

Subject: Chem 1

Unit 1

Laboratory Safety and Doing Chemistry

Designed by: Melissa Sherman

School District: Tunkhannock Area

School: High School

Brief Summary of Unit:

Chemistry is everywhere in our world. It describes our bodies, food, clothes, and our environment, and literally everything we touch. We are born with an innate desire to learn how things work. The scientific method is an important part of chemistry.

Chapter 1

S11.A.2.1 Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process.

S11.A.2.2 Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide.

S11.C.1.1 Explain the relationship between the structure and properties of matter.

Standards: 3.2.C.A.1 Differentiate between physical properties and chemical properties.

Differentiate between pure substances and mixtures; differentiate between heterogeneous and homogeneous mixtures.

Big Idea:

The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangements of atoms. These atoms retain their identity in chemical reactions.

Topical understanding	Essential Questions
Chemistry is a procedure for processing and understanding certain types of information. Making observations are fundamental to science. Science is not simply a process of trial and error.	Why should students study chemistry and chemicals? What is the value of studying the scientific method? How is the scientific method used and applied in the larger world? What is the importance of laboratory safety?
Knowledge	Skills

Data, graph, dependent and independent variable, qualitative and quantitative observations, experiment, hypothesis, scientific law, scientific method, technology.	<p>Identify the uses and applications of chemistry in everyday life.</p> <p>Work in the chemistry lab in a safe and productive manner.</p> <p>Demonstrate appropriate measurement techniques in the laboratory.</p> <p>Identify the steps in the scientific method and use the scientific method to solve a problem.</p> <p>Make observations and identify them as qualitative or quantitative.</p>
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Assessment

Evaluation Criteria	Evidence of Understanding
Lab Safety scavenger hunt Lab safety test Observation lab Scientific method inquiry activity	Proper use of laboratory equipment Proper ignition of the Bunsen burner Identify an observation as qualitative or quantitative Identify the steps of the scientific method. Consumer challenge

Materials and Resources

Acid in the eye demo Lab Chemicals & Solutions Lab Experiments Safety Contract Safety video Lab Equipment Lab Report format Lab Safety scavenger hunt Observation lab Consumer Challenge	Scientific method inquiry activity Study Guide PowerPoint Presentations Video clips Online tutorials Chapter test
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Subject: Chem 1
Chapter 2
Matter

Designed by: Melissa Sherman

School District: Tunkhannock Area

School: High School

Brief Summary of Chapter:

Chemistry deals with matter and the changes it undergoes. Matter can be classified as a mixture, element, or compound and can undergo a physical or chemical change. There are four different states (phases). There are a variety of ways to separate a mixture.

Chapter 1

S11.A.2.1 Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process.

S11.A.2.2 Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide.

S11.C.1.1 Explain the relationship between the structure and properties of matter.

Standards: 3.2.C.A.1 Differentiate between physical properties and chemical properties.

Differentiate between pure substances and mixtures; differentiate between heterogeneous and homogeneous mixtures.

Big Idea:

The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangements of atoms. These atoms retain their identity in chemical reactions.

Topical understanding	Essential Questions
Chemistry deals with matter and its changes. Matter can be separated physically or chemically.	<ol style="list-style-type: none">1. How do I describe the difference between the states of matter according to their shape, mass, and particle arrangement?2. How do I know if a mixture is homogeneous or heterogeneous?3. How would I construct an experiment to separate the parts of a mixture?4. What is the difference between an element, compound, and mixture?

Knowledge	Skills
chemical change, chemical, property, physical change, physical property, chemical reaction, chemical symbol, compound, distillation, element, extensive property, intensive property, filtration, gas, heterogeneous mixture, homogeneous mixture, intensive property, law of conservation of mass, liquid, mass, mixture, phase, physical change, physical property, precipitate, product, reactant, solid, solution, substance, alloy, vapor, volume, qualitative, quantitative	Distinguish between mass and weight and identify the units used for each. Describe the four states of matter. Compare physical and chemical properties of matter. Identify physical and chemical changes. Distinguish between an element, compound, and mixture. Compare heterogeneous and homogeneous mixtures. Describe techniques to separate mixtures. Explain the law of conservation of mass.

Assessment

Evaluation Criteria	Evidence of Understanding
Separation of a mixture by chromatography lab Physical/ chemical change lab Discovering the definition of matter activity Observing & identifying matter activity Quizzes/tests	Describe techniques to separate a mixture. Identify a change as physical or chemical. Demonstrate the basic safety rules that must be followed in lab. Identify a chemical element based on its symbol.

Materials and Resources

Lab Chemicals & Solutions

Lab Experiments

Safety Contract

Lab Equipment

Lab Report format

Observing & identifying matter activity

Discovering the definition of matter activity

Element Bingo

Physical/ chemical change lab

Study Guide

PowerPoint Presentations

Video clips

Online tutorials

Chapter test

Subject: Chem 1

Chapter 3 : Scientific Measurement

Grade Level: 11-12

Designed by: Melissa Sherman

School District: Tunkhannock Area

School: High School

Brief Summary of Chapter:

All measurements have some degree of uncertainty. In the chemistry lab it is important to strive for accuracy and precision in measurements. The scientific community utilizes the metric system for all measurement in science.

Chapter 3

S11.A.2.2.1 Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations

M11.A.3.1.1 Simplify/evaluate expressions using the order of operations to solve problems

S11.C.1.1.2

Explain the relationship between the physical properties of a substance and its molecular or atomic structure

M11.A.2.1. Solve problems using operations with rational numbers including rates and percents

M11.A.2.1.2 Solve problems using direct and inverse proportions

Big Idea:

The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangements of atoms. These atoms retain their identity in chemical reactions.

Topical understanding	Essential Questions
Matter has properties related to its structure that can be measured and used to identify, classify, and describe matter. Dimensional analysis is used to solve various quantitative problems in chemistry. Qualitative and quantitative observations are used in chemistry. Density can be used to identify a substance.	Why is a standard system of measurement important in science? Why is data collection important in science? Why do scientists use the metric system? Why is it essential for all measurements to have units? What is the relationship between qualitative and quantitative measurements?

Three different temperature scales are used in chemistry.	What are the three different temperature scales? How does the density of an object determine if it will float or sink in water?
Knowledge	Skills
Absolute zero, accepted value, , calorie. Celsius, conversion factor, density, dimensional analysis, energy, error, experimental value, gram, SI units, Joule, Kelvin Scale, kilogram, liter, measurement, meter, percent error, scientific notation temperature, weight	Write the names and abbreviations for the metric or SI units used in measurements of length, volume, mass, temperature, and time. Describe how to write a number in scientific notation. Demonstrate how to write a metric equality using metric base units and prefixes. Demonstrate how to calculate the density of a substance. Given density calculate either mass or volume of a substance. Identify both the independent and dependent variable. Interpret the trend on a graph based on the experimental data. Identify appropriate metric units. Use dimensional analysis to convert between units. Compare accuracy and precision. Compare the Fahrenheit, Celsius and Kelvin temperature scales and convert temperature values. Understand absolute zero.

Assessment

Evaluation Criteria	Evidence of Understanding
Worksheets Class discussion Oral review Graphing activity Measurement Activity Measurement Challenge lab Density of plastics Quizzes/tests	<ul style="list-style-type: none"> • Determine the density of regular and irregular solids and liquids. • Convert English units to metric units • Convert from one metric unit to another. • Identify substances based on their density. • Calculate the percent error in a measurement. • Convert between the three temperature scales.

Materials and Resources

Lab Chemicals & Solutions

Lab Equipment

Lab Report format

Study Guide

PowerPoint Presentations

Video clips

Chapter test

Measurement Activity

Graphing activity

Problem Solving on the wildlife refuge activity

Metric Conversion quiz

Measurement Challenge lab

Density of plastics lab

Subject: Chem 1
Chapter : Chapter 4
The Atom

Grade Level: 11-12

Designed by: Melissa Sherman

School District: Tunkhannock Area

School: High School

Brief Summary of Chapters 4:

Atomic models are used to explain atoms and help us understand the interaction of elements and compounds observed on a macroscopic scale. The model of the atom has evolved over a long period of time through the work of many scientists.

Chapter 4

S11.A.2.1 Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process.

S11.A.2.2 Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide.

S11.C.1.1 Explain the relationship between the structure and properties of matter.

3.2.C.A2. Compare the electron configurations for the first twenty elements of the periodic table.

Relate the position of an element on the periodic table to its electron configuration and compare its reactivity to the reactivity of other elements in the table.

Big Idea:

The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangements of atoms. These atoms retain their identity in chemical reactions.

Topical understanding	Essential Questions
The make-up of the atom is essential in understanding the properties of materials and how they interact with each substance. The model of the atom has changed over the past two hundred years.	What are the three subatomic particles? What is an isotope? How do models in science change over time? How are the colors in fireworks related to the study of the atom?
Knowledge	Skills

<p>atom, atomic mass, atomic mass unit, cathode ray, Dalton's atomic theory, electron, group, ion, isotopes, mass number, neutron, nucleus, period, periodic table, proton, atomic orbital,</p>	<p>List the postulates of Dalton's atomic theory. Discuss the contributions of various scientists that lead to the atomic structure. Name and describe the three subatomic particles of an atom. Determine the number of protons, neutrons, and electrons in an atom or ion. Define isotopes and atomic mass.</p>
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Assessment

Evaluation Criteria	Evidence of Understanding
<p>Worksheets Class discussion Oral review Flame tests Atom Family Activity Atom Model activity M&M isotope lab Firework Video Proton, neutron, electron quiz Quizzes/tests</p>	<p>Describe how the current model of the atom has evolved. Identify the protons, neutrons, and electrons, mass number, and atomic number in any atom or ion. Calculate the average atomic mass of the isotopes of an element and write the isotope notation for that element.</p>

Materials and Resources

Lab Chemicals & Solutions

Lab Equipment

Lab Report format

Study Guide

PowerPoint Presentations

Video clips

Chapter test

M&M isotope lab

Flame tests

Atomic structure quiz

Fireworks video

Atom Model

Subject: Chem 1
Chapter: 5
The Periodic Table

Grade Level: 11-12

Designed by: Melissa Sherman

School District: Tunkhannock Area

School: High School

Brief Summary of Chapter 5:

The periodic table is a compilation of the work of many scientists. It provides useful information about the elements.

Chapter 5

S11.C.1.1.4 Explain how the relationships of chemical properties of elements are represented in the repeating patterns within the periodic table.

Big Idea:

Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them. Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.

Topical understanding	Essential Questions
The periodic table is separated into metals, nonmetals, and metalloids. Each group on the periodic table has specific chemical and physical properties.	How is the periodic table a template of organization for the real world? What is the significance of valence electrons to chemical properties? What trends are present within the periodic table? What are the properties and location of alkali metals, alkali earth metals, transition metals, halogens, and noble gases? What is significant about the noble gases? What are differences between metals, nonmetals, and metalloids? Why should students study the periodic table of elements? How did scientists help to develop the modern periodic table? How can students identify between specific groups and periods?

Knowledge	Skills
alkali metals, alkaline earth metals, anion, atomic radius, cation, anion, halogens, inner transition metals, ion, ionization energy, metalloids, metals, noble gases, nonmetals, periodic law, representative elements, transition metals	<p>Explain the placement of an element on the periodic table.</p> <p>Classify elements as metals, nonmetals, or metalloids</p> <p>Describe the states of the elements at STP</p> <p>Compare and contrast properties of an element within a group or period</p> <p>Identify the different groups on the periodic table.</p>

Assessment

Evaluation Criteria	Evidence of Understanding
<p>Worksheets</p> <p>Class discussion</p> <p>Oral review</p> <p>Periodic table quiz</p> <p>Periodic table activity</p> <p>Periodic table inquiry activity</p> <p>Quizzes/tests</p>	<p>Determine if an element is a metal, nonmetal, or metalloid.</p> <p>Correctly place an unknown element on the periodic table based on its properties.</p> <p>Use density to predict trends in a group.</p>

Materials and Resources

<p>Lab Chemicals & Solutions</p> <p>Lab Equipment</p> <p>Lab Report format</p> <p>Textbook</p> <p>Study Guide</p> <p>PowerPoint Presentations</p> <p>Video clips</p>	<p>Chapter test</p> <p>Periodic table quiz</p> <p>Periodic table activity</p> <p>Periodic table inquiry activity</p>
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Subject: Chem 1
Chapter: 6
Nuclear Chemistry

Grade Level: 11-12

Designed by: Melissa Sherman

School District: Tunkhannock Area

School: High School

Brief Summary of Chapters 6

Nuclear reactions differ from everyday chemical reactions. They involve the core of the atom, not the electrons. Nuclear reactions are accompanied by a tremendous amount of energy. Nuclear energy has had a great impact on society.

Chapter 6

3.2.C.A.3 Identify the three main types of radioactive decay and compare their properties. Describe the process of radioactive decay. Compare and contrast nuclear fission and fusion.

S11.A.2.1.1

Critique the elements of an experimental design applicable to a specific experimental design.

S11.A.2.1.3

Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.

S11.A.2.1.4

Critique the results and conclusions of scientific inquiry for consistency and logic

Big Idea:

Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.

Topical understanding	Essential Questions
There are three types of radiation: alpha, beta, and gamma. Elements have unstable isotopes that decay into other elements. Nuclear chemistry plays a vital role in our everyday lives.	What is radiation and where does it come from? How are nuclear reactions different from ordinary chemical reactions? What happens when an unstable nucleus decays? How is the structure of atoms altered during fission and fusion?

	How does nuclear chemistry affect your life? What is the impact of nuclear energy on our society?
Knowledge	Skills
Aloha, beta, gamma, radiation, nuclear reaction, fission, fusion, radioactive isotope, decay, nuclear reactor, half-life	Distinguish between alpha, beta, and gamma radiation. Define half-life. Calculate the half life of a substance. Write and balance nuclear equations. Explain how a nuclear reactor works. Describe the impact of nuclear energy on the environment Differentiate between nuclear fission and fusion and provide examples of each.

Assessment

Evaluation Criteria	Evidence of Understanding
Worksheets Class discussion Oral review Quizzes/tests Half-life lab Nuclear Decay activity Inquiry Activity	Identify the three types of radiation. Determine the half-life of a substance. Explain nuclear energy and its impact on society. Calculate the half-life of a substance. Distinguish between nuclear fission and fusion.

Materials and Resources

Study Guide PowerPoint Presentations Half-life lab Nuclear Decay activity Inquiry Activity Video clips	Worksheets Chapter test
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Subject: Chem 1

Chapter: 7

Chemical Names and Formulas

Grade Level: 11-12

Designed by: Melissa Sherman

School District: Tunkhannock Area

School: High School

Brief Summary of Chapter 7:

The naming of matter is a systematic process. It is important for students to understand the language of chemistry- chemical nomenclature.

Chapter 7

S11.C.1.1 Explain the relationship between the structure and properties of matter.

S11.A.1.1.5 Analyze or compare the use of both direct and indirect observation as means to study the world and the Universe.

Big Idea:

Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them. Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons

Topical understanding	Essential Questions
All chemical formulas are neutral. Polyatomic ions are not neutral. Transition metals have variable valences. The mole is as practical unit measuring matter. Dimensional analysis is a tool for solving conversion problems.	How do you name and write formulas for ionic compounds? What are polyatomic ions? How do you name and write formulas for covalent compounds? How do you identify and name both binary and ternary acids? What is a variable valence metal? How are compounds named that contain these types of metals? Why is the mole an important measurement in chemistry?
Knowledge	Skills

<p>acid, base, binary compound ,law of definite proportions, law of multiple proportions, monatomic ion, polyatomic ion, variable valence metal, ionic compound, oxyacid, , molar mass, percent composition, Avogadro's number, atoms, mole</p>	<p>Using charge balance, write the correct formula for an ionic compound. Given the formula of an ionic compound, write the correct name; given the name of an ionic compound, write the correct formula. Write the name and formula of a compound containing a polyatomic ion. Given the formula of a covalent compound, write its correct name; given the name of a covalent compound, write its formula. Students will demonstrate how to write both formulas and names for acids. Define a mole and describe its importance. Identify and use Avogadro's number. Define molar mass and explain how it relates the mass of a substance to the number of particles in the substance. Convert among the number of particles, moles, and the mass of a substance. Describe molar volume and use it to solve problems. Find the percent composition of a given formula.</p>
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Assessment

Evaluation Criteria	Evidence of Understanding
<p>Worksheets Class discussion Oral review Chemical formula lab Quizzes/tests</p>	<p>Write the chemical formula for any binary compound with or without a variable valence metal. Identify polyatomic ions. Provide the correct name for a chemical compound. Identify the formula or correct name of binary and oxyacids. Define mole and explain its importance. Demonstrate how to calculate the molar mass of a given chemical formula. Use molar mass and Avogadro's number, to complete various conversions using dimensional analysis. Calculate the mass percentage of each element in a compound.</p>

Materials and Resources

Lab Chemicals & Solutions

Lab Equipment

Lab Report format

Quizzes

Mole Activity

Percent Composition Inquiry Lab

Study Guide

PowerPoint Presentations

Video clips

Chapter test

Chemical formula lab

Subject: Chem 1
Chapter: 8
Chemical Reactions

Grade Level: 11-12

Designed by: Melissa Sherman

School District: Tunkhannock Area

School: High School

Brief Summary of Chapter 8:

Thousands of chemical reactions occur each day. These reactions can have a direct impact on our lives. In a chemical reaction, one or more reactants are transformed into one or more new products. Chemical equations represent the reaction and must be balanced.

Chapter 8

S11.C.2.1.2 Describe energy changes in chemical reactions.

S11.C.2.1.3 Apply the knowledge of conservation of energy to explain common systems

S11.A.2.1.1

Critique the elements of an experimental design applicable to a specific experimental design.

S11.A.2.1.3

Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.

S11.A.2.1.4

Critique the results and conclusions of scientific inquiry for consistency and logic

Big Idea: Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them. Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.

Topical understanding	Essential Questions
Atoms of different types bond in simple, whole number ratios to form compounds and molecules. This fact is central in supporting modern atomic theory, and the fact that matter is particulate at the atomic level.	How do you know a chemical reaction has taken place? What are chemical reactions and why do they occur? What types of reactions can be used to better the world? Where does matter go after a reaction?

	How is a chemical equation like a recipe? How is it different?
Knowledge	Skills
balanced equation, catalyst, chemical equation, coefficients, synthesis reaction, combustion reaction, decomposition reaction, single replacement, double replacement, reactant, product	Write and balance chemical equations. Classify a reaction as synthesis, decomposition, combustion, single replacement, or double replacement.

Assessment

Evaluation Criteria	Evidence of Understanding
Worksheets Class discussion Oral review Balancing Equations Activity Quizzes/tests Labs	Describe the characteristics of a chemical reaction. Distinguish between the reactants and the products in a chemical equation. Illustrate the law of conservation of matter.

Materials and Resources

Balancing Equations Activity Study Guide PowerPoint Presentations Video clips Guided Readings	Worksheets Lab experiments and reports Quizzes/tests The chemistry of a toy lab
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Subject: Chem 1
Chapter: 9
Acids and Bases

Grade Level: 11-12

Designed by: Melissa Sherman

School District: Tunkhannock Area

School: High School

Brief Summary of Chapter 9:

Chapter 9

Read a comic book or watch a superhero movie and you will probably see a villain using an acid. You encounter acids and bases on a daily basis. Some of those substances are even ingested. Strong acids and bases can burn the skin. This chapter focuses on the properties of acids and bases as well as their strength.

Chapter 9

3.2.C.A.1 Differentiate between pure substances and mixtures.

S11.A.2.1.1

Critique the elements of an experimental design applicable to a specific experimental design.

S11.A.2.1.3

Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.

S11.A.2.1.4

Critique the results and conclusions of scientific inquiry for consistency and logic

Big Idea: Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them. Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.

Topical understanding	Essential Questions
We come in contact with acids and bases on an everyday basis. There	

are different strengths of acids and bases.	
Knowledge	Skills
Acid, base, pH, hydronium ion, concentration, molarity, indicator, titration, acid base reaction, acid rain, neutralization, hydroxide ion	Distinguish between an acid and a base. List properties of acids and bases. Define pH and calculate the hydronium and hydroxide ion concentration. Explain how acid rain forms and the affect on society. Define indicator and determine whether a substance is an acid or base using indicators.

Assessment

Evaluation Criteria	Evidence of Understanding
Worksheets Class discussion Oral review Quizzes Chapter test Labs	Calculate the concentration of an acid or base. Determine is a substance is an acid or base based on its properties. Describe acid base reactions that occur in everyday life.

Materials and Resources

Antacid activity Study Guide PowerPoint Presentations Video clips Guided Readings Worksheets	Antacid activity Household acids and base Quizzes Chapter test
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