Jonesville High School
Chemistry Four
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Overview:

Chemistry four is designed for students to apply the concepts and practices established in chemistry one, two and three 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 four 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 of Education (www.mi.gov/mde) as well as through the National Research Council (www.nextgenscience.org).

Units of Study

Unit Title:	Length
1. Buffers and Hydrolysis & Titration	3 weeks
○ **SA -** Unit #1 Test - Buffers, Hydrolysis & Titration	
2. Composition Stoichiometry	2 weeks
○ **SA -** Unit #2 Test - Composition Stoichiometry	
3. Oxidation, Reduction & Electrochemistry	2 weeks
○ **SA -** Unit 3 Test - Oxidation, Reduction & Electrochemistry	
4. Introduction to Organic Chemistry and Saponification	2 weeks
○ **SA -** Unit #3 Test - Organic Chemistry	
5. Climate Change Chemistry	3 weeks
○ **SA -** Unit #5 Test - Climate Change Chemistry	

Text: Scientific Journal Articles
Elective course for 11-12 graders
12th Grade/Chemistry 4:
Unit One 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 mass, are conserved	• 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 • phenolphthalein indicator • strong acid/base • diprotic acid	• 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

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.	● 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 4:
Unit Two Title: Composition Stoichiometry

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-PS1-2** 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.	• Identify Ionic and Covalent Compounds. • Describe molecular formulas • Identify empirical vs molecular formulas • Calculate percent composition • Use Percent composition to identify empirical formula. • Experimentally determine empirical formula.	• Cation • Anion • Ionic • Covalent • Polyatomic • Atomic Mass Weight • Atomic Weight • Avogadro's Number • Stoichiometry • Reaction Stoichiometry • Composition Stoichiometry • Formula • Formula Weight • Formula Unit • Ion • Mole • Molecular Formula • Molecular Formula Weight • Percent Composition • Percent Purity • Simplest Formula	• Mg • Bunsen Burner • Pennies • M&Ms • Crucible • Ring Stand • NaOH • HCl • NaCl • H_2O • Ring Stand • Wire Gauze • Crucible • Crucible Tongs	**FA -** Percent composition of a Penny. **FA -** Percent composition lab. **FA -** Identify Ionic and Covalent Compounds. **FA -** Describe molecular formulas **FA -** Identify empirical vs molecular formulas **FA -** Calculate percent composition **FA -** Use Percent composition to identify empirical formula. **FA -** Experimentally determine empirical formula. **SA -** Unit Test

Text: Scientific Journal Articles
Elective course for 11-12 graders
12th Grade/Chemistry 4:
Unit Three Title: Oxidation, Reduction & Electrochemistry

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-PS1-2** 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.	● Differentiate between oxidation and reduction in terms of electron behavior and oxidation states ● Write half-reactions and balanced, overall redox reactions given unbalanced redox reactions ● Identify whether or not a chemical reaction is a redox reaction by analyzing the oxidation numbers of all species in a chemical equation ● Assign oxidation numbers to free elements, monatomic ions, and combined	● Anion ● Anode ● Cation ● Cathode ● Conservation of Charge ● Electrode ● Electrolyte ● Electrolytic Cell ● Oxidation ● Oxidation numbers ● Reduction ● Redox (Oxidation –reduction) reactions ● Salt Bridge ● Voltaic Cells ● Electrolysis ● Electroplating ● Galvanic Cell ● Species ● Half-reaction ● Net/Overall redox reaction ● Voltmeter ● Battery	● Various Lab Equipment ● Sucrose Compound (Gummy Bears) ● Potassium Permanganate ● H_2SO_4 ● Iron III Ammonium Sulfate ● $KClO_3$ ● Pyrex Test Tube ● Ring Stand ● Bunsen Burner ● $CuCl_2$ ● Aluminum Foil	**FA -** What is oxidation? What is reduction? **FA -** Why does redox occur? **FA -** How does redox affect a chemical reaction? **FA -** Differentiate between oxidation and reduction in terms of electron behavior and oxidation states **FA -** Write half-reactions and balanced, overall redox reactions given unbalanced redox reactions Identify whether or not a chemical reaction is a redox reaction by analyzing the oxidation numbers of all species in a chemical equation **FA -** Assign oxidation numbers to free elements, monatomic ions, and combined elements in a molecule/compound **FA -** Identify the electrodes (anode and cathode), direction of electron flow

	elements in a molecule/compound ● Identify the electrodes (anode and cathode), direction of electron flow and the sites of oxidation and reduction for voltaic and electrolytic cells given diagrams. ● Explain the function of a salt bridge in a voltaic cell ● Recognize that in all redox reactions there is conservation of mass, energy and charge ● Recognize that oxidation and reduction occur simultaneously in all redox reactions	● Energy conversion ● Electron flow ● Electrochemistry		and the sites of oxidation and reduction for voltaic and electrolytic cells given diagrams. **SA -** Unit Test

Text: Scientific Journal Articles
Elective course for 11-12 graders
12th Grade/Chemistry 4:
Unit Four Title: Introduction to Organic Chemistry and Saponification

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-PS1-2** 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.	● Identify Hydrocarbons ● Create lewis structures ● Describe Isomers ● Identify Isomers ● Illustrate Carbon Skeletons ● Name Alkanes, Alkenes and Alkynes ● Name Alcohols ● Name Aldehydes ● Name Ketones ● Name Ethers ● Name Esters ● Name Carboxylic Acids ● Describe Saponification ● Create Soap	● Hydrocarbon ● Alkane ● Alkene ● Alkyne ● Isomer ● Nomenclature ● Lewis Structure ● Formula Unit ● Formula Structure ● Carbon Skeleton ● Alcohols ● Aldehydes ● Ketones ● Ethers ● Esters ● Carboxylic Acids ● Saponification	● Coconut Oil ● Essential Oils ● Soap Mould ● NaOH ● Lard ● Olive Oil ● Stir Rod ● Hot Plate ● Magnetic Stir	**FA -** Identify Hydrocarbons **FA -** Create lewis structures **FA -** Describe Isomers **FA -** Identify Isomers **FA -** Illustrate Carbon Skeletons **FA -** Name/Illustrate Alkanes, Alkenes and Alkynes **FA -** Name/Illustrate Alcohols **FA -** Name/Illustrate Aldehydes **FA -** Name/Illustrate Ketones **FA -** Name/Illustrate Ethers **FA -** Name/Illustrate Esters **FA -** Name/Illustrate Carboxylic Acids **FA -** Describe Saponification **SA -** Unit Four Test

Text: Scientific Journal Articles
Elective course for 11-12 graders
12th Grade/Chemistry 4:
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 illustrate the relationships among	● 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 being managed with respect to	● 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 change and associated future

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.	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.			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