

Area of Focus: Chemistry – Unit 01

Course Objective:

The curriculum for Chemistry is based around eight Main Units. For each of these units, there is a set of Core Concepts which will be used as a guide throughout the course. Below is an outline of the Chemistry Main Units and the Core Concepts covered in this unit.

| Main Unit | Core Concepts |
|--|---|
| Unit One Introduction to Chemistry | <ul style="list-style-type: none">A. There are three states of matter.B. All matter is made of atoms. There are a limited number of types of atoms known as elements.C. Atoms are so small that they are difficult to study directly. Atomic models are used to explain experimental data on collections of atoms.D. Elements can combine into compounds through chemical reactions. |

Research:

- Students select an everyday product and construct a poster that illustrates how that product relates to one of the chemical concepts studied during the year. Students show how the everyday product involves innovations based on chemistry to develop or improve the performance, accessibility and/or environmental impact of the product.

Reason:

In this unit students will come to understand:

- All things are made of matter.
- The three main states of matter include: solids, liquids and gases
- All matter is composed of tiny particles called atoms that are extremely small and thus are hard to study directly.
- There are 118 known types of atoms. These are called elements.
- Each element has a unique set of characteristics that separates it from other elements.
- Scientific measurements, such as the density, can be made on elements, however there is still some uncertainty in this data.
- Elements can be combined together in mixtures to produce a new set of characteristics unique from any of the individual elements.

Relate:

The following activities/labs will be used to help students relate the concepts discussed in class to real world applications:

- Math and Measurement in Science
 - Students learn how to measure mass and volume with varied pieces of equipment and focus on the accuracy of those pieces of equipment in their calculation and determination of significant figures.
- Density Lab
 - Using measurements of mass and volume to determine density, students will be able to predict the identity of an unknown sample of liquid.

Record:

Students write a lab report for each of the labs listed above. The lab report includes the following components:

- Beginning questions
- Safety
- Procedures
- Data/observations
- Claims/evidence
- Reasoning

The students will, and are required to, keep all laboratory report material in a lab notebook.

Area of Focus: Chemistry – Unit 02

Course Objective:

The curriculum for Chemistry is based around eight Main Units. For each of these units, there is a set of Core Concepts which will be used as a guide throughout the course. Below is an outline of the Chemistry Main Units and the Core Concepts covered in this unit.

| Main Unit | Core Concepts |
|---|---|
| <p>Unit Two Atomic Structure and Periodicity of the Elements</p> | <p>E. Models representing the structure of an atom have been modified throughout history as new data has been discovered.</p> <p>F. The prevailing model of the atom shows that atoms are composed of three subatomic particles (protons, neutrons and electrons).</p> <p>G. The arrangement of the three subatomic particles determine the identity and characteristics of an atom or element.</p> <p>H. Although each element is unique, similarities are found within groups of elements that allow them to be grouped together into classes and families.</p> |

Research:

- Students select an everyday product and construct a poster that illustrates how that product relates to one of the chemical concepts studied during the year. Students show how the everyday product involves innovations based on chemistry to develop or improve the performance, accessibility and/or environmental impact of the product.

Reason:

In this unit students will come to understand:

- A model is a way of representing a subject or idea that is difficult to study directly.
- Models may be a physical representation of the subject, or a mathematical equation that represents its behavior.
- The current model of the atom has undergone several modifications to account for the findings of many different scientists.
- The current model of the atom shows that atoms are made up of three subatomic particles (protons, neutrons and electrons) with a very dense core called a nucleus.
- Protons and neutrons reside within the nucleus of an atom. Protons are positively charged while neutrons have no charge.
- Both protons and neutrons have roughly the same mass.
- The nucleus accounts for most of the mass of an atom.
- Electrons are negatively charged particles that orbit the nucleus and account for most of the volume of an atom. They are significantly smaller than either protons or neutrons.
- The identity of an element can be determined by the number of protons found within the nucleus of an atom of that element.
- The arrangement of electrons around the nucleus gives an atom of a given element certain characteristics that are similar, not identical, to atoms of another element.
- The Periodic table arranges elements into classes and families based on these similar characteristics and is a useful tool in predicting how combinations of elements will behave.

Relate:

The following activities/labs will be used to help students relate the concepts discussed in class to real world applications:

- Organizing the Periodic Table
 - Students will work in groups to try and organize a group of known elements into classes and families. They will then try and predict the identity of several unknown elements based on similarities in characteristics.

Record:

Students write a lab report for each of the labs listed above. The lab report includes the following components:

- Beginning questions
- Safety
- Procedures
- Data/observations
- Claims/evidence
- Reasoning

The students will, and are required to, keep all laboratory report material in a lab notebook.

Area of Focus: Chemistry – Unit 03

Course Objective:

The curriculum for Chemistry is based around eight Main Units. For each of these units, there is a set of Core Concepts which will be used as a guide throughout the course. Below is an outline of the Chemistry Main Units and the Core Concepts covered in this unit.

| Main Unit | Core Concepts |
|---|---|
| <p>Unit Three Chemical Bonding and Systematic Naming</p> | <p>I. Chemical bonds form when electrons move between atoms.</p> <p>J. The type of movement of an electron determines the type of chemical bond formed.</p> <p>K. Chemical bonds form compounds and molecules.</p> <p>L. The type of bond that forms determines the name of the compound or molecule. Reversely, the name of a compound or molecule aids in identifying the type of chemical bond formed.</p> |

Research:

- Students select an everyday product and construct a poster that illustrates how that product relates to one of the chemical concepts studied during the year. Students show how the everyday product involves innovations based on chemistry to develop or improve the performance, accessibility and/or environmental impact of the product.

Reason:

In this unit students will come to understand:

- There are three main types of chemical bonds that form between atoms and ions: covalent bonds, ionic bonds and metallic bonds.
- In covalent bonding, electrons are shared between the nuclei of two atoms to form a molecule or polyatomic ion.
- Electronegativity differences between the two atoms in a covalent bond account for the arrangement of the shared electrons and the polarity of the bond.
- Ionic bonding results from the net attraction between oppositely charged ions.

- Metallic bonding describes a grouping of positively charged nuclei surrounded by a sea of mobile valence electrons.
- The Valence Shell Electron Pair Repulsion (VSEPR) model is used to describe the arrangement of electrons around the nuclei of atoms and molecules or compounds.
- Each type of chemical bond has a unique set of rules for naming molecules and compounds formed by each type of bond. The type of bond can be predicted by the name, and the name can be determined by the type of chemical bond.

Relate:

The following activities/labs will be used to help students relate the concepts discussed in class to real world applications:

- Bonding Lab
 - Students experimentally investigate ionic and molecular substances deducing properties of their bonds in the process.

Record:

Students write a lab report for each of the labs listed above. The lab report includes the following components:

- - Beginning questions
 - Safety
 - Procedures
 - Data/observations
 - Claims/evidence
 - Reasoning

The students will, and are required to, keep all laboratory report material in a lab notebook.

Area of Focus: Chemistry – Unit 04

Course Objective:

The curriculum for Chemistry is based around eight Main Units. For each of these units, there is a set of Core Concepts which will be used as a guide throughout the course. Below is an outline of the Chemistry Main Units and the Core Concepts covered in this unit.

| Main Unit | Core Concepts |
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|--|---|
| <p>Unit Four Chemical Reactions and Stoichiometry</p> | <p>M. A Mole is a measurement of matter that can be used to determine relationships between mass and volume of compounds.</p> <p>N. There are five main types of chemical reactions.</p> <p>O. A balanced chemical equation can be used to determine the amount of product formed, or the amount of reactant needed to run a reaction to completion.</p> <p>P. Limiting reactants restrict the amount of product that can be formed in a chemical reaction.</p> |
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Research:

- Students select an everyday product and construct a poster that illustrates how that product relates to one of the chemical concepts studied during the year. Students show how the everyday product involves innovations based on chemistry to develop or improve the performance, accessibility and/or environmental impact of the product.

Reason:

In this unit students will come to understand:

- What a mole represents in relation to the number of individual units.
- How the mole can be used as a conversion factor to relate the mass of a sample to the volume of a sample.
- The five main reaction types are: combination, decomposition, single-replacement, double-replacement and combustion.
- Chemical equations show the reactants used and the products formed when the correct number of moles of each reactant is used.
- A limiting reactant restricts the amount of product formed due to insufficient moles of the reactant.

Relate:

The following activities/labs will be used to help students relate the concepts discussed in class to real world applications:

- How Big is a Mole?
 - Students will prepare a poster that relates how large a mole is compared to everyday items.
- Stoichiometry Lab
 - Students determine the correct mole ratio of reactants in an exothermic reaction by mixing different amounts of reactants and graphing temperature changes.
- Limiting vs Excess Reactant Activity

- Students will predict which of two reactants will determine amount of product form. They will then run the reaction to confirm their predictions.

Record:

Students write a lab report for each of the labs listed above. The lab report includes the following components:

- Beginning questions
- Safety
- Procedures
- Data/observations
- Claims/evidence
- Reasoning

The students will, and are required to, keep all laboratory report material in a lab notebook.

Area of Focus: Chemistry – Unit 05

Course Objective:

The curriculum for Chemistry is based around eight Main Units. For each of these units, there is a set of Core Concepts which will be used as a guide throughout the course. Below is an outline of the Chemistry Main Units and the Core Concepts covered in this unit.

| Main Unit | Core Concepts |
|---|---|
| <p>Unit Five The Behavior of Gases and Liquids</p> | <p>Q. Each state of matter has a detailed set of characteristics that can be studied and manipulated.</p> <p>R. Gases are affected by many different conditions.</p> <p>S. Liquids are useful in allowing the combination of various compounds and molecules.</p> <p>T. The concentration of a solution identifies how much solute has been combined with a given amount of solute.</p> |

Research:

- Students select an everyday product and construct a poster that illustrates how that product relates to one of the chemical concepts studied during the year. Students show how the everyday product involves innovations based on chemistry to develop or improve the performance, accessibility and/or environmental impact of the product.

Reason:

In this unit students will come to understand:

- A more detailed look at the characteristics of atoms within each of the three main states of matter.
- A brief look into the fourth state of matter: plasma.
- Gases are easily manipulated by altering conditions of temperature, volume, pressure or amount of the gas.
- Liquids can form two different types of mixtures: homogenous and heterogeneous mixtures.
- A solute is a substance that is dissolved in another substance.
- A solvent is a substance used to dissolve another substance.
- A solution is a combination of solvent and solute.
- The concentration of a solution can be identified by using units of molarity, molality, percent by mass or percent by volume.
- The concentration of a solution can be diluted by adding more solvent.

Relate:

The following activities/labs will be used to help students relate the concepts discussed in class to real world applications:

- Vapor Pressure of Liquids
 - Students measure the vapor pressure of ethanol at different temperatures to see how temperature can affect liquids.
- Creating Solutions
 - Students will make solutions of varying units of concentration and then dilute those concentrations to a desired final concentration.

Record:

Students write a lab report for each of the labs listed above. The lab report includes the following components:

- Beginning questions
- Safety
- Procedures
- Data/observations
- Claims/evidence
- Reasoning

The students will, and are required to, keep all laboratory report material in a lab notebook.

Area of Focus: Chemistry – Unit 06

Course Objective:

The curriculum for Chemistry is based around eight Main Units. For each of these units, there is a set of Core Concepts which will be used as a guide throughout the course. Below is an outline of the Chemistry Main Units and the Core Concepts covered in this unit.

| Main Unit | Core Concepts |
|---|---|
| Unit Six Thermochemistry and Dynamic Equilibrium | U. Energy has a natural flow from objects with high energy to objects with low energy. This energy change can be measured as heat and work. V. Enthalpy shows the movement of energy. W. Some chemical reactions are reversible – a product can act as a reactant to create reactants as products. X. The rate of a reaction can be determined through experimental and theoretical means. |

Research:

- Students select an everyday product and construct a poster that illustrates how that product relates to one of the chemical concepts studied during the year. Students show how the everyday product involves innovations based on chemistry to develop or improve the performance, accessibility and/or environmental impact of the product.

Reason:

In this unit students will come to understand:

- Energy has a natural flow.
- Heat is a type of energy that flows from objects of higher temperature to objects of lower temperature.
- The amount of heat a system has can be used to do work within a system.
- Gibbs free energy (ΔG) is the amount of energy available in a system to do work.
- Based on the ΔG , some products have enough energy to run in reverse creating reactants from products.
- The rate at which a reaction runs changes over time. The initial rate is generally used as the overall rate of the reaction.
- Various K values can be used to determine reaction and solubility constants of a given system.

Relate:

The following activities/labs will be used to help students relate the concepts discussed in class to real world applications:

- Activation Energy Lab
 - Students will experimentally determine the amount of energy needed in order for a reaction to start.
- Solubility and ΔG
 - Students will determine the ΔG of a solution of calcium hydroxide and use the ΔG to determine the amount of energy needed to melt a sample.

Record:

Students write a lab report for each of the labs listed above. The lab report includes the following components:

- Beginning questions
- Safety
- Procedures
- Data/observations
- Claims/evidence
- Reasoning

The students will, and are required to, keep all laboratory report material in a lab notebook.

Area of Focus: Chemistry – Unit 07**Course Objective:**

The curriculum for Chemistry is based around eight Main Units. For each of these units, there is a set of Core Concepts which will be used as a guide throughout the course. Below is an outline of the Chemistry Main Units and the Core Concepts covered in this unit.

| Main Unit | Core Concepts |
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|-----------|---------------|

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|---|--|
| <p>Unit Seven Acids and Bases and Electrochemistry</p> | <p>Y. There are two main theories regarding the nature of an acid vs a base.</p> <p>Z. Acids and bases have varying strengths with corresponding acid or base.</p> <p>AA. Redox reactions have a correlation to the electrochemistry of a system.</p> <p>BB. Electrochemistry is the study of the electrostatic charges within ions and compounds.</p> |
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Research:

- Students select an everyday product and construct a poster that illustrates how that product relates to one of the chemical concepts studied during the year. Students show how the everyday product involves innovations based on chemistry to develop or improve the performance, accessibility and/or environmental impact of the product.

Reason:

In this unit students will come to understand:

- Hydrogen ions play a key role in the formation of acids.
- The difference between a Bronsted-Lowry acid vs an Arrhenius acid.
- How the relative strength of an acid plays a role in determining the strength of its corresponding base.
- Electrochemistry studies the movement of electrons in a closed system.
- Redox reactions are key in helping to determining the voltaic potential of a cell.

Relate:

The following activities/labs will be used to help students relate the concepts discussed in class to real world applications:

- Voltaic Cells Lab
 - Students find the reduction potentials of a series of reactions using voltaic cells/multi-meters and build their own reduction potential table.

Record:

Students write a lab report for each of the labs listed above. The lab report includes the following components:

- Beginning questions
- Safety
- Procedures
- Data/observations
- Claims/evidence
- Reasoning

The students will, and are required to, keep all laboratory report material in a lab notebook.

Area of Focus: Chemistry – Unit 08

Course Objective:

The curriculum for Chemistry is based around eight Main Units. For each of these units, there is a set of Core Concepts which will be used as a guide throughout the course. Below is an outline of the Chemistry Main Units and the Core Concepts covered in this unit.

| Main Unit | Core Concepts |
|---|--|
| Unit Eight Organic Chemistry and Functional Groups | CC. Organic chemistry is the study of carbon. DD. Hydrocarbons are the simplest of all organic molecules. EE. Functional groups play an important role in determining the function of an organic molecule. FF. Hydrocarbons play a key role in the maintaining of life. |

Research:

- Students select an everyday product and construct a poster that illustrates how that product relates to one of the chemical concepts studied during the year. Students show how the everyday product involves innovations based on chemistry to develop or improve the performance, accessibility and/or environmental impact of the product.

Reason:

In this unit students will come to understand:

- Organic chemistry focuses solely on the unique characteristics exhibited by the element carbon.
- A hydrocarbon is the simplest organic molecule being composed of only hydrogen and carbon.
- There are three types of hydrocarbons: Alkanes, Alkenes and Alkynes. Each has its own system of naming based on the presence, or lack, of double or triple covalent bonds found within the molecule.
- Functional groups are groups of atoms that behave as an individual unit.
- The shape of functional groups determine the function of the molecule as a whole.
- Hydrocarbons are found in all cells within the plasma membrane and allow cells to function correctly to sustain life.

Relate:

The following activities/labs will be used to help students relate the concepts discussed in class to real world applications:

- Naming Alkanes, Alkenes and Alkynes
 - Students will become familiar with the conventions of naming hydrocarbon compounds.

Record:

Students write a lab report for each of the labs listed above. The lab report includes the following components:

- Beginning questions
- Safety
- Procedures
- Data/observations
- Claims/evidence
- Reasoning

The students will, and are required to, keep all laboratory report material in a lab notebook.

Area of Focus: Chemistry – Unit 09**Course Objective:**

The curriculum for Chemistry is based around nine Main Units. For each of these units, there is a set of Core Concepts which will be used as a guide throughout the course. Below is an outline of the Chemistry Main Units and the Core Concepts covered in this unit.

| Main Unit | Core Concepts |
|--|---------------|
| <p>Unit Nine Biochemistry and Nuclear Chemistry</p> | <p>GG.</p> |

Research:

- Students select an everyday product and construct a poster that illustrates how that product relates to one of the chemical concepts studied during the year. Students show how the everyday product involves innovations based on chemistry to develop or improve the performance, accessibility and/or environmental impact of the product.

Reason:

In this unit students will come to understand:

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Relate:

The following activities/labs will be used to help students relate the concepts discussed in class to real world applications:

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Record:

Students write a lab report for each of the labs listed above. The lab report includes the following components:

- Beginning questions
- Safety
- Procedures
- Data/observations
- Claims/evidence
- Reasoning

The students will, and are required to, keep all laboratory report material in a lab notebook.