MCS IB Chemistry HL Year 1 Subject Group Overview

Unit Name	Atoms and Periodicity	From Models to Materials	Reaction Stoichiometry	Energetics and Kinetics
Time Frame	6 weeks	12 weeks	8 weeks	10 weeks
Standards/ IB Topics	S1.2, S1.3, S3.1	S2.1, S2.2, S2.3, S2.4, S3.2	S1.1, S1.4, S1.5, R2.1	R1.1, R1.2, R1.3,R1.4, R2.2, R2.3
Content Specific Information (texts, documents, methods)	**Statement of Inquiry:** The fundamental principles that shape the behavior and properties of elements enable scientists to develop and use predictive models across scientific disciplines. **Phenomenon:** Isotopes are used in medical imaging to diagnose and monitor a wide variety of conditions through the interactions that they have with electrons in the human body. **Crosscutting Concepts** ● Systems and System Models ● Patterns ● Cause and Effect **CORE IDEAS** ● Parts of the atom and counting subatomic particles ● Isotopes, abundance of isotopes, and relative atomic mass ● Mass spectra ● Properties of light ● Continuous and line spectra ● Line emission spectrum of hydrogen ● Energy levels and sublevels ● Electron configuration ● Ionization and limit of convergence in emission spectra ● Successive ionization energies ● Organization of the periodic table ● Periodicity (atomic radius, ionic radius, ionization energy, electron affinity, electronegativity, metallic character, oxidation state) ● Discontinuities in first ionization energy ● Trends in transition elements	**Statement of Inquiry:** The underlying principles governing the structure, behavior, and applications of diverse substances foster innovations in material science and engineering. **Phenomenon:** Shape memory polymers and alloys can “remember” and return to their original shape after being deformed through the use of external stimuli such as heat and pressure. **Crosscutting Concepts** ● Systems and System Models ● Structure and Function **CORE IDEAS** ● Bonding triangles ● Metallic bonding and properties ● Transition elements and delocalized d-electrons ● Alloys ● Ionic bonding, nomenclature, and polyatomic ions ● Three-dimensional lattice structures and lattice enthalpy ● Covalent bonding and nomenclature ● Nature, length and strength of single, double, and triple bonds ● Coordination bonds ● VSEPR theory ● Bond polarity ● Molecular polarity ● Covalent network structures ● Intermolecular forces ● Chromatography ● Resonance structures and benzene ● Structures with expanded octets	**Statement of Inquiry:** The quantitative aspects of chemical transformations enable scientists to design and optimize chemical processes across a multitude of applications. **Phenomenon:** Precise control over reactant quantities dictates the size, shape, and properties of nanoparticles, contributing to advancements for applications ranging from drug delivery to catalysis. **Crosscutting Concepts** ● Scale, Proportion, and Quantity **CORE IDEAS** ● Classification of matter ● Separation techniques ● Kinetic molecular theory, states of matter, and changes of state ● Temperature ● Ideal and real gases ● Moles and Avogadro’s number ● Relative formula mass and relative atomic mass ● Molar mass ● Empirical/molecular formulas ● Molar concentration and dilution ● Molar volume, Avogadro’s Law, ideal gas equation, combined gas law ● Writing and balancing chemical equations ● Mole ratios ● Stoichiometric calculations ● Limiting and excess reactants ● Percentage yield and atom economy	**Statement of Inquiry** The underlying factors influencing reaction pathways allow for the development of novel strategies for energy conversion and chemical synthesis across scientific disciplines and technological applications. **Phenomenon:** Utilizing bioethanol in internal combustion engines showcases the renewable and carbon-neutral nature of biofuels, providing a cleaner and more sustainable alternative to fossil fuels. **Crosscutting Concepts** ● Systems and System Models ● Energy and Matter ● Stability and Change ● Cause and Effect **CORE IDEAS** ● System and surroundings ● Energy transfer, endothermic, exothermic ● Relative stability ● Standard enthalpy change, heat, and temperature ● Average bond enthalpy ● Hess’s law ● Standard enthalpy changes of combustion and formation ● Born-Haber cycle ● Standard entropy change ● Gibbs energy and spontaneity ● Gibbs energy and equilibrium ● Combustion and incomplete combustion ● Fossil fuels, biofuels, and fuel cells ● Rate of reaction and collision

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	• Variable oxidation states in transition elements • Transition element complexes	• Formal charge • Sigma bonds and pi bonds • Hybridization • Formulas of organic compounds • Functional groups, homologous series, and nomenclature • Structural isomerism • Addition polymers, condensation polymers, and properties of polymers		theory • Factors influencing rate of reaction and catalysts • Activation energy • Reaction mechanisms • Energy profiles • Molecularity • Rate equations and rate order • Rate constant • Arrhenius equation and Arrhenius factor • Dynamic equilibrium • Equilibrium constant • Le Chatelier's principle • Reaction quotient • Equilibrium law • Determining equilibrium position from the equilibrium constant and Gibbs energy change
SEPs	**SEP** • Asking Questions and Defining Problems • Developing & Using Models • Carry out Investigations • Constructing Explanations • Planning and Carrying out investigations • Analyzing & interpreting data • Use mathematics and computational thinking • Engage in Argument from Evidence • Obtaining, evaluating and communicating information	**SEP** • Asking Questions and Defining Problems • Developing & Using Models • Carry out Investigations • Constructing Explanations • Planning and Carrying out investigations • Analyzing & interpreting data • Use mathematics and computational thinking • Engage in Argument from Evidence • Obtaining, evaluating and communicating information	**SEP** • Asking Questions and Defining Problems • Developing & Using Models • Carry out Investigations • Constructing Explanations • Planning and Carrying out investigations • Analyzing & interpreting data • Use mathematics and computational thinking • Engage in Argument from Evidence • Obtaining, evaluating and communicating information	**SEP** • Asking Questions and Defining Problems • Developing & Using Models • Carry out Investigations • Constructing Explanations • Planning and Carrying out investigations • Analyzing & interpreting data • Use mathematics and computational thinking • Engage in Argument from Evidence • Obtaining, evaluating and communicating information

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Common Assessments and Major Projects	**Assessments/Projects** ● Formative assessments on each subtopic ● Tool and Inquiry assessment ● Summative assessments for content mastery ● Summative assessment for IB preparedness using questions from IB Papers 1 & 2	**Assessments/Projects** ● Formative assessments on each subtopic ● Tool and Inquiry assessment ● Summative assessments for content mastery ● Summative assessment for IB preparedness using questions from IB Papers 1 & 2	**Assessments/Projects** ● Formative assessments on each subtopic ● Tool and Inquiry assessment ● Summative assessments for content mastery ● Summative assessment for IB preparedness using questions from IB Papers 1 & 2	**Assessments/Projects** ● Formative assessments on each subtopic ● Tool and Inquiry assessment ● Summative assessments for content mastery ● Summative assessment for IB preparedness using questions from IB Papers 1 & 2
Level Specific Differentiation	Marietta City Schools teachers provide specific differentiation of learning experiences for all students. Details for differentiation for learning experiences are included on the district unit planners.			
Resources	Resources for 2025 Syllabus: ● Chemistry for the IB Diploma Third Edition, Hodder Education ● IB Chemistry Guide First Assessment 2025 ● InThinking IB subject site for Chemistry ● IB Chemistry Schoology Course			