

South Hadley Public Schools

Subject: Accelerated Chemistry

School: High School

Big Idea/Essential Question: Physical and chemical properties can be used to classify and describe matter.

Standards	Learning Expectations	Skills	Assessments	Content
<p>PROPERTIES OF MATTER</p> <p>1.1 Identify and explain some of the physical properties that are used to classify matter, e.g., density, melting point, and boiling point</p> <p>1.2 Explain the differences between mixtures and pure substances</p> <p>1.3 Describe the four states of matter (solid, liquid, gas, plasma) in terms of energy, particle motion, and phase transitions</p> <p>1.4 Distinguish between chemical and physical changes</p>	<p>LE 1: Read, write, and communicate effectively</p> <p>LE 2: Define, analyze, and solve complex problems and communicate results</p> <p>LE 3: Study and work productively both independently and in groups</p> <p>LE 4: Demonstrate personal, social, and civic responsibility</p> <p>LE 5: Acquire, apply, integrate, analyze, and synthesize knowledge</p> <p>LE 8: Identify and apply appropriate technologies</p>	<p>1. Identify substances by their density, melting point, and boiling point</p> <p>2. Identify mixtures and pure substances by their properties</p> <p>3. Separate mixtures into their components</p> <p>4. Distinguish between chemical and physical changes based upon observations</p>	<p>1. lab - separating mixtures</p> <p>2. lab - decomposing pure substances</p> <p>3. lab - prepare heating and cooling curves for a pure substance</p> <p>4. test - chapter 2 (part 1)</p>	<p>text sections: 1.8, 1.9, 2.1, 2.2, 2.3, 2.4, 2.5</p> <p>demo - distillation</p> <p>demo - can crush</p> <p>demo - electrolysis of water</p>

South Hadley Public Schools

Subject: Accelerated Chemistry

School: High School

Big Idea/Essential Question: An atom is a discrete unit. The atomic model can help us to understand the interaction of elements and compounds observed on a macroscopic scale.

Standards	Learning Expectations	Skills	Assessments	Content
ATOMIC STRUCTURE				
2.1 Trace the development of atomic theory and the structure of the atom from the ancient Greeks to the present	LE 1: Read, write, and communicate effectively	1. Explain the refinement in atomic theory models as scientific knowledge increased	1. lab - electron configurations for atoms and ions in ground and excited state	text sections: 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 8.10, 9.1, 9.2, 9.3, 9.4, 9.9, 9.11, 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.8, 10.9, 10.10, 10.11
2.2 Interpret Dalton's atomic theory in terms of the Laws of Conservation of Mass, Constant Composition, and Multiple Proportions	LE 2: Define, analyze, and solve complex problems and communicate results	2. Apply conservation of mass to chemical reactions	2. lab - radioactive decay series	
2.3 Identify the major components of the nuclear atom (protons, neutrons, and electrons) and explain how they interact	LE 3: Study and work productively both independently and in groups	3. Determine percent composition of compounds	3. lab - calculation of photonic energy	
2.4 Understand that matter has properties of both particles and waves	LE 4: Demonstrate personal, social, and civic responsibility	4. Calculate photonic energies based on wavelength or frequency	4. lab - percent composition of compound	
2.5 Using Bohr's model of the atom interpret changes in electron energies in the hydrogen atom corresponding to emission transitions between quantum levels	LE 5: Acquire, apply, integrate, analyze, and synthesize knowledge	5. Write electron configurations for atoms and ions in ground and excited state	4. test - chapter 8 5. test - chapter 9	
2.6 Describe the electromagnetic spectrum in terms of wavelength and energy; identify regions of the electromagnetic spectrum	LE 8: Identify and apply appropriate technologies	6. Write balanced nuclear reaction representing spontaneous decay by alpha or beta emission	6. test - chapter 10	

South Hadley Public Schools

Subject: Accelerated Chemistry

School: High School

Big Idea/Essential Question: An atom is a discrete unit. The atomic model can help us to understand the interaction of elements and compounds observed on a macroscopic scale.

Standards	Learning Expectations	Skills	Assessments	Content
2.7 Write the electron configurations for elements in the first three rows of the periodic table	LE 1: Read, write, and communicate effectively	as outlined above	as outlined above	as outlined above
2.8 Describe alpha, beta, and gamma particles; discuss the properties of alpha, beta, and gamma radiation; and write balanced nuclear reactions	LE 2: Define, analyze, and solve complex problems and communicate results			
2.9 Compare nuclear fission and nuclear fusion and mass defect	LE 3: Study and work productively both independently and in groups			
2.10 Describe the process of radioactive decay as the spontaneous breakdown of certain unstable elements (radioactive) into new elements (radioactive or not) through the spontaneous emission by the nucleus of alpha or beta particles. Explain the difference between stable and unstable isotopes	LE 4: Demonstrate personal, social, and civic responsibility			
	LE 5: Acquire, apply, integrate, analyze, and synthesize knowledge			
	LE 8: Identify and apply appropriate technologies			
2.11 Explain the concept of half-life of a radioactive element, e.g., explain why the half-life of C14 has made carbon dating a powerful tool in determining the age of very old objects				

South Hadley Public Schools

Subject: Accelerated Chemistry

School: High School

Big Idea/Essential Question: Periodicity of physical and chemical properties relates to atomic structure and led to the development of the periodic table. The periodic table displays the elements in order of increasing atomic number.

Standards	Learning Expectations	Skills	Assessments	Content
PERIODICITY				
3.1 Explain the relationship of an element's position on the periodic table to its atomic number and mass	LE 1: Read, write, and communicate effectively LE 2: Define, analyze, and solve complex problems and communicate results	1. Read the periodic table in terms of groups, periods, metals, nonmetals, metalloids, valence electrons, atomic number, and atomic mass	1. lab - graphing periodic trends in properties 2. test - chapter 11	text sections: 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 11.7
3.2 Use the periodic table to identify metals, nonmetals, metalloids, families (groups), periods, valence electrons, and reactivity with other elements in the table	LE 3: Study and work productively both independently and in groups LE 4: Demonstrate personal, social, and civic responsibility	2. Relate electron configuration to position of element in the periodic table		
3.3 Relate the position of an element on the periodic table to its electron configuration	LE 5: Acquire, apply, integrate, analyze, and synthesize knowledge	3. Describe periodic trends in properties such as atomic radius, ionization energy, electron affinity, relative ionic size, and electronegativity		
3.4 Identify trends on the periodic table (ionization energy, electronegativity, electron affinity, and relative size of atoms and ions).	LE 8: Identify and apply appropriate technologies			

South Hadley Public Schools

Subject: Accelerated Chemistry

School: High School

Big Idea/Essential Question: Atoms form bonds by the interaction of their valence electrons.

Standards	Learning Expectations	Skills	Assessments	Content
CHEMICAL BONDING				
4.1 Explain how atoms combine to form compounds through both ionic and covalent bonding	LE 1: Read, write, and communicate effectively	1. Draw Lewis dot diagrams for elements	1. lab - writing formulas for combinations of ions	text sections: 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7, 13.8
4.2 Draw Lewis dot structures for simple molecules	LE 2: Define, analyze, and solve complex problems and communicate results	2. Determine if a compound exhibits ionic or covalent bonding based on electronegativity difference	2. lab - building models of molecules	
4.3 Relate electronegativity and ionization energy to the type of bonding an element is likely to undergo	LE 3: Study and work productively both independently and in groups	3. Draw Lewis dot diagrams for ionic and molecular compounds	3. test - chapter 2 (part 2)	
4.4 Predict the geometry of simple molecules and their polarity (valence shell electron pair repulsion)	LE 4: Demonstrate personal, social, and civic responsibility	4. Write names and formulas for compounds bonded ionically and/or covalently	4. test - chapter 13	
4.5 Identify the types of intermolecular forces present based on molecular geometry and polarity	LE 5: Acquire, apply, integrate, analyze, and synthesize knowledge			
4.6 Predict chemical formulas based on the number of valence electrons	LE 8: Identify and apply appropriate technologies			
4.7 Name and write the chemical formulas for simple ionic and molecular compounds, including those that contain common polyatomic ions				

South Hadley Public Schools

Subject: Accelerated Chemistry

School: High School

Big Idea/Essential Question: The conservation of atoms in chemical reactions leads to the ability to calculate the mass of products and reactants.

Standards	Learning Expectations	Skills	Assessments	Content
CHEMICAL REACTIONS AND STOICHIOMETRY	LE 1: Read, write, and communicate effectively	1. Write word equations for a chemical change using correct nomenclature	1. lab - counting rice by mass	text sections: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11, 3.12, 4.1, 4.2, 4.3, 4.4, 4.5, 4.9, 4.10, 4.11, 4.12, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6
5.1 Balance chemical equations by applying the law of conservation of mass	LE 2: Define, analyze, and solve complex problems and communicate results	2. Translate word equations into unbalanced formula equations	2. lab - mole-mole 3. lab - mass-mass	
5.2 Recognize synthesis, decomposition, single displacement, double displacement, and neutralization reactions	LE 3: Study and work productively both independently and in groups	3. Use coefficients to balance chemical equations	4. lab - types of reactions	
5.3 Understand the mole concept in terms of number of particles, mass, and gaseous volume	LE 4: Demonstrate personal, social, and civic responsibility	4. Identify type of chemical reaction based on formulas for reactants and products	5. test - chapter 3 6. test - chapter 4	
5.4 Determine molar mass, percent compositions, empirical formulas, and molecular formulas	LE 5: Acquire, apply, integrate, analyze, and synthesize knowledge	5. Determine molar mass of elements and compounds	7. test - chapter 5	
5.5 Calculate mass-mass, mass-volume, volume-volume, and limiting reactant problems for chemical reactions	LE 8: Identify and apply appropriate technologies	6. Convert between mass and moles for elements and compounds		
5.6 Calculate percent yield in a chemical reaction		7. Convert between mass and moles for gases at standard temperature and pressure		
		8. Solve stoichiometry problems to predict amount of product made or amount of reactant used		

South Hadley Public Schools

Subject: Accelerated Chemistry

School: High School

Big Idea/Essential Question: The behavior of gases can be explained by the Kinetic Molecular Theory.

Standards	Learning Expectations	Skills	Assessments	Content
<p>GASES AND KINETIC MOLECULAR THEORY</p> <p>6.1 Using the kinetic molecular theory, explain the relationship between pressure and volume (Boyle's law), volume and temperature (Charles' law), and the number of particles in a gas sample (Avogadro's hypothesis)</p> <p>6.2 Explain the relationship between temperature and average kinetic energy</p> <p>6.3 Perform calculations using the ideal gas law</p> <p>6.4 Describe the conditions under which a real gas deviates from ideal behavior</p> <p>6.5 Interpret Dalton's empirical Law of Partial Pressures and use it to calculate partial pressures and total pressures</p> <p>6.6 Use the combined gas law to determine changes in pressure, volume, or temperature</p>	<p>LE 1: Read, write, and communicate effectively</p> <p>LE 2: Define, analyze, and solve complex problems and communicate results</p> <p>LE 3: Study and work productively both independently and in groups</p> <p>LE 4: Demonstrate personal, social, and civic responsibility</p> <p>LE 5: Acquire, apply, integrate, analyze, and synthesize knowledge</p> <p>LE 8: Identify and apply appropriate technologies</p>	<p>1. Qualitatively and quantitatively describe the effect on a gas sample when volume, temperature, or pressure is changed</p> <p>2. Use the ideal gas law appropriately to solve for any variable</p>	<p>1. lab - Boyle's law</p> <p>2. lab - Charles' law</p> <p>3. lab - molar volume of hydrogen</p> <p>4. test - chapter 6</p> <p>5. test - chapter 7</p>	<p>text sections: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7</p> <p>demo - vacuum chamber</p>

South Hadley Public Schools

Subject: Accelerated Chemistry

School: High School

Big Idea/Essential Question: Solids, liquids, and gases dissolve to form solutions.

Standards	Learning Expectations	Skills	Assessments	Content
<p>SOLUTIONS</p> <p>7.1 Describe the process by which solutes dissolve in solvents</p> <p>7.2 Identify and explain the factors that affect the rate of dissolving (i.e., temperature, concentration, and mixing)</p> <p>7.3 Describe the dynamic equilibrium that occurs in saturated solutions</p> <p>7.4 Calculate concentration in terms of molarity, molality, and percent by mass</p> <p>7.5 Use a solubility curve to determine saturation values at different temperatures</p> <p>7.6 Calculate the freezing point depression and boiling point elevation of a solution</p> <p>7.7 Write net ionic equations for precipitation reactions in aqueous solutions</p>	<p>LE 1: Read, write, and communicate effectively</p> <p>LE 2: Define, analyze, and solve complex problems and communicate results</p> <p>LE 3: Study and work productively both independently and in groups</p> <p>LE 4: Demonstrate personal, social, and civic responsibility</p> <p>LE 5: Acquire, apply, integrate, analyze, and synthesize knowledge</p> <p>LE 8: Identify and apply appropriate technologies</p>	<p>1. Identify a solution by its characteristic properties</p> <p>2. Identify the solutes and solvents in a solution</p> <p>3. Determine the concentration of a solution in terms of molarity, molality, and percent by mass</p> <p>4. Identify and describe the factors that affect the rate of dissolving a solute into a solvent</p> <p>5. Make and read solubility curves in terms of unsaturated, saturated, and supersaturated solutions at various temperatures</p> <p>6. Calculate freezing point depression and boiling point elevation for various solvents at different solute concentrations</p> <p>7. Write net ionic equations for precipitation reactions in aqueous solutions</p>	<p>1. lab - prepare solutions of given concentrations</p> <p>2. lab - make a solubility curve for an ionic compound</p> <p>3. lab - boiling point elevation/freezing point depression</p> <p>4. test - chapter 15</p>	<p>text sections: 4.6, 4.7, 4.8, 15.1, 15.2, 15.3, 15.4, 15.5, 15.6, 15.7, 15.8, 15.9, 15.10</p>

South Hadley Public Schools

Subject: Accelerated Chemistry

School: High School

Big Idea/Essential Question: Acids and bases are important in numerous chemical processes that occur around us, from industrial processes to biological ones, from the laboratory to the environment.

Standards	Learning Expectations	Skills	Assessments	Content
ACIDS AND BASES				
8.1 Define Arrhenius' theory of acids and bases in terms of the presence of hydronium and hydroxide ions, and Bronsted's theory of acids and bases in terms of proton donor and acceptor, and relate their concentrations to the pH scale	LE 1: Read, write, and communicate effectively LE 2: Define, analyze, and solve complex problems and communicate results LE 3: Study and work productively both independently and in groups	1. Identify acids and bases by their ability to produce the hydronium and hydroxide ions respectively when in aqueous solutions 2. Apply the pH scale to acidic and basic solutions 3. Explain the differences between strong and weak acids and bases in terms of dissociation or ionization	1. lab - titration to determine the mass of acid in an aspirin tablet 2. test - chapter 19	text sections: 19.1, 19.2, 19.3, 19.4, 19.5, 19.6, 19.7, 19.8
8.2 Compare and contrast the nature, behavior, concentration and strength of acids and bases a. Acid-base neutralization b. Degree of dissociation or ionization c. Electrical conductivity	LE 4: Demonstrate personal, social, and civic responsibility LE 5: Acquire, apply, integrate, analyze, and synthesize knowledge	4. Understand the requirements for preparing a buffer in both acidic and basic pH ranges		
8.3 Identify a buffer and explain how it works	LE 8: Identify and apply appropriate technologies	5. Perform acid-base titrations to the equivalence point to determine the acidity or basicity of a solution		
8.4 Explain how indicators are used in titrations and how they are selected		6. Understand the role of indicators in acid-base titrations		
8.5 Describe an acid-base titration. Identify when the equivalence point is reached and its significance		7. Calculate the pH/pOH of aqueous solutions using the hydronium or hydroxide ion concentration		
8.6 Calculate the pH/pOH of aqueous solutions using the hydronium or hydroxide ion concentration				

South Hadley Public Schools

Subject: Accelerated Chemistry

School: High School

Big Idea/Essential Question: Chemical equilibrium is a dynamic process which is significant in many systems (biological, ecological and geological). Chemical reactions occur at different rates.

Standards	Learning Expectations	Skills	Assessments	Content
<p>EQUILIBRIUM AND KINETICS</p> <p>9.1 Write the equilibrium expression and calculate the equilibrium constant for a reaction</p> <p>9.2 Predict the shift in equilibrium when the system is subjected to a stress (LeChatelier's principle)</p> <p>9.3 Identify the factors that affect the rate of a chemical reaction (temperature, concentration) and the factors that can cause a shift in equilibrium (concentration, pressure, volume, temperature)</p> <p>9.4 Explain rates of reaction in terms of collision frequency, energy of collisions, and orientation of colliding molecules</p> <p>9.5 Define the role of activation energy in a chemical reaction</p>	<p>LE 1: Read, write, and communicate effectively</p> <p>LE 2: Define, analyze, and solve complex problems and communicate results</p> <p>LE 3: Study and work productively both independently and in groups</p> <p>LE 4: Demonstrate personal, social, and civic responsibility</p> <p>LE 5: Acquire, apply, integrate, analyze, and synthesize knowledge</p> <p>LE 8: Identify and apply appropriate technologies</p>	<p>1. Write the equilibrium expression and calculate the equilibrium constant for a reaction</p> <p>2. Predict the shift in equilibrium when the system is subjected to a stress</p> <p>3. Identify and apply the factors that make a reaction proceed at a faster or slower rate as desired</p>	<p>1. lab - changing the rate of the Iodine Clock reaction</p> <p>2. test - chapter 17</p> <p>3. test - chapter 18</p>	<p>text sections: 17.1, 17.2, 17.3, 17.4, 17.5, 17.6, 17.7, 17.8, 18.1, 18.2, 18.3, 18.4, 18.5, 18.6, 18.7, 18.8, 18.9</p>

South Hadley Public Schools

Subject: Accelerated Chemistry

School: High School

Big Idea/Essential Question: The driving forces of chemical reactions are energy and entropy. This has important implications for many applications (synthesis of new compounds, meteorology, and industrial engineering).

Standards	Learning Expectations	Skills	Assessments	Content
THERMODYNAMICS (ENTHALPY)	LE 1: Read, write, and communicate effectively	1. Understand the driving forces of chemical reactions in terms of enthalpy and entropy changes	1. lab - heat of fusion of ice	text sections: 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.7, 16.8, 16.9, 16.10, 16.11
10.1 Interpret the law of conservation of energy	LE 2: Define, analyze, and solve complex problems and communicate results	2. Apply Hess's law to determine the heat of reaction	2. test - chapter 16	
10.2 Explain the relationship between energy transfer and disorder in the universe	LE 3: Study and work productively both independently and in groups	3. Solve calorimetry problems for temperature change and phase change scenarios		
10.3 Analyze the energy changes involved in physical and chemical processes using calorimetry	LE 4: Demonstrate personal, social, and civic responsibility			
10.4 Apply Hess's law to determine the heat of reaction	LE 5: Acquire, apply, integrate, analyze, and synthesize knowledge LE 8: Identify and apply appropriate technologies			

South Hadley Public Schools

Subject: Accelerated Chemistry

School: High School

Big Idea/Essential Question: Oxidation-reduction reactions occur by electron transfer and constitute a major class of chemical reactions. Examples of redox reactions occur everywhere; their consequences are experienced daily

Standards	Learning Expectations	Skills	Assessments	Content
<p>OXIDATION-REDUCTION</p> <p>11.1 Describe the chemical processes known as oxidation and reduction</p> <p>11.2 Assign oxidation numbers</p> <p>11.3 Balance oxidation-reduction equations by using half-reactions</p> <p>11.4 Identify the components, and describe the processes that occur in an electrochemical cell</p> <p>11.5 Explain how a typical battery, such as a lead storage battery or a dry cell, works</p> <p>11.6 Compare and contrast voltaic and electrolytic cells and their uses</p> <p>11.7 Calculate the net voltage of a cell given a table of standard reduction potentials</p>	<p>LE 1: Read, write, and communicate effectively</p> <p>LE 2: Define, analyze, and solve complex problems and communicate results</p> <p>LE 3: Study and work productively both independently and in groups</p> <p>LE 4: Demonstrate personal, social, and civic responsibility</p> <p>LE 5: Acquire, apply, integrate, analyze, and synthesize knowledge</p> <p>LE 8: Identify and apply appropriate technologies</p>	<p>1. Identify which species in chemical reaction are oxidized or reduced using oxidation numbers</p> <p>2. Balance oxidation-reduction equations by using half-reactions</p> <p>3. Identify the components, and describe the processes that occur in an electrochemical cell</p> <p>4. Calculate the net voltage of a cell given a table of standard reduction potentials</p>	<p>1. lab - electrochemical cells</p> <p>2. test - chapter 20</p>	<p>text sections: 20.1, 20.2, 20.3, 20.4, 20.5, 20.6, 20.7, 20.8, 20.9</p>