Seymour Public Schools Curriculum

Chemistry Curriculum

The intent of this unit is to demonstrate the proper use of lab materials and equipment. Also, correctly answer safety questions, demonstrate safe working practices in the lab as described by the lab safety contract.

Grade: 11-12	**Subject:** **Chemistry Curriculum-Laboratory Safety**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To properly use lab equipment
Essential Questions	*How do we use laboratory equipment properly?* *How can we work safely in the laboratory?*
Content Standard:	Design, conduct, and report lab research in chemistry (3.b.26).
Performance Expectations (Student outcomes)	The students will: • Identify and locate safety equipment in the lab. • Properly use lab materials and equipment. • Work safely in the lab.

Strategies/Modes (examples)	**Materials/Resources (examples)**	**Assessments (examples)**
Demonstrate, model, and instruct proper use of lab and safety equipment.	Lab and safety equipment i.e. beakers, test tubes, Bunsen burners, hot plates, ring stands, shower, eye wash, fire extinguisher, etc.	Pictorial and visual identification of lab and safety equipment.

Seymour Public Schools Curriculum

The intent of this unit is to continue the integration of scientific inquiry, literacy and numeracy throughout the entire course. Scientific inquiry is a state-wide standard that is included in each grade level throughout a student's science career. Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain, and predict natural phenomena.

Grade: 11-12	**Subject:** **Chemistry Curriculum – Scientific Method and Measurements**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	Measurements are used to analyze data and making observations
Essential Questions	• *How is scientific knowledge created, explored, investigated, and communicated?* • *How is data analyzed and interpreted to arrive at valid conclusions?* • *What are SI units and how are they used?* • *How do we calculate density?* • *How do we distinguish between accuracy and precision?* • *How do we determine significant figures in measurements?* • *How convert into scientific notation?*
Content Standard:	To analyze and interpret data using mathematical knowledge (3.c.31).
Performance Expectations (Student outcomes)	The students will: • Identify questions that can be answered through scientific investigation. • Formulate testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment. • Design and conduct appropriate types of scientific investigations to answer different questions. • Identify independent and dependent variables, including those that are kept constant and those used as controls. • Use appropriate tools and techniques to make observations and gather data. • Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.

Seymour Public Schools Curriculum

	• Name SI units for length, mass, time, volume, and density. • Perform density calculations. • Transform a statement of equality into a conversion factor. • Perform mathematical operations involving significant figures and scientific notation.

Strategies/Modes (examples)	**Materials/Resources (examples)**	**Assessments (examples)**
Demonstrate, model, and instruct in the use of mathematics to analyze data and make observation.	Calculators, rulers, thermometers, text books, computers.	Perform observational labs, construct graphs from collected data.

Seymour Public Schools Curriculum

Chemistry is the study of the composition, structure, properties of matter and the changes it undergoes. Chemists answer questions that they encounter routinely. All mater has different characteristics and properties.

Grade: 11-12	**Subject:** **Chemistry Curriculum- Matter and Its Changes**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To distinguish between matter and its changes, to classify types of changes, and to describe the periodic table
Essential Questions	• *How do distinguish between physical and chemical properties of matter?* • *How do you explain the gas, liquid, and solid states based on their properties?* • *How do we classify matter as physical or chemical changes?* • *How do we the periodic table to name elements given their symbol?* • *What are the names of the chemical families?* • *What are the characteristic of metals, metalloids, and nonmetals?*
Content Standard:	Physical and chemical properties and classification of element periodicity (3.a.3)
Performance Expectations (Student outcomes)	The students will: • Distinguish between physical and chemical changes in matter. • Classify changes of matter as physical or chemical. • Distinguish between a mixture and pure substance. • Use the periodic table to name elements. • Describe the arrangement of the periodic table. • List the characteristics that distinguish metals, nonmetals, and metalloids.

Seymour Public Schools Curriculum

Strategies/Modes (examples)	Materials/Resources (examples)	Assessments (examples)
Demonstrate, model, and instruct in the use of mathematics to analyze data and make observation.	Any phases of matter, interacting chemicals.	Perform observational labs and conduct qualitative experiments.

Seymour Public Schools Curriculum

Virtually all chemists of all chemists of the late 1700s accepted the modern definition of an element as a substance that cannot be further broken down by ordinary chemical means. Elements combine to form chemical compounds that have different properties than the elements that formed them.

Grade: **11-12**	**Subject:** **Chemistry Curriculum- Atomic Structure**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To understand the fundamental structure of atoms
Essential Questions	• *What is the conservation of mass in relations to Dalton's?* • *What is an atom?* • *What are the properties of protons, neutrons, and electrons?* • *What are isotopes and how do you name them?* • *How to define atomic number and mass number?* • *What is a mole in terms of Avogadro's number and how to solve problems involving the mole?*
Content Standard:	Fundamental structure of atoms (3.a.1)
Performance Expectations (Student outcomes)	The students will: • Explain the laws of conservation of mass and definite proportions. • Explain the relationship between Dalton's atomic theory and laws conservation of mass and definite proportions. • Define atom. • List the properties of protons, neutrons, and electrons. • Define isotopes. • Define atomic number and mass number a mole. • Solve problems involving the mole.

Seymour Public Schools Curriculum

Strategies/Modes (examples)	Materials/Resources (examples)	Assessments (examples)
Demonstrate, model, and explore the structure of the atom and its components.	Audio visual equipment, atomic models, poster boards	Perform observational labs and conduct qualitative experiments. Students are expected to create an audio visual presentation to explain the nature of the atom or historical relevance.

Seymour Public Schools Curriculum

The Rutherford model of the atom was an improvement over previous models, but it was incomplete. It did not explain how the atom's negatively charged electrons occupy the space surrounding the positively charged nucleus. In the early twentieth century, a new atomic model evolved as a result of investigations into the absorption and emission of light matter. The studies revealed a relationship between light and an atom's electron.

Grade: 11-12	**Subject:** **Chemistry Curriculum-Arrangement of Electrons in Atoms**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To properly organize electrons in any given atom
Essential Questions	• *What is the mathematical relationship between the speed, wavelength, and frequency?* • *What are properties of light?* • *What is the Bohr model of the hydrogen atom?* • *What is quantum chemistry?* • *What is electron configuration what are the applications?*
Content Standard:	Fundamental structure of atoms (3.a.1)
Performance Expectations (Student outcomes)	The students will: • Explain the mathematical relationship between the speed, wavelength, and frequency of electromagnetic energy. • Discuss the dual wave-particle nature of light. • Discuss the significance of the photoelectric effect. • Describe the Bohr model of the hydrogen atom. • Discuss the quantum model of the atom. • List and explain the significance of the 4 quantum numbers. • Describe the electron configurations of any atom using orbital notation, electron configuration, and noble gas notation.

Seymour Public Schools Curriculum

Strategies/Modes (examples)	Materials/Resources (examples)	Assessments (examples)
Demonstrate, model, and explore the arrangements of electrons in an atom.	Audio visual equipment, electronic models, poster boards.	Perform observational labs and conduct qualitative experiments. Students are expected to create a visual model of electron arrangement in a given atom.

Seymour Public Schools Curriculum

In September 1860, a group of chemists assembled to settle the issue of atomic mass as related to properties of atomic elements. Many of these scientists noticed a relationship between atomic number and recurring properties. Such a repeating pattern is known as periodic law.

Grade: 11-12	**Subject:** **Chemistry Curriculum – Periodic Law**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To define, compare, and explain the arrangement of elements in the Periodic Table
Essential Questions	• *Who were the scientists responsible of the development of the periodic table?* • *What information can be taken from the periodic table?* • *How does electron configuration explain the periodic law?* • *What is the relationship between electron configuration and properties of elements?*
Content Standard:	Historical development, perspectives, and the evolution of theories in Chemistry (3.b.25)
Performance Expectations (Student outcomes)	The students will: • Explain the role of several scientists in the development of the modern periodic table. • Explain how the periodic law can be used to predict the physical and chemical properties of elements. • Locate and name the 4 blocks of the periodic table. • Describe the locations in the periodic table and the general properties of the different families. • Define and compare the periodic trends of atomic and ionic radii, ionization energy, electron affinity, and electronegativity.

Seymour Public Schools Curriculum

Strategies/Modes (examples)	Materials/Resources (examples)	Assessments (examples)
Demonstrate, model, and explore the importance of the position of the element on the Periodic Table.	Audio visual equipment, electronic models, Periodic Table.	Perform observational labs and conduct qualitative and quantitative experiments. Students are expected to design a Periodic Table based on periodic trend information.

Seymour Public Schools Curriculum

The total number of natural and synthetic chemical compounds runs into the millions. For some of these substances, certain common names remain in everyday use. Unfortunately, common names usually give no information about chemical composition. In this unit, students will be introduced to some of the rules used to identify simple chemical compounds.

Grade: 11-12	**Subject:** **Chemistry Curriculum- Chemical Formulas and Compounds**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To understand the significance of a chemical formula, to name compounds, and calculate their mass.
Essential Questions	• *What is the significance of a chemical formula?* • *How to name an ionic compound?* • *How to use the stock system for naming compounds?* • *How to assign and determine oxidation number?* • *How to calculate formula mass, molar mass, and percent composition?* • *What is an empirical formula and how to calculate it?*
Content Standard:	Nomenclature (3.a.6.b)
Performance Expectations (Student outcomes)	The students will: • Explain the significance of a chemical formula. • Determine and name the formula of ionic compounds. • Determine the chemical formula of an ionic compound given the name. • List rules for assigning oxidation numbers. • Determine the oxidation number of each element in a formula. • Calculate formula mass, molar mass, and percent composition of a given compound. • Define and determine empirical and molecular formula.

Seymour Public Schools Curriculum

Strategies/Modes (examples)	Materials/Resources (examples)	Assessments (examples)
Demonstrate, model, and explore the importance of naming compounds and writing chemical formulas.	Audio visual equipment, ionic and molecular models, construction paper	Perform observational labs and conduct qualitative and quantitative experiments. Students are expected to construct a poster listing various ionic compounds and their chemical formulas.

Seymour Public Schools Curriculum

A chemical reaction is a process which one or more substances are changed into different substances. The original substances are known as the reactants and resulting substances are known as the products. According to the law of conservation of mass, the total mass of reactants must equal the total mass of the products. A chemical equation represents the identities and relative amounts of the reactants and products.

Grade: 11-12	**Subject:** **Chemistry Curriculum- Chemical Equations and Stoichiometry**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To investigate types of chemical reactions, predict the products, and calculate the amounts.
Essential Questions	• *What are evidences of a chemical reaction?* • *How do you write a word equation and formula equation for a given chemical reaction?* • *How to balance a formula equation?* • *What are the 5 types of chemical reactions?* • *How to predict the products of a chemical reaction?* • *How to use the activity series predict the probability of a chemical reaction?* • *How to calculate amounts of reactants ands products in a chemical reaction?*
Content Standard:	Mole concept, stoichiometry, and laws of composition (3.a.6)
Performance Expectations (Student outcomes)	The students will: • List evidences that a chemical reaction has taken place. • Write a word equation and formula equation for a given chemical reaction. • Balance a formula equation. • Define and give general equations for the 5 types of reactions. • Predict the products of simple reactions given the reactants. • Explain the significance and use of an activity series.

Seymour Public Schools Curriculum

Strategies/Modes (examples)	Materials/Resources (examples)	Assessments (examples)
Predict the products formed by a chemical reaction and demonstrate, model, and calculate the amounts of matter produced.	Audio visual equipment, electronic models, Periodic Table, polyatomic ion table.	Perform observational labs and conduct qualitative and quantitative experiments.

Seymour Public Schools Curriculum

Every substance is made up of a combination of atoms held together by chemical bonds. By bonding with each other, atoms decrease in potential energy thereby creating more stable arrangements of matter. The characteristics of these arrangements depend on the type of bonding that exists between their atoms. Some bonds may be ionic, covalent, or metallic. Properties of molecules also depend on their geometry as explained by the VSEPR.

Grade: 11-12	**Subject:** **Chemistry Curriculum- Chemical Bonding, Polarity, Molecular Geomertry**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To investigate the different types of bonding, their properties, and predict the shapes of molecules.
Essential Questions	• *What is a chemical bond?* • *What is the difference between metallic, ionic, and covalent bonding?* • *What is a molecule?* • *What is the octet rule?* • *How to write a Lewis structure?* • *What are the properties of ionic compounds and molecules?* • *How to predict the shapes of molecules using VSEPR theory?* • *How to determine molecular polarity?*
Content Standard:	Basic principles of ionic, covalent, and metallic bonding; Lewis adducts and coordination compounds (3.a.2 and 3.17.b)
Performance Expectations (Student outcomes)	The students will: • Define chemical bond. • Describe ionic, covalent, and metallic bond according to electronegativity differences. • Compare and contrast ionic compound vs. molecules. • State the octet rule. • Explain how to determine Lewis structures. • List and compare the properties of ionic and molecular compounds.

Seymour Public Schools Curriculum

	• Explain VSEPR theory and apply it to shapes of molecules. • Explain what determines molecular polarity.

Strategies/Modes (examples)	Materials/Resources (examples)	Assessments (examples)
Predict the type of bonds and their molecular structure based on the VSEPR Theory.	Audio visual equipment, electronic models, Periodic Table, polyatomic ion table, 3-D molecular models.	Perform observational labs, conduct qualitative experiments, construct 3-D molecular models, give an oral presentation.

Seymour Public Schools Curriculum

Carbon is found in nature both as an element and in combined form and it is found in all living matter. Organic compounds are defined as covalently bonded compounds containing carbon. Their diversity results from the uniqueness of carbon structure and bonding. In fact, its

Grade: 11-12	**Subject:** **Chemistry Curriculum - Organic Chemistry**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To name and classify organic compounds and to investigate reaction mechanisms.
Essential Questions	• *How does carbon form covalent bonds?* • *How does the different allotropes of carbon affect their properties?* • *What are the different types of isomers?* • *How to name and write formulas for different types of hydrocarbons?* • *How to classify organic compounds based on their functional groups?* • *What is the difference between a monomer and a polymer?*
Content Standard:	Organic synthesis and organic mechanisms (3.b.22)
Performance Expectations (Student outcomes)	The students will: • Identify the allotropes of carbon and their structural differences. • Explain how the different structures affect their properties. • Compare structural and geometric isomers. • Be able to name and write structural formulas for saturated and unsaturated hydrocarbons. • Define functional groups and explain their importance. • Identify organic compounds based on their functional groups. • Relate some functional groups to some characteristic reactions. • Explain the relationships between monomers and polymers.

Seymour Public Schools Curriculum

Strategies/Modes (examples)	Materials/Resources (examples)	Assessments (examples)
Predict the structure and the properties of the organic compound based on the name. Demonstrate the formation of polymers.	Audio visual equipment, Periodic Table, 3-D molecular models.	Construct 3-D molecular models, give an oral presentation.

Seymour Public Schools Curriculum

The kinetic molecular theory is based on the idea particles of matter are always in motion. The theory can be used to explain the properties of solids liquids and gases in terms of energy of particles and forces that act between them. Also, such theory can help understand the behavior of gas molecules and the physical properties of gases. Gas laws have been developed to mathematically explain the relationships between the volume, temperature, pressure, and quantity of a gas.

Grade: 11-12	**Subject:** **Chemistry Curriculum- Gases**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To use the gas laws and stoichiometry to predict changes in P, T, and V.
Essential Questions	• *What is the kinetic molecular theory of matter?* • *What are the characteristic properties of gases?* • *What is an ideal gas, its law, and its application?* • *What is pressure?* • *How to use the gas laws to predict changes in P, T, and V?* • *What is partial pressure?* • *What is Avogadro's law?* • *What is the standard molar volume of a gas?* • *How to perform volume to volume, volume to mass, and mass to volume calculations?* • *What is Graham's law?*
Content Standard:	Kinetic molecular theory of gases (3.a.4.b)
Performance Expectations (Student outcomes)	The students will: • State the kinetic molecular theory and its 5 assumptions. • Define real and ideal gas. • Describe several properties of gases. • Define pressure, volume, and temperature; its units; and measurements.

Seymour Public Schools Curriculum

	• Use the kinetic molecular theory to explain the relationship between pressure, volume, and temperature. • Use the combined gas law to calculate volume, temperature, and pressure changes. • State Avogadro's law and its significance. • Define standard molar volume and its use. • State the ideal gas law and its derivations. • Using the ideal gas law calculate P, V, T, molar mass, and density. • Perform volume to volume, mass to volume, and volume to mass calculations. • State Graham's law of effusion and its applications.

Strategies/Modes (examples)	**Materials/Resources (examples)**	**Assessments (examples)**
Predict the properties of gases based on changes in P, T, and V. Investigate Avogadro's Law and perform stoichiometric calculations	Audio visual equipment, electronic models, Periodic Table, polyatomic ion table, 3-D molecular models.	Perform observational labs, conduct qualitative experiments, and evaluate understanding using formative and summative assessments.

Seymour Public Schools Curriculum

A liquid can be described as form of matter with a definite volume and takes the shape of its container and solid has a definite shape and definite volume. Particles in liquids and gases are in constant motion. However, the particles in a solid are closer together and lower in kinetic energy than those in a liquid.

Grade: 11-12	**Subject:** **Chemistry Curriculum - Liquids, Solids, and Changes of State**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To predict the characteristics of solids and liquids using Kinetic Molecular Theory.
Essential Questions	• *How do particles move according to kinetic molecular theory?* • *What is evaporation, boiling and freezing?* • *How do solids move according to kinetic molecular theory?* • *What are two types of solids?* • *What is equilibrium?* • *What Le Chatelier's Principle?* • *What is Equilibrium vapor pressure?* • *How to interpret phase diagrams?*
Content Standard:	Chemical kinetic concepts and changes of state (3.b.16.b)

Seymour Public Schools Curriculum

Performance Expectations (Student outcomes)	The students will: • Describe the motion of particles in liquids and solids according to the kinetic molecular theory. • Define evaporation, melting, and freezing. • Distinguish between two types of solids. • Explain the relationship between equilibrium and changes of state. • Predict changes in equilibrium using Le Chatelier's Principle. • Describe the process of boiling, freezing, melting, and sublimation. • Interpret phase diagram.

Strategies/Modes (examples)	**Materials/Resources (examples)**	**Assessments (examples)**
Predict the change of state based on kinetic molecular theory (KMT). Investigate motion of particles based on KMT.	Audio visual equipment, Periodic Table, polyatomic ion table, 3-D molecular models.	Perform observational labs, conduct qualitative experiments, and evaluate understanding using formative and summative assessments.

Seymour Public Schools Curriculum

There are two types of mixtures; homogeneous and heterogeneous. A homogenous mixture is a solution composed of solutes and solvents. There are several types of solutions such as suspensions and colloids which have different properties. A substance that dissolves in water and conducts electricity is an electrolyte. Solution equilibrium is the physical state in which the opposing properties of dissolution and crystallization occur at equal rates. The rate determines whether a solution is saturated, unsaturated, or supersaturated.

Grade: 11-12	**Subject:** **Chemistry Curriculum - Solutions**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To develop an understanding of the different types of mixtures and factors that affect solubility.
Essential Questions	• *What are the different types of mixtures?* • *What are the properties of suspensions, colloids, and solutions?* • *What is the difference between electrolytes and nonelectrolytes?* • *What are the factors that affect the rate of solution?* • *What is the difference unsaturated, saturated, and supersaturated solutions?* • *What are the factors that contribute to the heat of solution?* • *What are the effects of temperature and pressure on solubility?* • *How to calculate concentration of solutions?*
Content Standard:	Solution, colloids, and colligative properties (3.b.18); Solvent system concepts (3.b.20)
Performance Expectations (Student outcomes)	The students will: • Define solution. • Distinguish between heterogeneous and homogeneous mixtures. • Compare and contrast the properties of suspensions, colloids, and solutions. • Distinguish between electrolytes and nonelectrolytes. • Explain the factors that affect the rate of solution. • Explain solution equilibrium and distinguish between saturated, unsaturated, and supersaturated solutions.

Seymour Public Schools Curriculum

	• Explain exothermic and endothermic reactions. • Compare the effects temperature and pressure on solubility. • Define and calculate concentration of solutions.

Strategies/Modes (examples)	Materials/Resources (examples)	Assessments (examples)
Compare the properties of liquids and solids and the factors that affect solubility. Evaluate solution concentrations.	Audio visual equipment, Periodic Table, polyatomic ion table.	Perform observational labs, conduct qualitative experiments, and evaluate understanding using formative and summative assessments.

Seymour Public Schools Curriculum

When an ionic compound is dissolved in water dissociation occurs. Compounds of low solubility are known as precipitates. Only those compounds and ions that undergo a chemical change are represented by a net ionic equation. Some molecular compounds can form ions in solution. This process is known as ionization. Properties that depend on the concentration of solute particles but not on there identity are called colligative. Some of the colligative properties are freezing point depression, boiling point elevation, and solution molality of nonelectrolytic solution.

Grade: 11-12	**Subject:** **Chemistry Curriculum - Colligative Properties**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To predict and calculate the colligative properties.
Essential Questions	• *How to write an equation for the dissolution of soluble ionic compounds?* • *How to predict the formation of a precipitate?* • *What is a strong electrolyte?* • *What are colligative properties and how to calculate them?* • *What are the causes of the differences between the expected and experimentally observed colligative properties.*
Content Standard:	Solution, colloids, and colligative properties (3.b.18)
Performance Expectations (Student outcomes)	The students will: • Write equations for the dissolution of soluble ionic compounds. • Predict the formation of a precipitate. • Distinguish between dissociation and ionization. • Distinguish between strong and weak electrolytes. • Define and calculate colligative properties. • Discuss the differences between expected and experimentally observed colligative properties.

Seymour Public Schools Curriculum

Strategies/Modes (examples)	Materials/Resources (examples)	Assessments (examples)
Predict the formation of a precipitate. Define and calculate colligative properties.	Audio visual equipment, Periodic Table, polyatomic ion table.	Perform observational labs, conduct qualitative experiments, and evaluate understanding using formative and summative assessments.

Seymour Public Schools Curriculum

Substances, depending on their pH, can be either acids or bases. Acids that contain only two elements one of which is hydrogen are known as binary. Acids that contain hydrogen oxygen and a third element are known as oxyacids. Usually bases consist of and element and a hydroxide ion. There are several definitions acids and bases; Arrhenius, Bronsted-Lowry, and Lewis. Reactions that occur between acids and bases are known as neutralization. Acids and bases are expressed in terms of hydronium and hydroxide concentration represented by pH, defined as the negative of the common logarithm of the hydronium ion concentration. Likewise, the pOH as the negative of the common logarithm of the hydroxide ion concentration. An approximate value for the pH of a solution can be obtained using compounds whose colors are sensitive to pH known as indicators. The addition of a known concentration of an acid or a base to an unknown concentration of an acid or base in the presence of an indicator is known as titration.

Grade: 11-12	**Subject:** **Chemistry Curriculum- Acids and Bases – Properties and Calculations**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To name and distinguish acids and bases. To define and calculate pH and pOH.
Essential Questions	• *What are the properties of acids and bases?* • *How to name acids and bases?* • *How to distinguish amongst the three definitions of acids and bases?* • *How to explain the difference between strong acids and bases?* • *What is a conjugate acid, conjugate base, and an amphoteric compound?* • *What is the process of neutralization?* • *What is pH and pOH and how to calculate them?* • *How to calculate concentration based on titration?*
Content Standard:	Acids and bases, oxidation – reduction chemistry, and solutions (3.a.8)
Performance Expectations (Student outcomes)	The students will: • List properties of acids and bases. • Name binary and oxyacids. • Define acids and bases according to Arrhenius, Bronsted-Lowry, and Lewis classifications.

Seymour Public Schools Curriculum

	• Explain the difference between a strong acid and base. • Define and relate conjugate acids and bases. • Define amphoteric compounds. • Describe the self ionization of water. • Define and calculate pH, pOH, $[H_3O^+]$ and $[OH^-]$. • Describe how an indicator functions. • Define titration and calculate concentration.

Strategies/Modes (examples)	**Materials/Resources (examples)**	**Assessments (examples)**
Demonstrate, model, and explore the properties of acids and bases. Calculate their strength and concentration.	Audio visual equipment, Periodic Table, polyatomic ion table, various pH indicators.	Perform observational labs, conduct qualitative experiments, and evaluate understanding using formative and summative assessments.

Seymour Public Schools Curriculum

Every chemical reaction has a change of energy associated with it. The study of such change is called thermal chemistry. Changes in energy are measured by temperature and heat is the sum total of the kinetic energies. The quantity of heat released or absorbed during a chemical reaction is heat of reaction. If this heat change occurs at constant pressure is known as enthalpy. To calculate heats of reaction we must use Hess's Law which states that the overall enthalpy change in a reaction is equal to the sum of all individual enthalpy changes in the process. The path between the initial and final state of reaction is known as the reaction mechanism and the rate of which the steps occur is known as reaction rate. Such rate is influenced by the nature of reactants, surface area, temperature, concentration, and the presence of a catalyst.

Grade: 11-12	**Subject:** **Chemistry Curriculum- Reaction Energy and Kinetics**
NSTA Standard	Recommendations for Teachers of Chemistry. Core Competencies. All teachers of chemistry should be prepared to lead students to understand the unifying concepts required in science (C.3.a)
Enduring Understanding	To define and calculate kinetic properties and the factors that affect reaction rate.
Essential Questions	• *What is temperature and Heat?* • *What is Heat of reaction, formation, combustion, enthalpy, and how to calculate them?* • *What is enthalpy, entropy, free energy?* • *What is reaction mechanism?* • *What is an activated complex?* • *What is chemical kinetics?* • *What are the factors that affect reaction rate?* • *What is a catalyst and what are its uses?* • *How to write a rate law?*
Content Standard:	Chemical kinetics and thermal dynamics (3.a.4)
Performance Expectations (Student outcomes)	The students will: • Define temperature and heat. • Perform specific – heat calculations • Explain and solve problems involving heat of reaction, formation, combustion, and enthalpy. • Explain enthalpy and entropy changes.

Seymour Public Schools Curriculum

	• Discuss free energy and its effect on the tendency for the reaction to occur. • Explain the concept of reaction mechanism. • Define activated complex, heat of reaction, and chemical kinetics. • Discuss the five factors that influence reaction rate. • Define catalyst and discuss the types. • Write rate laws for chemical reactions.

Strategies/Modes (examples)	**Materials/Resources (examples)**	**Assessments (examples)**
Demonstrate, model, and predict the thermal dynamic properties of matter and explore the factors that influence rate.	Audio visual equipment, Periodic Table, polyatomic ion table, calorimeters.	Perform observational labs, conduct qualitative experiments, and evaluate understanding using formative and summative assessments.