STRATFORD PUBLIC SCHOOLS
Stratford, Connecticut

"Tantum eruditi sunt liberi"
Only The Educated Are Free

Chemistry
Grades 11-12

Revised and Edited by
Richard Gabbard, Lorraine Keogh, Kathleen McCarthy,
Dr. James Nuzzo, James Rooney, Diana Tseperkas, and Clifford Yaffe

Reviewed by
Secondary Science Department Heads
Peter Bowe and Donald Mascola

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Irene Cornish
Superintendent of Schools

Jeanne D'Angelo
Assistant Superintendent

DISTRICT MISSION

The mission of the Stratford Public Schools is to develop a community of learners in which students acquire the knowledge, skills and confidence to meet the challenges of a changing and increasingly diverse 21st century society.

DISTRICT CORE VALUES

Students will acquire content knowledge, strengthen higher-order thinking, and develop character in order to address 21st century challenges.

BUNNELL HIGH SCHOOL BELIEFS

We believe teachers must work collaboratively in support of student learning and to model collaboration as a social skill with students. We believe that a rigorous curriculum for all students, an acceptance of diversity, and a culture that actively welcomes all learners will contribute to a more knowledgeable community and society. We believe in the value of a strong education as a means of preparing students for work and life in the remainder of the 21st century.

STRATFORD HIGH SCHOOL BELIEFS

- a safe, positive school climate that embraces diversity is essential to ensure respect and opportunity for each individual
- students should understand the world beyond their community in order to contribute to a global society
- parents and students must share responsibility and work in partnership with the school in order to improve academic performance and to develop lifelong learners
- students should use technology effectively to acquire, process, and deliver information

BUNNELL HIGH SCHOOL and STRATFORD HIGH SCHOOL

LEARNING EXPECTATIONS

All students will…

- use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. (Academic)
- work independently and collaboratively to solve problems and accomplish goals. (Civic-Social)
- communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes. (Academic)
- demonstrate innovation, flexibility and adaptability in thinking patterns, work habits and working/learning conditions. (Academic)
- effectively apply the analysis, synthesis and evaluation processes that enable productive problem solving. (Academic)
- value and demonstrate personal responsibility, character, cultural understanding and ethical behavior. (Civic-Social)
- show competence in all core academic subjects and other fields of interest, including the ability to clearly and effectively communicate content information in multiple formats. (Academic)

Stratford Information Literacy and Technology Standards

Standard 1: Information Strategies

Students determine their need for information and apply strategies to select, locate, and access information resources.

Essential Understanding:

Intelligent decision-making is based on recognizing the need and applying appropriate strategies for accessing information.

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Essential Understanding:

All information is not equal.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Essential Understanding:

The effective communication of ideas and information is influenced by the use of appropriate formats.

Standard 4: Literacy and Literary Appreciation

Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Essential Understanding:

Reading provides a variety of benefits and advantages.

Standard 5: Personal Management

Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Essential Understanding:

Successful learning requires self-evaluation and discipline

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Stratford Public Schools

Essential Understandings for Chemistry

Essential Understanding #1: Matter

Matter is neither created nor destroyed in any chemical or physical process. Matter can be classified as elements, compounds, homogeneous mixtures or heterogeneous mixtures.

Essential Understanding #2: Measurements Specific to Chemistry

Meticulous measurements and mathematics play an essential role in understanding the major concepts of chemistry. A variety of technologies such as measuring instruments, calculators and computers are used in scientific investigations.

Essential Understanding #3: The Atom

Atoms have specific properties and structures. Matter is made up of minute particles called atoms, which are composed of even smaller components (protons, neutrons and electrons) that have measurable properties, such as mass and electrical charge.

Essential Understanding #4: Periodicity

Elements are arranged and grouped in the periodic table based on their properties. The periodic table is used to predict common properties of elements.

Essential Understanding #5: Bonding and Formula Writing

Atoms interact with each other by transferring or sharing valence electrons forming ionic or covalent bonds. These outer electrons govern the chemical properties of the element. The bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes, and chemical properties and provide the biochemical basis of life.

Essential Understanding #6: Chemical Equations and Reactions

Chemical formulas and equations can be used to obtain and communicate information about chemical reactions. Predictions can be made bases on known quantities of reactants or products. In both chemical and physical reactions, energy may be consumed but is never created of destroyed. Chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules.

Essential Understanding #7: Phases of Matter and Gas Laws

The Kinetic Molecular Theory is used to describe properties of solids, liquids, and gases. The higher the temperature, the greater is the atomic or molecular motion. Changes in pressure, temperature or volume of a gas result in predictable changes in either of the other properties.

Essential Understanding #8: Solutions

Solutions such as acids, bases, salts and non-electrolytes are homogenous mixtures having identifiable and predictable properties.

Safety In The Science Laboratory

Students and teachers must be aware of the potential for safety problems in the science classrooms and laboratories. Schools should review available safety resources and develop safety training for their teachers and students as well as safety rules for the classroom.

Teachers must choose safe labs that cover important concepts. Thought must be given to the chemicals purchased by schools. Which chemicals are the safest for the proposed labs, how much is needed, where will the chemicals be stored and in what arrangement? Are the storage areas locked and well ventilated?

General Lab Safety Recommendations

1. Always perform an experiment or demonstration prior to allowing students to replicate the activity. Look for possible hazards. Alert students to potential dangers.
2. Safety instructions should be given orally and be posted each time an experiment is begun.
3. Constant surveillance and supervision of student activities are essential.
4. Never eat or drink in the laboratory or from laboratory equipment. Keep personal items off the lab tables.
5. Never use mouth suction in filling pipettes with chemical reagents. Use a suction bulb.

General Science Safety Checklist

The following is a suggested checklist of safety concerns in K-12 science laboratories.

1. Appropriate protective equipment for the science laboratory
2. Enforcement of safety procedures
3. All students and teachers know the location of all protective equipment
4. All students read and sign a lab safety contract.
5. Sufficient, accessible lab stations per number of students in each laboratory
6. All students must wear proper safety goggles whenever chemicals, glassware, or heat are used

No food products should be consumed by staff or students as part of a lesson, unit or related course work.

Stratford Public Schools

Unit Name: Matter	**Est. # of Weeks: 6 weeks**
Synopsis: After studying the properties of matter, students should be able to identify elements, compounds, mixtures as well as chemical and physical changes.	
STUDENT LEARNING GOALS	
	Interdisciplinary Standards (as appropriate)

Content-Specific Powered Standards:

1. Students will recognize that a chemical change occurs when substances interact to form new materials with properties that differ from those of the original substances.
2. Students will use physical and chemical properties to classify and describe matter in terms of elements, compounds and mixtures.
3. Students will show that, while the quantity of matter is conserved, changes in matter can result in the formation of new materials.
4. Students will demonstrate that some properties (such as mass and volume) depend on the amount of material and some properties (such as density, melting point and boiling point) are independent of the amount of material.

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Key Terms:

Matter
Mass
Substance
Physical property
Solid
Liquid
Gas
Vapor
Physical change
Mixture
Heterogeneous mixture
Homogeneous mixture
Solution
Phase
Distillation
Elements
Compounds
Chemical symbol
Chemical reaction
Reactants
Products
Chemical property
Law of conservation of mass

Enduring Understandings:

Matter is neither created nor destroyed in any chemical or physical process. Matter can be classified as elements, compounds, homogeneous mixtures or heterogeneous mixtures.

Essential Questions

What characteristics or properties do scientists use to distinguish between physical and chemical properties of matter; physical and chemical changes of matter; elements, compounds, and mixtures?

Learning Objectives / Grade Level Expectations

Students will:

- Classification and definition of matter
- The difference between mixtures and substances
- The differences between elements and compounds
- Homogeneous vs. heterogeneous mixtures
- Characteristics of solids, liquids and gases

- Arrangement of particles in solids, liquids and gases
- Differences between chemical and physical changes
- Potential vs. kinetic energy
- Conservation of mass

ASSESSMENT PLAN

Summative Assessment(s)
- Quiz on scientific method
- Quiz on density
- Test on Matter

Formative and Diagnostic Assessment(s)
CFA #1

21st Century Skills
Aluminum Pellets Benchmark

LEARNING PLAN COMPONENTS

May include but are not limited to:

- Guar gum lab
- Designing an experiment
- Estimating and Measuring in the Metric System
- Demonstration MnO_2/H_2O_2 reaction
- $CuCl_2$/Al reaction lab
- Density problems
- Determining slope
- Demonstration of density- golf ball, soda can, multilayered column
- Density of various substances lab
- Bunsen burner lab
- Elements, compounds, mixtures lab
- Physical/Chemical change lab
- Demonstration of endothermic and exothermic reaction
- Pen chromatography lab

Unit Name: Measurements Specific to Chemistry (The Mole) **Est. # of Weeks: 6 weeks**

Synopsis: After studying the mole concept, students should be able to convert grams into moles and moles into grams.

STUDENT LEARNING GOALS

District Standard(s)

1. Demonstrate an understanding of basic scientific concepts relative to the science program completed by the student.

Content Specific Power Standard(s):
Content Standard 11

Structure of Matter-Educational experiences in grades 9-12 will assure that students:

Interdisciplinary Standards (as appropriate)

Standard 2: Information Use
Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3:

Explain how the chemical and physical properties of substances are related to their atomic and molecular structures.

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Key Vocabulary

Mole
Avogadro number
Gram atomic mass
Gram molecular mass
Gram formula mass
Molar mass
Standard temperature & pressure (STP)
Molar volume
Percent composition
Empirical formula
Molecular formula

Enduring Understandings:
Measurements Specific to Chemistry

Meticulous measurements and mathematics play an essential role in understanding the major concepts of chemistry. A variety of technologies such as measuring instruments, calculators and computers are used in scientific investigations.

Essential Questions:

How does a scientist measure something as tiny as an atom?

Learning Objectives / Grade Level Expectations

Students will be able to :
Explain gram atomic and gram formula mass
Describe the mole
Discuss Avagadro's number (number of particles)
Calculate percent composition

Skills

Math: Conversions between mass and moles
Using the periodic table as a reference tool
Math: Calculating the mass of one chemical in an equation when the mass of another chemical in the equation known.

ASSESSMENT PLAN

Summative Assessment:

Students must demonstrate mastery of converting grams to moles and moles to grams. Some samples are provided below:

1. Calculate the gram formula mass for $Al_2(SO_4)_3$.
2. How many grams are there in 1.5 moles of $ZnSO_4$?
3. How many moles are there in 105 grams of

Formative and Diagnostic Assessment(s)

CFA : The mole

21st Century Skills:

Alka Seltzer Lab

NH_4OH? 4. Quiz gram formula mass 5. Mole Test 6. Mass—Mass Quiz	

LEARNING PLAN COMPONENTS

Learning Plan Components:

1. Exercise the dozen … the mole
2. Guide to calculating gram formula mass (one mole)
3. Atomic and molecular weights
4. Determining the number of grams
5. Determining the number of moles
6. Mole lab
7. Molar masses and conversions

Unit Name: The Atom **Est. # of Weeks : 5 weeks**

Synopsis: After studying the atom, students should be able to identify the atomic structure of an element using the periodic table and be able to compare and contrast elemental isotopes.

STUDENT LEARNING GOALS

Content Standard(s): Connecticut Science Curriculum Framework	**Interdisciplinary Standards (as appropriate)**
Content-Specific Powered Standards	**Standard 2: Information Use** Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.
1. Demonstrate mastery of fundamental scientific concepts relative to the science program completed by the student. 2. Identify and solve problems through scientific	**Standard 3: Information and Technology Application** Students use appropriate technologies to create written,

investigation, including collection of relevant evidence or data, use of logical reasoning, appropriately analyzing data from qualitative data from experiments, drawing conclusions and identifying the validity of an experiment.

3. Demonstrate various scientific inquiry skills including: making generalizations from observations, relating an effect to its cause, identifying patterns or relationships, and comparing, sorting and/or classifying objects or events.

Content Standard

1. Recognize that all matter is made up of atoms which are too small to be seen directly through a microscope, but that indirect evidence can be used to construct a useful model of the atom. (Grades 5-
2. Describe the nature of atoms (Grades 9-12)

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

visual, oral and multimedia products that communicate ideas and information.

Key Vocabulary:

Dalton's atomic theory
Atom
Electrons
Proton
Neutrons
Nucleus
Cathode ray
Atomic number
Mass number
Isotopes
Atomic mass unit (amu)
Atomic mass
Periodic table
Periods
Periodic law
Group
Representative elements
Metals
Alkali metals
Alkaline earth metals
Transition metals
Inner transition metals
Nonmetals
Halogens
Noble gases
Metalloids

Enduring Understandings:

Atoms have specific properties and structures. Matter is made up of minute particles called atoms, which are composed of even smaller components (protons, neutrons and electrons) that have measurable properties such as mass and electrical charge.

Essential Questions

How can a knowledge of atomic structure help a chemist develop new products?

Learning Objectives/Grade Level Expectations

Students will be able to describe:

1. Models of the atom – including contributions by Dalton, Thomson, Rutherford.
2. Location, mass, charge and symbols for subatomic particles.
3. Atomic number and mass number.
4. Determine the number of protons and electrons for the atom of an element.

5. Determine the element based on its number of protons and/or electrons.
6. How the isotopes of elements are the same and how they differ from each other.
7. Atomic mass of an isotope versus the atomic mass of an element.
8. Given an isotope, determine atomic number, mass number, and numbers of subatomic particles.
9. Given combinations of properties, determine the identity of an isotope.
10. Atomic emission spectra of elements.

ASSESSMENT PLAN

Summative Assessments	**Formative and Diagnostic Assessment(s)**
1. Periodic table quiz—atomic structure 2. Isotope quiz 3. Gold Foil Lab Experiment 4. Test – Atomic structure and Isotopes	CFA : Atomic Structure

LEARNING PLAN COMPONENTS

Learning Plan Components:

May include but are not limited to:

1. Symbols and formulas worksheet
2. Hidden Elements word search
3. Percent composition of eggs lab (compare brown to white eggs)
4. Be a science detective lab
5. Atomic models review worksheet
6. Atomic structure review worksheet
7. Atomic number and weight worksheet
8. Keeping track of particles worksheet
9. Periodic chart review (atomic structure) worksheet
10. Isotopes lab (1982 pennies)
11. Spectroscopy I lab
12. Spectroscopy II lab
13. Concept map – the atom
14. Atoms and compounds worksheet
15. Excited Atoms and the Fourth Of July article

I.E.P. Lesson modifications:
I.E.P. Modifications will be made on an individual basis.

Unit Name: Chemical Periodicity **Est. # of Weeks : 4 weeks**

Synopsis: After studying the periodic table, students should be able to identify the name of an element and its relative reactivity based on the group and period locations on the periodic table.

STUDENT LEARNING GOALS

Content Standard(s): Connecticut Science Curriculum Framework

Content-Specific Powered Standards

1. Demonstrate mastery of fundamental scientific concepts relative to the science program completed by the student.
2. Identify and solve problems through scientific investigation, including collection of relevant evidence or data, use of logical reasoning, appropriately analyzing data from qualitative data from experiments, drawing conclusions and identifying the validity of an experiment.
3. Demonstrate various scientific inquiry skills including: making generalizations from observations, relating an effect to its cause, identifying patterns or relationships, and comparing, sorting and/or classifying objects or events.

Content Standard(s): Connecticut Science Curriculum Framework

Content Standard 11

1. Recognize that all matter is made up of atoms, which are too small to be seen directly through a microscope, but that indirect evidence can be used to construct a useful model of the atom.
2. Describe the nature of atoms and how atoms combine to form molecules. (Grades 9-12)
3. Use the periodic table to predict common properties of elements.(Grades 9-12)

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Interdisciplinary Standards (as appropriate)

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Key Vocabulary

Periodic table
Periods
Periodic law
Group
Representative elements
Metals
Alkali metals
Alkaline earth metals
Transition metals
Inner transition metals
Nonmetals
Halogens
Noble gases
Metalloids
Atomic radius
Ionization energy
Electronegativity

Enduring Understandings

Elements are arranged and grouped in the periodic table based on their properties. The periodic table is used to predict common properties of elements.

Essential Questions

How does an element's position on the periodic table determine its reactivity?

Learning Objectives / Grade Level Expectations

Students will:

1. Describe the correlation between the atomic emission spectrum of an element and its electron structure.
2. Explain how electrons are arranged within the atom according to the Bohr model.
3. Determine energy levels for an element based on its period position.
4. Determine valence electrons for an element based on its group position.
5. Describe energy level occupancy by electrons for atoms according to the Bohr model.
6. Use electron configurations to help determine energy level and group number for and element.
7. Use group numbers and energy levels to locate an element on the periodic table.
8. Use atomic radius information to help determine an element's reactivity.
9. Use ionization information to help determine an element's reactivity.

ASSESSMENT PLAN

Summative Assessment(s)	**Formative and Diagnostic Assessment(s)**
Summative Assessments: **Formative Assessments:** 1. Quizzes 2. Test	CFA # 4 Periodicity

LEARNING PLAN COMPONENTS

May include but are not limited to:

1. Bohr models-large sheet lab
2. Energy levels, valence electron worksheet
3. Bohr Diagrams worksheet
4. Bohr models practice worksheet
5. Atomic radius graph lab
6. Ionization graph lab
7. Periodic table summary worksheet
8. Periodic table puzzle lab
9. Oxygen lab
10. Hydrogen lab
11. Carbon dioxide lab
12. Atomic Structure/Periodic Table crossword puzzle

I.E.P. Lesson Modifications:

I.E.P. modifications will be made on an individual basis.

Unit Name: Bonding and Formula Writing **Est. # of Weeks: 4 weeks**

Synopsis: After studying bonding and formula writing, students should be able to describe the characteristics of ionic bonds, covalent bonds and metallic bonds, and the importance of hydrogen bonding.

STUDENT LEARNING GOALS

Content-Specific Powered Standards

Chemical Bonds

Biological, chemical and physical properties of matter result from the ability of atoms to form bonds from electrostatic forces between electrons and protons and between atoms and molecules

Supportive Concepts

1.Explain how atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds.

2. Describe how atoms and molecules in liquids move in a random pattern relative to one another because the intermolecular forces are too weak to hold the atoms or molecules in a solid form.

3. Lewis dot structures can provide models of atoms and molecules.

4. Describe shape of simple molecules and their polarity can be predicted from Lewis dot structures.

5. Describe how electronegativity and ionization energy are related to bond formation.

6. Describe how solids and liquids held together by Van der Waals forces or hydrogen bonds are affected by volatility and boiling/melting point temperatures.

Interdisciplinary Standards (as appropriate)

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Key Vocabulary

Valence
Octet
Ion
Cation
Anion
Polyatomic
Covalent bond
Ionic bond
Electronegativity
Electron dot notation

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Enduring Understandings	**Essential Questions**

Atoms interact with each other by transferring or sharing valence electrons forming ionic or covalent bonds. These outer electrons govern the chemical properties of the element. The bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes, and chemical properties and provide the biochemical basis of life.	How do atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by transferring electrons to form ionic bonds?

Learning Objectives / Grade Level Expectations

Students will:

- Write formulas for: binary ionic compounds, ternary ionic compounds, binary molecular compounds with prefixes
- Name compounds when given their formulas: binary ionic compounds, ternary ionic compounds, binary molecular compounds
- Know when to use ?? numbers in a chemical name
- Describe mole relationships in balanced equations
- Describe particle relationships in balanced equations
- Explain mass relationships in balanced equations
- Explain volume relationships in balanced equations
- Describe energy relationships in balanced equations
- Identify exothermic and endothermic reactions

ASSESSMENT PLAN

Summative Assessment(s)	**Formative and Diagnostic Assessment(s)**
Unit test Quizzes	CFA : # 5 Bonding

LEARNING PLAN COMPONENTS

May include but are not limited to:

1. Electron dot diagrams practice worksheet (ionic bonds)
2. Ionic bonding quiz
3. Molecular model lab
4. Paper Chromatography lab
5. Covalent bonding quiz
6. Test

Unit Name: Chemical Equations and Reactions **Est. # of Weeks: 5 weeks**

Synopsis: Chemical formulas and equations can be used to obtain and communicate information about chemical reactions. Predictions can be made based on known quantities of reactants or products. In both chemical and physical reactions energy may be consumed but is never created or destroyed. Chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules.

STUDENT LEARNING GOALS

Content-Specific Powered Standards
Demonstrate mastery of fundamental scientific concepts relative to the science program completed by the student.
Identify and solve problems through scientific investigation, including collection of relevant evidence or data, use logical reasoning, appropriately analyzing qualitative data from experiments, drawing conclusions and identifying the validity of an experiment.

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis,

Interdisciplinary Standards (as appropriate)

Standard 2: Information Use
Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application
Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Key Vocabulary:
Chemical equation
Skeleton equation
Catalyst
Coefficients
Balanced equation
Combination reaction
Decomposition reaction
Single-replacement reaction
Double-replacement reaction
Combustion reaction
Complete ionic equation
Spectator ions
Net ionic equation

synthesis, and evaluative processes that enable productive problem solving. **6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.**	

Enduring Understandings	**Essential Questions**
Atoms interact with each other by transferring or sharing valence electrons forming ionic or covalent bonds. These outer electrons govern the chemical properties of the element.	Why and how do ionic bonds form? How are ionic and covalent bonds similar and different? How are polar and non-polar covalent bonds similar and different? What type of bond is stronger and why?

Learning Objectives / Grade Level Expectations

Students will:

- Identify five types of chemical reactions: combustion reactions, decomposition reactions, combination reactions, single replacement reactions, double replacement reactions
- Identify products in a chemical reaction
- Identify reactants in a chemical reaction
- Describe factors that affect the rate of reactions
- Draw Bohr models of representative elements before and after exchanging electrons.
- Draw electron dot formulas for atoms of representative elements.
- Write and naming ionic compounds.
- Create Lewis structures for molecular compounds.
- Build models of molecules to compare polar and non-polar covalent bonds.

ASSESSMENT PLAN

Summative Assessment(s)	**Formative and Diagnostic Assessment(s)**
1. Students will draw dot diagrams for representative atoms and their ions such as: Na^{1+} and Cl^{1-}. 2. Students will write formulas and name ionic compounds such as: sodium. chloride, ammonium sulfate and copper (II) nitrate. 3. Students will draw Lewis structures for simple molecules such as: H_2O and CO. 4. Test formula writing 5. Quiz variable valences	CFA # 6 Chemical Equations **21st Century Skills:** Cold Packs

LEARNING PLAN COMPONENTS

May include but are not limited to:

1. Formulas and oxidation numbers
2. Epsom salts (% H_2O)
3. Copper sulfate (% H_2O)
4. Alka seltzer (% CO_2)
5. Alka Seltzer Percent Composition Comparison
6. Bond types and physical properties
7. Covalent Bonds

Unit Name: Phases of Matter and Gas Laws **Est. # of Weeks: 5 weeks**

Synopsis: After phases of matter and the gas laws, students should be able to explain kinetic molecular theory to describe the properties of solids, liquids, and gases.

STUDENT LEARNING GOALS

Content-Specific Powered Standards	**Interdisciplinary Standards (as appropriate)**
• Recognize that atoms and molecules are perpetually in motion and that as the temperature of a substance increases, the average energy of motion also increases. • Give examples which show that changes in pressure, temperature or volume of a gas sample result in predictable changes in either or both of the other properties.	**Standard 2: Information Use** Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests. **Standard 3: Information and Technology Application** Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.
	Key Vocabulary

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Boyles's Law
Charles' Law
Combined gas law
Dalton's Law of partial pressures
Diffusion
Effusion
Gay-Lussac's law
Graham's law of effusion
Ideal gas constant
Ideal gas law
Partial pressure
Kinetic theory
Kinetic energy
Vapor pressure
melting point
boiling point
phase diagram

Enduring Understandings

Phases of Matter and Gas Laws

The Kinetic Molecular Theory is used to describe properties of solids, liquids, and gases. The higher the temperature, the greater the atomic or molecular motion.

Changes in pressure, temperature or volume of a gas result in predictable changes in either of the other properties.

Essential Questions

What happens to a balloon filled with helium when it is released into the air and allowed to rise freely into the sky?

Topical Questions:

1. Predict what will happen to a balloon placed in a vacuum pump and explain why.
2. Predict what will happen to a balloon placed in a freezer and explain why.

Predict what will happen inside a car tire as a car drives at highway speeds on a very hot day and explain why.

Learning Objectives / Grade Level Expectations

Students will:

- Use Boyle's law to calculate pressure and volume changes at constant temperature.
- Use Charles' law to calculate temperature and volume changes at constant pressure.

- Use Gay-Lussac's law to calculate temperature and pressure changes at constant volume
- Be able to apply the combined gas laws to solve problems related to pressure-volume, temperature-volume, and temperature-pressure changes.
- Be able to apply these concepts to real life scenarios.

ASSESSMENT PLAN

Summative Assessment(s)	**Formative and Diagnostic Assessment(s)**
1. Boyle's gas law quiz 2. Charles' gas law quiz 3. Combined gas law quiz	CFA# 7; Phases of Matter and Gas Laws

LEARNING PLAN COMPONENTS

May include but are not limited to:

1. Gas law demonstration/discussion
    a. Pressure – Volume: Marshmallows in vacuum pump; Marshmallows in a syringe; Soda can with heated water placed upside down in cool water; balloon in a vacuum pump
    b. Pressure – Temperature: "Boil" water in a vacuum pump; cooking with a pressure cooker; cooking directions for high altitudes
    c. Temperature – Volume: Popcorn bag in a microwave; balloon in ice water

2. Boyle's law
    a. Boyle's law worksheet
    b. Boyle's law lab using a syringe and wooden blocks

3. Charles' law
    a. Problem sheet – Kelvin scale
    b. Charles' law lab using syringe or Charles' law lab using pipette (absolute zero)

Unit Name: Chemical Solutions **Est. # of Weeks: 5 weeks**

Synopsis:

After studying solutions, students should be able to draw and interpret solubility curves. Students should also be able to identify the effects of a solute on its colligative properties.

STUDENT LEARNING GOALS

District Standard(s	**Interdisciplinary Standards (as appropriate)** **Standard 2: Information Use**

1. Demonstrate an understanding and apply basic scientific concepts relative to the science program completed by the student.
2. Identify and solve problems through scientific investigation, including the formulation of predictions, student design of experiments, collection of relevant evidence or data, use of logical reasoning, appropriately analyzing data from experiments, drawing conclusions and identifying the validity of an experiment.

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Content Standard(s): Connecticut Science Curriculum Framework

Content Standard 11

Structure of Matter: Students will know the characteristic properties of matter and the relationship of these properties to structure and composition.

Key Vocabulary:

Saturated solution
Solubility
Unsaturated
Miscible
Immiscible
Henry's law
Supersaturated solution
Concentration
Dilute solution
Concentrated solution
Molarity (M)
Colligative properties
Boiling-point elevation
Freezing-point depression
Molality
Mole fraction
Molal freezing-point elevation constant (K_b)
Molal freezing-point depression (K_f)

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Enduring Understandings:

Solutions

Solutions such as acids, bases, salts and non-electrolytes are homogeneous mixtures having identifiable and predictable properties.

Essential Questions:

How does knowledge of solutions help you in your everyday life?

Learning Objectives:

Topics

Comparison of solutions and suspensions.
Characteristics of solutions.
Solubility and the effects of temperature and pressure.
Colligative properties.

Skills

Create and interpret solubility curves.
Create and interpret a graph about the effects of a solute on the boiling temperature of water.

ASSESSMENT PLAN

Summative Assessment :

Students must demonstrate the ability to interpret solubility curves and apply the effects of a solute on colligative properties. Some samples are provided below:

1. Determine how many grams of KCl are dissolved at 10°C?
2. Determine the temperature at which 50g of KCl are dissolved?
3. What type of solution would you have if 50g of KCl are dissolved at 50°C?
4. Why does a warm soda have more fizz when you open it then a cold soda does?
5. Why does a town add salt to sand in wintertime? Why not just use sand?
6. Solubility test.

Formative and Diagnostic Assessment(s)

CFA # 8 Solutions

21st Century Skills:

Research based Project

LEARNING PLAN COMPONENTS

Learning Plan Components:

1. Boiling temperatures lab.
2. Freezing Point Depression lab
3. A Solution versus a Pure Substance worksheet
4. Preparation of a solubility curve lab.
5. Types of Solutions lab – (unsaturated, saturated, supersaturated)
6. Energy changes in solutions lab
7. Activity: Solutions and the dissolving process.
8. Solubility Curves solutes
9. Analyze solubility curves
10. Activity Solubility Curves
11. Solubility worksheet
12. Benchmark activity : Cold Packs

Stratford Public Schools Pacing Guide Template

Staff can appropriately adjust length of time given to teaching skills and content to meet the needs of students without compromising the pace of the curriculum. *(Adopted BOE, 6/26/06)*

Chemistry Grades 11 - 12

Unit Name and Synopsis	Projected # of Days	Actual # of Days	Factors that Affected the Pace of Learning	Implications for Curriculum and Unit Design
Essential Understanding #1: Matter **Synopsis:** After studying the properties of matter, students will be able to identify elements, compounds, mixtures as well as chemical and physical changes.	6 weeks Ongoing throughout the school year	.	.	
Essential Understanding #2: Measurements Specific to Chemistry **Synopsis:** After studying the mole concept, students will be able to convert grams into moles and moles into grams.	6 weeks Ongoing throughout the year.			
Essential Understanding #3: The Atom **Synopsis:** After studying the atom, students will be able to identify the atomic structure of an element using the periodic table, and be able to compare and contrast elemental isotopes.	*5 weeks*			
Essential Understanding #4: Periodicity **Synopsis:** After studying the periodic table, students will be able to identify the name of an element and its relative reactivity based on	4 weeks			

the group and period locations on the periodic table.				
Unit Name and Synopsis	**Projected # of Days**	**Actual # of Days**	**Factors that Affected the Pace of Learning**	**Implications for Curriculum and Unit Design**
Essential Understanding #5: Bonding and Formula Writing Synopsis: After studying bonding and formula writing, students will be able to describe the characteristics of ionic bonds, covalent bonds and metallic bonds, and the importance of hydrogen bonding.	4 weeks			
Essential Understanding #6: Chemical Equations and Reactions Synopsis: After studying chemical formulas and equations students will be able to communicate information about chemical reactions.	5 weeks			
Essential Understanding #7: Phases of Matter and Gas Laws Synopsis: After phases of matter and the gas laws, students will be able to explain kinetic molecular theory to describe the properties of solids, liquids, and gases.	5 weeks			
Essential Understanding #8: Chemical Solutions Synopsis: After studying solutions, students will be able to draw and interpret solubility curves. Students should also be able to identify the effects of a solute on its colligative properties.	5 weeks			
