Jonesville High School
Chemistry Two

Overview:

This one trimester (12 week) course is designed to elaborate on the concepts and laboratory skills built during chemistry one. Chemistry two is designed for students to apply the concepts and practices established in chemistry one in a manner that creates a deep conceptual understanding and appreciation of not only chemistry but science in general. My goal is that successful completion of chemistry 2 will provide students with a skill set that will enable students to move forward in their education so they will be prepared to take a basic college chemistry class. Successful completion of this course will also ensure that all students graduating from Jonesville High School will have the conceptual knowledge as well as the understanding to apply the scientific computational process to all of life's journeys. While this class covers many of the old high school objectives described in the Michigan Merit Curriculum for Chemistry, (Michigan Department of Education, 2006) an emphasis on The Next Generation Science Standards, which were adopted by the state in 2016, will be the central focus of the curriculum design. The document that describes these expectations can be obtained from the Michigan Department o Education (www.mi.gov/mde) as well as through the National Research Council (www.nextgenscience.org.)

Units of Study

Unit Title:	Length
1. Periodic Trends and Electron Configuration	1.5 weeks
2. Intramolecular, Intermolecular forces & Phase Diagrams	2.5 weeks
3. Chemical Kinetics and Equilibrium	1.5 weeks
4. Chemical Reactions and Conservation	3 weeks
5. Acid/Bases and Environmentalism	1.5 weeks
6. Energy in chemical reactions	2 weeks

Text: Scientific Journal Articles
Required course for 10-11 graders
11th Grade/Chemistry 2:
Unit One Title: Periodic Trends and Electron Configuration

NGSS Standards:	**Learning Targets & "I can statements": (Performance Task)**	**Key Vocabulary and Case Studies:**	**Instructional Resources:**	**Suggested Assessment:**
HS-PS1-1 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.	● Quantify subatomic particles based on atomic symbols. ● Quantify subatomic particles when mass number and charge changes. ● Describe the difference between mass number and average atomic mass. ● Describe how the percentage of each isotope contributes to average atomic mass number. ● Analyze trends and patterns within the periodic table. ● Make predictions based off of trends in the periodic table and collect data to support their predictions.	● Periodic Table ● Proton ● Neutron ● Electron ● Mass number ● Charge ● Nucleus ● Ion ● Cation ● Anion ● Electron Cloud ● Isotope ● Average atomic mass. ● Period ● Group ● Ionization Energy ● Electronegativity ● Bipolar disorder ● Lithium ● Nervous System ● Atomic Radius ● Reactivity ● Energy level ● Quantum number ● Orbital ○ S ○ P	● Calcium ● Water ● Magnesium ● Tin ● 0.5 M HCl ● Test Tubes ● Test Tube Rack ● Lima Beans ● Buckets ● Graph paper ● Electron Configuration Bingo cards ● Plastic Bingo Markers ● Vernier Temperature Probes. ● Chromebook ● Schoology	**FA -**Worksheet - Students can identify subatomic particles. **FA -** Worksheet - Students can identify subatomic particles based off of atomic symbol when charge and mass number are manipulated. **FA -** Lab - Students can identify how isotopes relate to average atomic mass. **FA -** Lab - Students can write a lab report. **FA -** Graphical Analysis - Students can create a graph analyzing trends and patterns within the periodic table. **FA -** Use periodic trends to describe how lithium works in treating people who suffer from bipolar disorder.

	● Identify ground vs. excited state electron configuration. ● Relate electron configuration to charge.	○ D ○ F ● Electron Configuration ● Ground state electron configuration. ● Excited state electron configuration.		**SA -** Lab -Students can make predictions based off of trends in the periodic table and collect data to support their predictions. **FA -** Activity - Students can describe how average atomic mass is calculated. **FA -** Worksheet - Students can describe a 3D model of the electron cloud. **FA -** Lab - Students can identify electron configuration in lab. **SA -** Unit #1 Test: Periodic Trends and Electron Configuration.

Text: Scientific Journal Articles
Required course for 10-11 graders
11th Grade/Chemistry 2:
Unit Two Title: Intramolecular, Intermolecular forces & Phase Diagrams

NGSS Standards:	**Learning Targets & "I can statements": (Performance Task)**	**Key Vocabulary and Case Studies:**	**Instructional Resources:**	**Suggested Assessment:**
HS-PS1-1 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. **HS-PS1-3** Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer electrical forces between particles. **HS-PS2-6** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. **HS-ESS2-5** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.	• Identify bond type. • Use electronegativity to describe valence electron distribution in a chemical bond. • Identify bond polarity. • Identify molecular shape based off of molecular models. • Use molecular geometry to describe VSEPR Theory. • Use bond polarity and VSEPR to predict molecular polarity. • Describe intermolecular forces. • Identify and describe how intermolecular force relates to phase changes.	• Chemical Bond • Ionic • Covalent • Charge • Electron • Polar covalent • Lewis Dot Structure • Valence Electrons • Nonpolar covalent • Electronegativity • Polarity • Bond Polarity • VSEPR • Molecular Geometry • Electron Geometry • Molecular Polarity • Intramolecular Force • Intermolecular Force	• Computers • Molecular Modeling blocks • H_2O • Isopropyl alcohol • Ethyl alcohol • Glycerol • Xylenes • NaCl • Erlenmeyer Flasks • Plastic Disposable Pipettes • CO_2 • Buckets • Pennies • Wax Paper • Pasco Thermometer • Graph paper	**FA -** Worksheet - Students can identify Bond Type (Polarity). **FA -** Modeling Activity - Students can identify molecular shape based off of molecular models. **FA -** PHET - Students can describe VSEPR Theory. **SA -** VSEPR Theory Quiz. **FA** - Worksheet - Student can identify and describe intermolecular forces. **FA** - Labs - Student can identify and describe how intermolecular force relates to phase changes. **SA -** Lab - Students can design a lab to test IMF of an ion-dipole

	● Design a lab to test IMF of an ion-dipole interaction in terms of strength of IMF. ● Describe how pressure and temperature relate to phase. ● Identify triple point within lab.	● Kinetic Molecular Theory ○ Solid ○ Liquid ○ Gas ● Surface Tension ● Evaporation ● Phase Change ● Temperature ● Pressure ● Phase Diagram ● Triple Point ● Critical Point		interaction in terms of strength of IMF. **FA** - Worksheet - Students can describe how pressure and temperature relate to phase. **FA -** Lab - Students can identify triple point within lab. **SA -** Unit #2 Test: Intra/Intermolecular forces & Phase Diagrams.

Text: Scientific Journal Articles
Required course for 10-11 graders
11th Grade/Chemistry 2:
Unit Three Title: Chemical Kinetics and Equilibrium

NGSS Standards:	**Learning Targets & "I can statements": (Performance Task)**	**Key Vocabulary and Case Studies:**	**Instructional Resources:**	**Suggested Assessment:**
HS-PS1-5 Apply scientific principles and evidence to provide an explanation about the effects of changing temperature or concentration of the reacting particles on the rate at which a reaction occurs. **HS-PS1-6** Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.	• Identify factors that influence rate of reaction through data collection and analysis. • Describe equilibrium. • Describe equilibrium concentrations when reactants or products are favored. • Analyze an equilibrium curve and identify when reaction has reached equilibrium. • Describe Le Chateliers Principle. • Design a chemical system and use Le Chatelier's principle to describe how the reaction shifts.	• Surface Area • Reactants • Products • Equilibrium • Concentration • Le Chatelier's Principle • Equilibrium Constant • Pressure • Temperature • Stress	• Alka-Seltzer • Ice • Mortar & Pestle • $CoCl_2$ • $AgNO_3$ • 12 M HCl • Ice • Hot Plate • Straws • Graduated Cylinders • Respiration and Le Chatelier's Principle Article • Fixing the nitrogen problem agriculture reading article.	**SA -** Lab Report - Students can I.D. factors that influence rate of reaction through data collection and analysis. **FA -** Lab - Students can describe equilibrium. **FA -** Lab - Students can describe equilibrium concentrations when reactants or products are favored. **FA -** Worksheet - Students can analyze an equilibrium curve and identify when reaction has reached equilibrium. **FA -** PHET - Students can describe Le

				Chatelier's Principle. **FA -** Lab Report - Students can design a chemical system and use Le Chatelier's principle to describe how the reaction shifts. **SA -** Unit #3 Test: Chemical Kinetics and Equilibrium

Text: Scientific Journal Articles
Required course for 10-11 graders
11th Grade/Chemistry 2:
Unit Four Title: Chemical Reactions and Conservation of Mass

NGSS Standards:	**Learning Targets & "I can statements": (Performance Task)**	**Key Vocabulary and Case Studies:**	**Instructional Resources:**	**Suggested Assessment:**
HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. **HS-PS1-7** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. **HS-ESS2-6** Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere	• Balance Chemical Reactions. • Relate Balancing Chemical Reactions to the Law of Conservation. • Describe how carbon cycles through our atmosphere. • Relate the carbon cycle to the law of conservation. • Count atoms. (mole conversions) • Perform Stoichiometric calculations. • Relate stoichiometry to the conservation of mass. • Determine the limiting reactant. • Determine percent yield.	• Reactant • Product • Coefficient • Subscript • Mole • Particle • Stoichiometry • Conversion • Excess reactant • Limiting reactant • Percent Yield • Law of Conservation. • Actual Yield • Theoretical Yield	• Aluminum • Magnesium • HCl • Na_2CO_3 • $NaHCO_3$ • Balloon • CH_3COOH • H_2SO_4 • Scale • Calculators • Crucibles	**FA -** Virtual Lab - Balancing Chemical Reactions. **FA -** Mole Conversion Worksheet. **SA -** Mole conversion Lab Practicum. **SA -** Conservation of mass lab **FA -** Law of conservation reading activity - Carbon Cycle. **FA -** Mass → Mass Stoichiometry Worksheet. **FA -** Mol → Mol Lab **FA -** Mass → Mass Lab **FA -** Percent Yield Competition Lab **SA -** $NaHCO_3$ + HCl Independent Lab **SA -** Unit #4 Test: Reaction Stoichiometry

	• Design and carry out an experiment to test how measure percent yield based on limiting and excess reactants.			

Text: Scientific Journal Articles
Required course for 10-11 graders
11th Grade/Chemistry 2:
Unit Five Title: Acid/Bases and Environmentalism

NGSS Standards:	**Learning Targets & "I can statements": (Performance Task)**	**Key Vocabulary and Case Studies:**	**Instructional Resources:**	**Suggested Assessment:**
HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. **HS-ESS2-6** Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. **HS-ESS3-6** Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. **HS-ESS3-1** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural	• Describe 3 models of Acid/Base Theory • Identify acids and bases in chemical reactions based on proton movement. • Describe the difference between an acid and a base. • Describe a neutralization reaction. • Describe how acid rain relates to the carbon cycle. • Describe how ocean acidification relates to the carbon cycle. • Describe how ocean acidification relates to the law of conservation.	• Acid • Base • Arrhenius • Bronsted Lowry • Lewis • Propton • Hydronium • Hydroxide • Neutralization • Ocean Acidification • Acid Rain	• $CaCO_3$ • HCl • CH_3COOH • Universal Indicator • Apple • Petri Dish • H_2SO_4 • USGS Acid Rain Reading Article • Ocean Acidification Journal Article • Internet	**FA -** Identifying Conjugate Acids/Bases Activity. **FA -** Writing Neutralization Reactions WS **FA -** Microscale Acid Rain Lab. **FA -** Acid Rain USGS Article Reflection. **FA -** Ocean Acidification Lab. **FA -** Ocean Acidification Journal Article Reflection **FA -** Addressing ecological issues in chemistry and investigating/designing solutions research paper. **SA -** Unit #5 Test: Acid/Base Theory & Ocean Acidification

hazards, and changes in climate have influenced human activity. **HS-ETS1-1** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. **HS-ETS-1-3** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.	• Describe proposed solutions to environmental chemistry problems.			

Text: Scientific Journal Articles
Required course for 10-11 graders
11th Grade/Chemistry 2:
Unit Six Title: Energy in Chemical Reactions

NGSS Standards:	**Learning Targets & "I can statements": (Performance Task)**	**Key Vocabulary and Case Studies:**	**Instructional Resources:**	**Suggested Assessment:**
HS-PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. **HS-PS3-1** Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. **HS-PS3-4** Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).	● Describe the difference between temperature and heat. ● Describe Bond Energy ● Describe endo and exothermic chemical reactions. ● Compare bond energy in reactants and products in a chemical reaction. ● Use bond energy to describe temperature change in chemical reactions. ● Describe how to measure energy change. ● Design/Make a calorimeter. ● Describe how to use a calorimeter.	● Heat ● Temperature ● Energy ● Endothermic Chemical Reaction ● Exothermic Chemical Reaction ● Bond Energy ● Energy Level Diagram ● Enthalpy ● Specific Heat ● Calorimeter ● Thermochemical Equation ● MSDS	● Food Dye ● Hot plate ● PASCO Thermometer ● Metal Samples: ○ Al ○ Zn ○ Cu ○ Ni ● Styrofoam ● Styrofoam cups. ● Beakers ● Graduated cylinders ● Ionic Compounds ● Material Safety and Data Sheets ● Poster Board ● Matches ● Marshmallows ● Nuts ● Safety pins ● Cork ● Soda Can ● Ring stand	**FA -** Lab - Student can describe the difference between temperature and heat. **FA -** Worksheet - Student can describe how energy is transferred from one substance to another. **FA -** Lab - Student can observe a chemical reaction and describe the difference between bond energy in reactants and products. **FA -** Lab - Students can create and describe an energy level diagram. **FA -** Lab - Students can design and

HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.	● Calibrate a calorimeter. ● Describe specific heat. ● Calculate specific heat of metals using a calorimeter. ● Calculate change in energy using a calorimeter ● Describe caloric value in terms of bond energy and joules.		● Iron Ring ● Stir Rod	build a calorimeter. **FA -** Lab - Students can calibrate a calorimeter. **FA -** Students can describe specific heat. **FA -** Worksheet & Lab - Students can calculate specific heat in lab. **FA -** Lab - Students can relate food to bond energy and joules. **FA -** Worksheet & Lab - Students can calculate caloric value per gram. **SA -** Lab - Students can use understanding of thermochemistry to design and build a hand warmer. **SA -** Unit #6 Test: Thermochemistry