Jonesville High School
Chemistry Three
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Overview:

Chemistry three is designed for students to apply the concepts and practices established in chemistry one and two 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 three will provide students with a skill set that will enable students to move forward in their education so they will be prepared to be successful in their first college chemistry course. The Next Generation Science Standards is 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. Significant Figures and Stoichiometry ○ **SA -** Unit #1 Test - Accuracy, Precision, Error, Significant Figures & Stoichiometry	2 weeks
2. Gas Stoichiometry ○ **SA -** Unit 2 Test - Gas Laws, Gas Stoichiometry.	2.5 weeks
3. Solution Chemistry & Acid/Base Theory ○ **SA -** Unit #3 Test - Concentration, dilution, acid/base theory	2 weeks
4. Acid/Base Titration, Buffers and Hydrolysis ○ **SA -** Unit #4 Test - Acid/Base Titration, Buffers & Hydrolysis	3 weeks
5. Climate Change Chemistry ○ **SA -** Unit #5 Test - Climate Change Chemistry	2.5 weeks

Text: Scientific Journal Articles
Elective course for 11-12 graders
12th Grade/Chemistry 3:
Unit One Title: Significant Figures and Stoichiometry

NGSS Standards:	**Learning Targets & "I can statements": (Performance Task)**	**Key Vocabulary & Case Studies:**	**Instructional Resources:**	**Suggested Assessment:**
HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	• Describe Lab Safety. • Identify Labware. • Describe Accuracy and Precision. • Identify Significant Figures. • Identify Significant Figures in lab. • Apply significant figures in measuring density. • Make predictions based off of data. • Determine percent error. • Determine percent yield. • Identify systematic vs. random error. • Describe the law of conservation. • Apply Significant figures in stoichiometry. • Identify the limiting reactant. • Identify the excess reactant. • Identify mass of all reactants and products in a chemical reaction.	• Significant Figures • Accuracy • Precision • Error • Systematic Error • Random Error • Reactant • Product • Limiting Reactant • Excess Reactant • Law of Conservation • Coefficient • Formula Unit • Subscript • Mass • Volume • Density • Percent Error • Percent Yield	• Food Coloring • Labware • Metal Samples • HCl • CH_3CHOOH • $NaHCO_3$ • Al • Mg	**FA -** Lab Safety Contract Assessment - Students will use the FLINN Lab Safety Contract to answer questions regarding laboratory safety. **FA** - Significant Figures Practice - Students will complete an assessment identifying sig figs and applying sig fig rules to simple addition/subtraction & multiplication/division. **FA** - Application of significant figures in lab. Students will apply the concept of significant figures in reading labware. **SA** - Application of significant figures in laboratory measurements - Students will apply significant figures in

	● Use mathematics and computational thinking to measure percent yield in stoichiometric reactions.			collecting data in order to determine the density/identity of unknown metals in lab. **FA -** Stoichiometry practice worksheet - Students will apply significant figures in reviewing stoichiometry from chemistry two. **FA** - Application of significant figures in lab measurements in a stoichiometry lab. **SA -** Laboratory report where students will plan and carry out an investigation applying significant figures to measure percent yield for a chemical reaction. **SA -** Unit #1 Test - Accuracy, Precision, Error, Significant Figures & Stoichiometry

Text: Scientific Journal Articles
Elective course for 11-12 graders
12th Grade/Chemistry 3:
Unit Two Title: Gas Stoichiometry

NGSS Standards:	**Learning Targets & "I can statements": (Performance Task)**	**Key Vocabulary & Case Studies:**	**Instructional Resources:**	**Suggested Assessment:**
HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	• Identify Boyles, Charles, Gay Lussac´s & the Combined Gas Law. • I can apply significant figures to Science 10 gas law calculations. • Describe Avogadro's Law. • Determine the gas constant values based off of Avogadro´s law. • Describe the Ideal Gas Law. • Use the ideal gas law to determine the molar mass of an ideal gas. • Apply the ideal gas laws to stoichiometric calculations. • Apply gas stoichiometry in order to create a self inflating balloon.	• Boyle's Law • Charles Law • Gay Lussac's Law • Combined Gas Law • Significant Figures • Ideal Gas Law • Avogadro´s Law • Molar Mass • Stoichiometry • Pressure • Volume • Gas Constant • Mole • Temperature • Celsius • Kelvin	• Boyle's Law Kit • Charles Law Kit • Foam • Lab Equipment • Butane Lighters • Buckets • Aluminum Can • HCl • Na_2CO_3 • $CaCl_2$ • $NaHCO_3$ • Freezer Storage Bags	**FA -** Apply significant figures to basic gas law calculations. **FA -** Identify direct/inverse relationships within gas laws in lab. **FA -** Perform ideal gas law calculations with respect to significant figures. **FA -** Use the ideal gas law to determine the experimental molar mass of butane. **SA -** Plan and carry out a lab, determining the gas constant value. **FA -** Apply significant figures and the ideal gas law in stoichiometric calculations. **FA -** Apply significant figures and the ideal gas law in stoichiometric calculations in lab. **SA -** Apply significant figures and the ideal gas law in stoichiometric calculations in lab. **SA -** Unit 2 Test - Gas Laws, Gas Stoichiometry.

Text: Scientific Journal Articles
Elective course for 11-12 graders
12th Grade/Chemistry 3:
Unit Three Title: Solution Chemistry & Acid/Base Theory

NGSS Standards:	**Learning Targets & "I can statements": (Performance Task)**	**Key Vocabulary and Case Studies:**	**Instructional Resources:**	**Suggested Assessment:**
HS-PS1-1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. **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. **HS-PS2-6** Communicate scientific and technical information about why the molecular level structure is important in the functioning of designed materials.	● Calculate molarity of a solution. ● Determine the concentration of a diluted solution. ● Create specific concentrations of solutions from solid to aqueous and through the process of dilution. ● Describe three acid/base theory. ● Describe Lewis, Bronsted-Lowry and Arrhenius Acids/Bases. ● Name acids/bases ● Identify conjugate acids/bases.	● Molarity ● Concentration ● Strong vs Weak Electrolyte ● Aqueous ● Dilution ● pH, pOH ● Arrhenius Acid/Base ● Binary Acid ● Oxyacid ● Strong/Weak Acid ● Amphoteric ● Bronsted Lowry Acid/Base ● Diprotic Acid ● Lewis Acid/Base ● Monoprotic acid ● Polyprotic Acid ● Triprotic Acid ● Conjugate acid/base ● Neutralization ● Salt ● Hydrogen ion ● Hydroxide ion ● Hydronium ion ● Hydroxyl group	● D.I. H_2O ● $NaHCO_3$ ● HCl ● NaOH ● CH_3COOH ● NaCl ● Universal Indicator ● Vernier Sensor - (Conductivity, pH) ● pH Test Strips ● Warheads	**FA -** Perform molarity and dilution calculations. **FA -** Create specific concentrations from solutions and solid compounds in lab. **SA -** Make predictions about strong/weak acids/bases from data collected in lab. **FA -** Use the three acid/base theory to identify acids/bases. **FA -** Name Acids/Bases. **FA -** Write and balance neutralization reactions. **SA -** Unit #3 Test - Concentration, dilution, acid/base theory.

Text: Scientific Journal Articles
Elective course for 11-12 graders
12th Grade/Chemistry 3:
Unit Four Title: Titration, Buffers and Hydrolysis

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-PS1-6** Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. **HS-PS1-7** Use mathematical representations to support the claim that atoms, and therefore	• Define Acids/Bases. • Describe pH and pOH. • Calculate pH and pOH. • Describe how indicators work. • Create an indicator. • Describe/identify transition intervals. • Describe hydronium and hydroxide levels in acids and bases. • Calculate hydronium and hydroxide levels in acids and bases. • Describe ionization of water. • Use K_w to describe the relative	• Acid • Base • pH • pOH • Indicator • Transition intervals • Hydronium • Hydroxide • self-ionization of water • K_w • equivalence point • pH meter • acid-base indicator • Le Chatelier's principle • standard solution • Titration • Buffer	• D.I. H_2O • $NaHCO_3$ • HCl • NaOH • CH_3COOH • NaCl • Universal Indicator • Vernier Sensor - (Conductivity, pH) • pH Test Strips • Graph paper • Magnetic stir • Phenolphthalein • Bromothymol blue • Various Salts • Petri Dish • Pipette	**FA -** Name/ID acids/bases based off of three theories. **FA -** Calculate pH, pOH, H_3O^+ & OH^- concentrations for strong acids/bases. **FA** - Use Le Chatelierś principle to describe how indicators work. **FA -** Create an indicator and identify transition intervals. **FA -** Write and balance neutralization reactions. **FA -** Perform titration reactions. **SA -** Determine the Calculate pH, pOH, H_3O^+ & OH^- concentrations for strong acids/bases through titration. **SA -** Determine the Calculate pH, pOH, H_3O^+ & OH^- concentrations for weak

mass, are conserved during a chemical reaction. **HS-ESS2-5** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.	strength/ionization of acids/bases. ● Use Le Chatelier's principle to describe acids/bases. ● Perform Titration Reactions. ● Create titration curves in order to determine the endpoint of a titration. ● Perform titration reactions with weak acid/base and strong acid/bases. ● Describe hydrolysis. ● Write hydrolysis reactions. ● Describe acid rain. ● Plan an investigation to investigate how properties of water and its effects earth's materials.	● phenolphthalein indicator ● strong acid/base ● diprotic acid ● Hydrolysis ● Cation ● Anion ● Acid Rain		acids/bases through titration. **FA -** Describe buffers and the role that they play in biological systems. **FA -** Create and test the buffering capacity of a system. **FA -** Describe hydrolysis. **FA -** Identify hydrolysis in lab and write out chemical reactions for hydrolysis. **FA -** Investigate hydrolysis and the role that it plays in biological systems. **SA -** Unit #4 Test - Acid/Base Titration, Buffers & Hydrolysis

Text: Scientific Journal Articles
Elective course for 11-12 graders
12th Grade/Chemistry 3:
Unit Five Title: Climate Change Chemistry

NGSS Standards:	**Learning Targets & "I can statements": (Performance Task)**	**Key Vocabulary and Case Studies:**	**Instructional Resources:**	**Suggested Assessment:**
HS-ESS3-5 Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. **HS-ESS3-3** Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. **HS-ESS3-6** Use a computational representation to	● Understands the essential principles of Earth's climate system. ● Analyze geoscience data and describe climate models to make evidence-based forecast of current rate of global climate change. ● Describe how to assess scientifically credible information about climate. ● Describe how natural resources are	● Acid Rain ● Ocean Acidification ● Greenhouse gasses. ● Impacts of climate change. ● Credibility. ● Climate change. ● Geoscience data. ● Climate models. ● Natural Resources.	● American Chemical Society Climate Education ● HCl ● CH_3COOH ● Mg ● $CaCO_3$ ● Balloon ● Universal Indicator ● Vernier Sensor.	**FA -** Describe Acid Rain. **FA -** Describe Ocean Acidification. **FA -** Describe greenhouse gasses and their sources. **FA -** Plan and conduct an investigation of the properties of acidic water (precipitation & ocean water) and its effects on Earth materials and surface processes. **FA -** Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate

illustrate the relationships among Earth systems and how those relationships are being modified due to 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-ETS1-3** 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.	being managed with respect to human populations and biodiversity. ● Communicate about climate and climate change in a meaningful way. ● Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. ● Make informed and responsible decisions with regard to actions that may affect climate.			change and associated future impacts to Earth systems **FA -** Identify natural resources used in obtaining energy. **FA -** Describe relationship among management of natural resources, the sustainability of human populations, and biodiversity. **SA -** Identify a real world climate problem/global challenge and analyze solutions and constraints that account for societal needs and wants. **SA -** Propose a solution for a climate problem accounting for cost, , safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. **SA -** Unit #5 Test - Climate Change Chemistry