation of mass. |
| Students will define the different parts of the atom. | Students can relate the parts of an atom to the overall structure of matter. |
| Students will study atomic number, mass number, and isotopes. | Students can relate information in the periodic table and atomic symbols to types of atoms and their constituents. |
| Students will be introduced to the basic types of radiation. | Student can relate radiation and its impact on matter and how matter changes. |
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EVIDENCE OF LEARNING & ASSESSMENT

| Name of Assessment | Type (formative, summative, project-based, diagnostic) | Description |
|--|--|---|
| Early Ideas About Matter Quiz | Formative | Lesson check-in |
| Defining the Atom Quiz | Formative | Lesson check-in |
| How Atoms Differ Quiz | Formative | Lesson check-in |
| Unstable Nuclei and Radioactive Decay Quiz | Formative | Lesson check-in |
| The Structure of the Atom Test | Summative | Assess student knowledge, understanding, and application of module concepts |

Unit 4: Electrons in Atoms

HS CP Chemistry 1

UNIT OVERVIEW

Students will learn that the atoms of each element have a unique arrangement of electrons, and the valence electrons primarily contribute to the chemical properties of the element.

STANDARDS/EXPECTATIONS

Pennsylvania - Grade 9-12 - Science, Technology & Engineering, And Environmental Literacy & Sustainability Standards (STEELS) (2023)

3.2.9-12.A

3.2.9-12.C

3.2.9-12.W

3.2.9-12.T

3.2.9-12.V

BIG IDEAS

Big Ideas

- Light and Quantized Energy
- Quantum Theory and the Atom
- Electron Configuration

ESSENTIAL QUESTIONS

Essential Questions

- How do we know what stars are made of?
- What is light made of?
- Why does every element produce a unique atomic emission spectrum?
- How are electrons arranged in atoms?

Unit 4: Electrons in Atoms

HS CP Chemistry 1

LEARNING TARGETS: KNOWLEDGE & SKILLS

| Knowledge | Skills |
|--|--|
| Students will know (Acquired Knowledge) | Students can do (Acquired Skill) |
| Students will study the dual nature of light. | Students can interpret atomic emission spectra and analyze the light from the stars. |
| Students will apply the idea of quantized energy to the atom. | Students can understand how different colors of light can signal different elements in stars. |
| Students will learn to model the arrangements of electrons in atoms. | Students can draw orbital diagrams, write electron configurations, and draw Bohr models to explain how electrons are arranged. |
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EVIDENCE OF LEARNING & ASSESSMENT

| Name of Assessment | Type (formative, summative, project-based, diagnostic) | Description |
|----------------------------------|--|---|
| Light and Quantized Energy Quiz | Formative | Lesson check-in |
| Quantum Theory and the Atom Quiz | Formative | Lesson check-in |
| Electron Configuration Quiz | Formative | Lesson check-in |
| Electrons in Atoms Test | Summative | Assesses student knowledge, understanding, and applicaiton of module concepts |
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Unit 5: The Periodic Table and Periodic Law

HS CP Chemistry 1

UNIT OVERVIEW

Students will learn how periodic trends in the properties of atoms allow us to predict physical and chemical properties.

STANDARDS/EXPECTATIONS

Pennsylvania - Grade 9-12 - Science, Technology & Engineering, And Environmental Literacy & Sustainability Standards (STEELS) (2023)

3.2.9-12.C

3.2.9-12.B

3.2.9-12.D

3.2.9-12.A

3.2.9-12.N

3.5.9-12.T

3.5.9-12.Y

3.5.9-12.I

3.3.9-12.O

BIG IDEAS

Big Ideas

- Development of the Modern Periodic Table
- Classification of the Elements
- Periodic Trends

ESSENTIAL QUESTIONS

Essential Questions

- What can we learn from the periodic table?
- How are elements organized in the periodic table?
- Why do elements in the same group have similar properties?
- How can you use the periodic table to predict an element's properties?

Unit 5: The Periodic Table and Periodic Law

HS CP Chemistry 1

LEARNING TARGETS: KNOWLEDGE & SKILLS

| Knowledge | Skills |
|---|--|
| Students will know (Acquired Knowledge) | Students can do (Acquired Skill) |
| Students will know the history of the periodic table. | Students can understand why elements are so arranged and how to begin extracting information from the periodic table. |
| Students will connect the organization of the periodic table to the organization of electrons in atoms. | Students can solidify their understanding of the table's construction and prepare themselves to analyze trends on the table. |
| Students will study the basic trends on the periodic table. | Students can understand the reasons for the trends on the periodic table. |
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EVIDENCE OF LEARNING & ASSESSMENT

| Name of Assessment | Type (formative, summative, project-based, diagnostic) | Description |
|---|--|---|
| Development of the Modern Periodic Table Quiz | Formative | Lesson check-in |
| Classification of the Elements Quiz | Formative | Lesson check-in |
| Periodic Trends Quiz | Formative | Lesson check-in |
| The Periodic Table and Periodic Law Test | Summative | Assesses student knowledge, understanding, application of module concepts |
| STEM Unit Project I | Summative | Assesses students' ability to apply their understanding of chemistry and their ability to work as a team to solve a real-world problem. |

Unit 6: Ionic Compounds and Metals

HS CP Chemistry 1

UNIT OVERVIEW

Students will learn how ionic compounds are held together by chemical bonds formed by the attraction of oppositely charged ions.

STANDARDS/EXPECTATIONS

Pennsylvania - Grade 9-12 - Science, Technology & Engineering, And Environmental Literacy & Sustainability Standards (STEELS) (2023)

3.2.9-12.C

3.2.9-12.B

3.2.9-12.D

3.2.9-12.N

3.2.9-12.L

3.2.9-12.S

BIG IDEAS

Big Ideas

- Ion Formation
- Ionic Bonds and Ionic Compounds
- Names and Formulas for Ionic Compounds
- Metallic Bonds and Properties of Metals

ESSENTIAL QUESTIONS

Essential Questions

- Why do some crystals form cubes?
- Why do elements form compounds?
- How are the ions in ionic compounds arranged?
- What are the names and formulas of ionic compounds?
- How do metals and ionic compounds compare and contrast?

Unit 6: Ionic Compounds and Metals

HS CP Chemistry 1

LEARNING TARGETS: KNOWLEDGE & SKILLS

| Knowledge | Skills |
|--|--|
| Students will know (Acquired Knowledge) | Students can do (Acquired Skill) |
| Students will study the formation of ions. | Students can predict the gain or loss of electrons as an atom turns into an ion. |
| Students will learn how ionic bonds form and their properties. | Students can discuss the crystal structures that emerge from ionic bonds. |
| Students will name ionic compounds and write their formulas. | Students can show the transfer of electrons between two ions to predict the formula and name of an ionic compound. |
| Students will learn about bonding in metals. | Students can predict metallic properties based on metals' abilities to bond. |
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EVIDENCE OF LEARNING & ASSESSMENT

| Name of Assessment | Type (formative, summative, project-based, diagnostic) | Description |
|--|--|---|
| Ion Formation Quiz | Formative | Lesson check-in |
| Ionic Bonds and Ionic Compounds Quiz | Formative | Lesson check-in |
| Names and Formulas for Ionic Compounds Quiz | Formative | Lesson check-in |
| Metallic Bonds and Properties of Metals Quiz | Formative | Lesson check-in |
| Ionic Compounds and Metals Test | Summative | Assesses student knowledge, understanding, and application of module concepts |

Unit 7: Covalent Bonding

HS CP Chemistry 1

UNIT OVERVIEW

Students will learn about covalent bond formation by atoms sharing one or more pairs of electrons and the respective energy needed to break a covalent bond.

STANDARDS/EXPECTATIONS

Pennsylvania - Grade 9-12 - Science, Technology & Engineering, And Environmental Literacy & Sustainability Standards (STEELS) (2023)

3.2.9-12.C

3.2.9-12.L

3.2.9-12.N

3.2.9-12.S

BIG IDEAS

Big Ideas

- The Covalent Bond
- Naming Molecules
- Molecular Structures
- Molecular Shapes
- Electronegativity and Polarity

ESSENTIAL QUESTIONS

Essential Questions

- Why does water freeze when it expands?
- How do atoms bond in covalent molecules?
- How do you name molecules?
- How are electrons shared in covalent molecules?
- What shapes do molecules form?
- How does molecular shape affect the way that covalent compounds are held together?

Unit 7: Covalent Bonding

HS CP Chemistry 1

LEARNING TARGETS: KNOWLEDGE & SKILLS

| Knowledge | Skills |
|---|--|
| Students will know (Acquired Knowledge) | Students can do (Acquired Skill) |
| Students will explore how atoms can gain stability from sharing electrons. | Students can understand the bonding in water. |
| Students will study the formal system for naming molecules. | Students can write formulas and name covalent compounds. |
| Students will write structural formulas for molecules. | Students can predict structural formulas for molecules that do not follow the octet rule. |
| Students will be able to describe and name the shape of molecules based on their structure. | Students can assign molecular shape names, including molecules with lone pairs of electrons on the central atom. |
| Students will study bond character and how it affects the properties of compounds. | Students can analyze the bonds in water and how they affects the properties of water. |
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Unit 7: Covalent Bonding

HS CP Chemistry 1

EVIDENCE OF LEARNING & ASSESSMENT

| Name of Assessment | Type (formative, summative, project-based, diagnostic) | Description |
|-------------------------------------|--|---|
| The Covalent Bond Quiz | Formative | Lesson check-in |
| Naming Molecules Quiz | Formative | Lesson check-in |
| Molecular Structure Quiz | Formative | Lesson check-in |
| Molecular Shapes Quiz | Formative | Lesson check-in |
| Electronegativity and Polarity Quiz | Formative | Lesson check-in |
| Covalent Bonding Test | Summative | Assesses student knowledge, understanding, and application of module concepts |
| Unit STEM Project II | Summative | Assesses students' ability to apply their understanding of chemistry and their ability to work as a team to solve a real-world problem. |

Unit 8: Chemical Reactions

HS CP Chemistry 1

UNIT OVERVIEW

Students will learn that millions of chemical reactions in and around them transform reactants into products, resulting in the absorption or release of energy.

STANDARDS/EXPECTATIONS

Pennsylvania - Grade 9-12 - Science, Technology & Engineering, And Environmental Literacy & Sustainability Standards (STEELS) (2023)

3.2.9-12.F

3.2.9-12.G

3.2.9-12.C

BIG IDEAS

Big Ideas

- Reactions and Equations
- Classifying Chemical Reactions
- Reactions in Aqueous Solutions

ESSENTIAL QUESTIONS

Essential Questions

- What happens to food when you cook it?
- How are chemical reactions modeled?
- What are the different types of chemical reactions?
- What is unique about reactions that take place in water?

Unit 8: Chemical Reactions

HS CP Chemistry 1

LEARNING TARGETS: KNOWLEDGE & SKILLS

| Knowledge | Skills |
|---|--|
| Students will know (Acquired Knowledge) | Students can do (Acquired Skill) |
| Students will learn to describe chemical reactions. | Students can balance chemical equations. |
| Students will learn to classify chemical reactions. | Student can predict the outcomes of chemical reactions. |
| Student will learn about reactions between substances dissolved in water. | Students can write net ionic equations and combine two reactions into an overall reaction. |
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EVIDENCE OF LEARNING & ASSESSMENT

| Name of Assessment | Type (formative, summative, project-based, diagnostic) | Description |
|--------------------------------|--|---|
| Reactions and Equations Quiz | Formative | Lesson check-in |
| Classifying Chemical Reactions | Formative | Lesson check-in |
| Reactions in Aqueous Solutions | Formative | Lesson check-in |
| Chemical Reactions Test | Summative | Assesses student knowledge, understanding, and application of module concepts |
| | | |

Unit 9: The Mole

HS CP Chemistry 1

UNIT OVERVIEW

Students will learn that the mole represents a very large number of extremely small particles.

STANDARDS/EXPECTATIONS

Pennsylvania - Grade 9-12 - Science, Technology & Engineering, And Environmental Literacy & Sustainability Standards (STEELS) (2023)

3.2.9-12.G

BIG IDEAS

Big Ideas

- Measuring Matter
- Mass and the Mole
- Moles of Compounds
- Empirical and Molecular Formulas
- Formulas of Hydrates

ESSENTIAL QUESTIONS

Essential Questions

- How is counting pennies like counting atoms?
- Why is it useful to group large numbers of things?
- What is the mass of a mole?
- What do chemical formulas say about mole relationships?
- How can you determine the amount of water in a hydrate?

Unit 9: The Mole

HS CP Chemistry 1

LEARNING TARGETS: KNOWLEDGE & SKILLS

| Knowledge | Skills |
|---|---|
| Students will know (Acquired Knowledge) | Students can do (Acquired Skill) |
| Students will learn about the mole. | Students can convert between moles and particles. |
| Students will convert between mass of a substances and the moles of representative particles. | Students can convert between any two units using an appropriate conversion factor. |
| Students will apply their understandings of the mole to compounds. | Students can determine the molar mass of any compound when given a formula or masses of its constituent elements. |
| Students will apply mass and the mole to determine empirical and molecular formulas from percent composition. | Students can identify unknown compounds given percent compositions and a molar mass. |
| Students will analyze hydrates. | Students can determine the moles of water associated with each mole of a compound. |
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EVIDENCE OF LEARNING & ASSESSMENT

| Name of Assessment | Type (formative, summative, project-based, diagnostic) | Description |
|---------------------------|--|---|
| Measuring Matter Quiz | Formative | Lesson check-in |
| Mass and the Mole Quiz | Formative | Lesson check-in |
| Moles of Compounds Quiz | Formative | Lesson check-in |
| Formulas of Hydrates Quiz | Formative | Lesson check-in |
| The Mole Test | Summative | Assesses student knowledge, understanding, and application of module concepts |

Unit 10: Stoichiometry

HS CP Chemistry 1

UNIT OVERVIEW

Students will learn that chemists use mole ratios in stoichiometric calculations to predict the amounts of reactants used and products formed in any specific reaction.

STANDARDS/EXPECTATIONS

Pennsylvania - Grade 9-12 - Science, Technology & Engineering, And Environmental Literacy & Sustainability Standards (STEELS) (2023)

3.2.9-12.G

3.2.9-12.C

3.2.9-12.B

3.2.9-12.N

3.5.9-12.T

3.5.9-12.Y

3.5.9-12.I

3.3.9-12.R

BIG IDEAS

Big Ideas

- Defining Stoichiometry
- Stoichiometric Calculations
- Limiting Reactants
- Percent Yield

ESSENTIAL QUESTIONS

Essential Questions

- How much carbon dioxide did this field of corn need to grow?
- What can you learn from balanced chemical equations?
- How do you determine the amounts of products and reactants involved in chemical reactions?
- How do you know if you have enough of a reactant?
- Do you always get the calculated amount of product out of a reaction?

Unit 10: Stoichiometry

HS CP Chemistry 1

LEARNING TARGETS: KNOWLEDGE & SKILLS

| Knowledge | Skills |
|---|--|
| Students will know (Acquired Knowledge) | Students can do (Acquired Skill) |
| Students will define the relationships in a balanced chemical equation. | Students can write mole ratios given the balanced chemical equation. |
| Students will apply molar mass and mole ratios to convert between masses of reactants and products. | Students can predict the amount of product formed when given the |
| Students will identify the limiting reactant. | Students can determine the mass of products formed and excess reactant remaining based on the limiting reactant. |
| Students will compare the actual yield of a reaction to the theoretical yield. | Students can calculate the percent yield based on the limiting reactant and actual yield. |
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EVIDENCE OF LEARNING & ASSESSMENT

| Name of Assessment | Type (formative, summative, project-based, diagnostic) | Description |
|----------------------------------|--|---|
| Defining Stoichiometry Quiz | Formative | Lesson Check-in |
| Stoichiometric Calculations Quiz | Formative | Lesson Check-in |
| Limiting Reactants Quiz | Formative | Lesson check-in |
| Percent Yield Quiz | Formative | Lesson check-in |
| Stoichiometry Test | Summative | Assesses student knowledge, understanding, and application of module concepts |
| STEM Unit Project III | Summative | Assesses students' ability to apply their understanding of chemistry and their ability to work as a team to solve a real-world problem. |