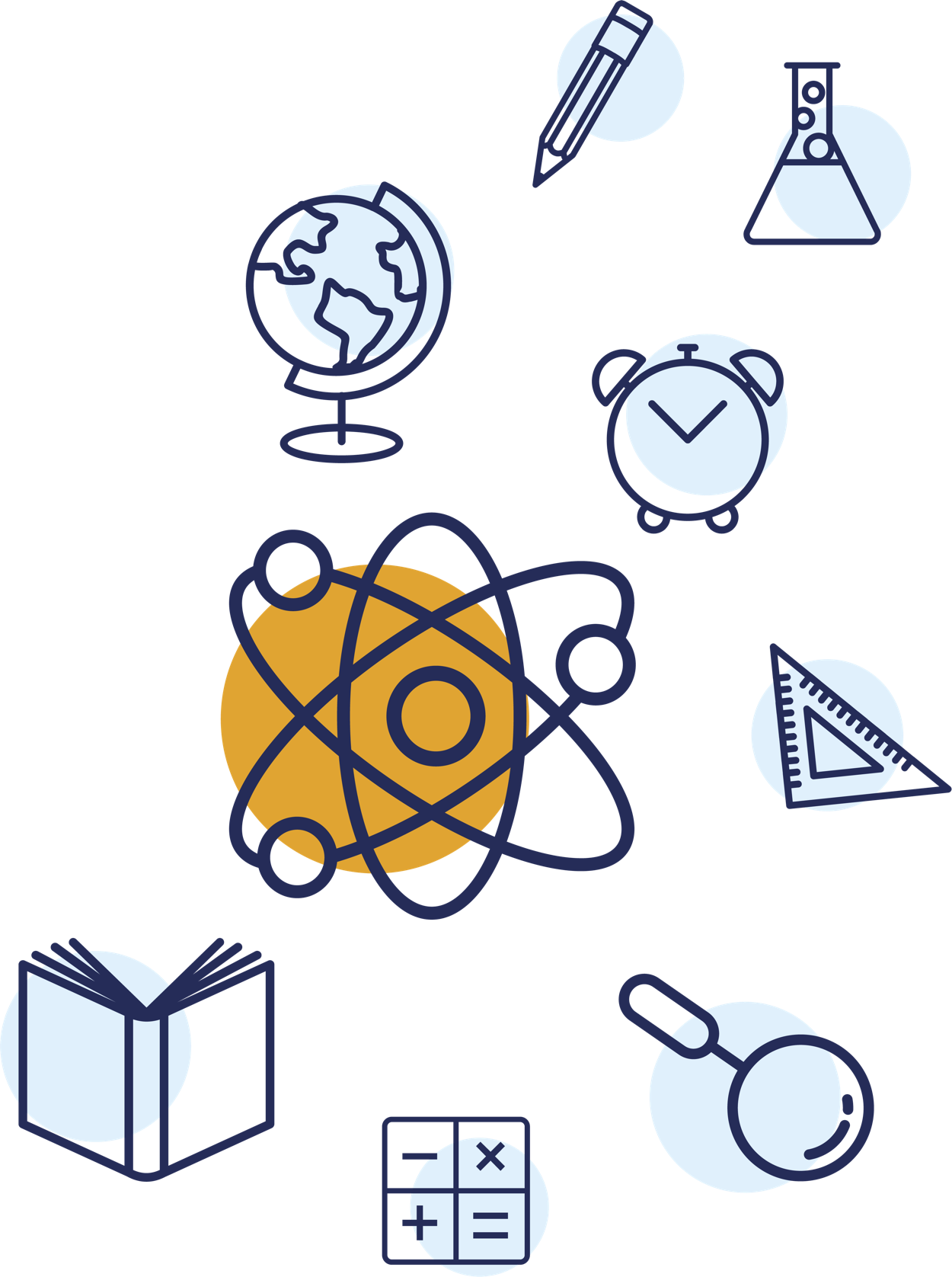
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**SUGGESTED**

**INSTRUCTIONAL PLANNING GUIDE**

*for the Mississippi College- and Career-Readiness Standards*

**q SCIENCE**

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| **CHEMISTRY** |

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**Mississippi Department of Education**359 North West Street

P. O. Box 771

Jackson, Mississippi 39205-0771

(601) 359-3513

[www.mdek12.org](http://www.mdek12.org)

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| **Nathan Oakley, Ph.D.**  Chief Academic Officer | | |
| **Wendy Clemons**  Executive Director, Office of Secondary  Education/Dropout Prevention & Professional Development | | **Tenette Smith, Ed.D.** Executive Director, Office of Elementary  Education and Reading |
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| **Kevin L. Gaylor, Ed.D.** K-12 Science Content Director | | **Tanjanikia McKinney**  Professional Development Coordinator, Science |
|  | |  | |
|  | |  | |
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**INTRODUCTION**

The unprecedented, nationwide school closures in the spring of 2020 due to the COVID-19 pandemic have created a shift in how districts plan for school re-entry. Instead of the traditional brick-and-mortar planning, administrators are now identifying models that will support a variety of instructional delivery scenarios as they plan for school reopening. The traditional methods of planning and delivery are nearly impossible to implement as a stand-alone model; instead, innovative educators are developing and identifying strategies and resources to support a variety of distance learning scenarios as part of their plans. When using new models of delivery, it is important to recognize that the traditional approach to remediation—providing work better suited for earlier grades—may be insufficient. Instead, the conventional approach to remediation will likely compound the problem educators are trying to correct. According to a 2018 study, ***The Opportunity Myth***[[1]](#footnote-2), the approach of “meeting students where they are”, while often well-intended, only widens the achievement gap. Instead of remediation, teachers and administrators are encouraged to look toward acceleration methods to support student growth and close the gaps.

**PURPOSE**

The purpose of the Suggested Mississippi College- and Career-Readiness Standards Instructional Planning Guide is to provide teachers with an assistive tool for planning units of instruction. This tool will provide suggested standards grouping that should facilitate a coherent and logical delivery of related science concepts. Suggested planning sources and tools are included to assist teachers with curating instructional materials, designing and implementing effective lessons and activities, and building content knowledge and pedagogical practices. This tool encourages instructors to maintain a focus on preparing students to master skills and acquire knowledge at their current grade level.

**DEVELOPMENT**

The following suggested Instructional Planning Guide was developed with a focus on the subsequent key areas, Conceptual Connections, Real-World Connections and Phenomena, Embedded Science and Engineering Practices and Crosscutting Concepts, and Core Vocabulary. The standards are grouped into suggested units based on their underlying conceptual relationships. A list of real-world connections and/or phenomena is associated with each unit group. Their purpose is to give teachers and students researchable opportunities that lead to an in-depth and authentic quest for conceptual understanding. The embedded Science and Engineering Practices (SEPs) and Crosscutting Concepts (CCCs) are extracted from the grouped performance objectives and should encourage students to act and think like scientists. The included list of SEPs and CCCs does not indicate that other SEPs and CCCs are not relevant to the respective standard and performance objectives. Core vocabulary terms are included to emphasize terminology that is essential to the conceptual understandings captured in the standards and performance objectives. It is suggested that instructors pace themselves based on student assessment performance and demonstration of skill mastery and knowledge comprehension.

**RESOURCES for CONSIDERATION**

The resources listed below may be referenced to support classroom teachers in the development of lesson plans and instruction at the local level.   This list is not meant to be exhaustive, rather it represents consultative resources that align with the Units/Themes provided in the Instructional Planning Guides.   Educators are encouraged to use these resources in addition to those curriculum materials that meet the needs of the students they serve.

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| **High-Quality**  **Instructional Material**  **(HQIM)** | **Planning and Instruction Resources** | **Assessment**  **Resources** | **Professional Development**  **Resources** |
| * [Adopted Science Texts](https://mdek12.org/OEER/Caravan) * [STEM Teaching Tools](http://stemteachingtools.org/) | * [5 E Science Instructional Model](http://nextgenerationscience.weebly.com/5-es-of-science-instruction.html) * [The Concord Consortium](https://concord.org/ngss/) * [PBS Learning Media](https://mpb.pbslearningmedia.org/standards/0/) * [Teacher Tube](https://www.teachertube.com/) * [Next Generation Science Standards](https://www.nextgenscience.org/) * [Phenomena for Next Generation Science](https://www.ngssphenomena.com/) * [Khan Academy](https://www.khanacademy.org/) * [OpenSciEd](https://www.openscied.org/) * [Science Buddies](https://www.sciencebuddies.org/) * [PhET Interactive Simulations](https://phet.colorado.edu/) * [Phenomenal GRC Lessons](https://sites.google.com/3d-grcscience.org/going3d/home?authuser=0) | * [MS MAAP Program](https://mdek12.org/OSA/MAAP) * [MS MAAP-A Program](https://mdek12.org/OSA/SP/MAAP-A) * [Access for All Guidance](https://mdek12.org/sites/default/files/documents/OAE/OAE/2019-access-for-all-guide.pdf) * [Problem-Attic](https://www.problem-attic.com/) * [EDInformatics](https://www.edinformatics.com/testing/testing.htm) * [STEM Teaching Tools for Assessments](http://stemteachingtools.org/tgs/Assessment) * [Next Generation Science Assessment](http://nextgenscienceassessment.org/) (Middle Focus) | * [MDE Professional Development](https://www.mdek12.org/OPD/home) * [The Teaching Channel](https://www.teachingchannel.com/) * [California Academy of Sciences](https://www.calacademy.org/) * [Teacher Tube](https://www.teachertube.com/) * [Knowles Teacher Short Courses](https://knowlesteachers.org/knowles-academy/short-courses) * [STEM Teaching Tools OER PD](http://stemteachingtools.org/pd) |

| **CHEMISTRY** | | | |
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| **UNIT OF STUDY**  (REAL-WORLD CONNECTIONS and PHENOMENA)  **q** | **SCIENCE FOUNDATION STANDARDS q** | **SCIENCE AND ENGINEERING PRACTICES  SCIENCE CROSSCUTTING CONCEPTS**  **q** | **VOCABULARY TERMS** CORE ACADEMIC  **q** |
| **COURSE INTRODUCTION**  Chemistry, a one-credit course, is an elective and should be a rigorous course to prepare students for careers in science, technology, engineering, integrated STEM activities, and mathematics. Chemistry explores empirical concepts central to all areas of science. These concepts should be explored in-depth using both quantitative and qualitative analysis, computational and experimental rigor, and the use of inquiry-based methods of teaching. To accomplish a level of sophistication and depth, chemistry teachers  should extend concepts mastered by students in earlier grades. Cornerstone objectives of chemistry that must be addressed and readdressed throughout the course are dimensional analysis, naming compounds, balancing equations, and stoichiometry. To be successful in Chemistry, it is recommended that students have completed Algebra I (Integrated Math I) and be enrolled in an upper level math course. | **FOUNDATION STANDARDS**   * Identify and select appropriate science and engineering tools to collect, analyze, and communicate science and engineering data and information. * Demonstrate effective questioning and observation skills * Communicate science and engineering data using appropriate SI units of measurement * Identify and discuss science and engineering practices * Identify and discuss Crosscutting Concepts   **OVERARCHING (start to finish) SEPs for INQUIRY EXTENSION of LABS**  Ask questions to generate hypotheses for scientific investigations based on empirical evidence and observations and/or ask questions to clarify or refine models, explanations, or designs.  Plan and conduct controlled scientific investigations to produce data to answer questions, test hypotheses and predictions, and develop explanations or evaluate design solutions, which require the following:   * Identify dependent and independent variables and appropriate controls * Select and use appropriate tools or instruments to collect data and represent data in an appropriate form * Analyze and interpret various types of data sets, using appropriate mathematic to verify or refute hypothesis or determine an optimal design solution * Construct an explanation of observed relationships between variables * Communicate scientific and/or technical information in various formats. | **SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Plan and Conduct Investigations * Use Mathematical and Computational Thinking * Engage in Scientific Argument from Evidence * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **SCIENCE CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Scale, Proportion, and Quantity * Systems and System Models * Energy and Matter *(Flows, Cycles, Conservation)* * Structure and Function * Stability and Change | Argument  Change  Concepts  Data  Dependent Variable  Engineering  Evaluate  Evidence  Gram  Independent Variable  Interpret  Investigation  Liter  Meter  Observation  Patterns  Quantity  Science  SI Units of Measurement  Stability |

| **TERM 1** | | | |
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| **UNIT OF STUDY**  (REAL-WORLD CONNECTIONS and PHENOMENA)  **q** | **MS CCR STANDARDS q** | **SCIENCE AND ENGINEERING PRACTICES  SCIENCE CROSSCUTTING CONCEPTS**  **q** | **VOCABULARY TERMS** CORE ACADEMIC  **q** |
| **MATHEMATICAL & COMPUTATIONAL ANALYSIS**  **Measurements and Dimensional Analysis**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Discover instruments such as the measuring wheel used by surveyors to measure various lengths and distances. * Research the electron microscope and how it is used to measure objects in biological and chemical research. | **CHE.1 Students will use mathematical and computational analysis to evaluate problems.**  **CHE.1.1** Use dimensional analysis (factor/label) and significant figures to convert units and solve problems.  **CHE.1.2** Design and conduct experiments using appropriate measurements, significant figures, graphical analysis to analyze data.  **CHE.1.3 Enrichment:** Research information from multiple appropriate sources and assess the credibility, accuracy, possible bias, and conclusions of each publication. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Analyze and Interpret Data * Plan and Conduct Investigations * Use Mathematical and Computational Thinking * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Scale, Proportion, and Quantity | Accuracy  Conversion Factor  Density  Factor-Label Method  Mass  Mass  Precision  Quantity  SI Units of Measurement  Significant Figures  Volume  Weight |
| **ATOMIC THEORY and STRUCTURE**  **Atomic Theories and Atomic Structures**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Explore how isotopes of various elements are used in daily processes to include carbon dating. * Research how absorption and emission spectra are used to determine the composition of stars and other light emitting substances * Demonstrate flame tests with various elements to show emission colors. | **CHE.2 Students will demonstrate an understanding of the atomic structure and the historical developments leading to modern atomic theory.**  **CHE.2.1** Investigate the historical progression leading to the modern atomic theory, including, but not limited to, work done by Dalton, Rutherford’s gold foil experiment, Thomson’s cathode ray experiment, Millikan’s oil drop experiment, and Bohr’s interpretation of bright line spectra.  **CHE.2.2** Construct models (e.g., ball and stick, online simulations, mathematical computations) of atomic nuclei to explain the abundance weighted average (relative mass) of elements and isotopes on the published mass of elements.  **CHE.2.3** Investigate absorption and emission spectra to interpret explanations of electrons at discrete energy levels using tools such as online simulations, spectrometers, prisms, flame tests, and discharge tubes. Explore both laboratory experiments and real-world examples.  **CHE.2.4** Research appropriate sources to evaluate the way absorption and emission spectra are used to study astronomy and the formation of the universe. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Plan and Conduct Investigations * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Scale, Proportion, and Quantity * Energy and Matter *(Flows, Cycles, Conservation)* * Structure and Function * Stability and Change | Absorption  Atom  Atomic Number  Electron  Emission  Ground State  Isotope  Mass Number  Neutron  Nucleus  Proton |
| **PERIODIC TABLE**  **Periodic Properties of Elements**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Use video media to show increasing reactivity in group one elements. * Research and explore the uses of elements classified as noble gases. | **CHE.3 Students will demonstrate an understanding of the periodic table as a systematic representation to predict properties of elements.**  **CHE.3.1** Explore and communicate the organization of the periodic table, including history, groups, families, family names, metals, nonmetals, metalloids, and transition metals.  **CHE.3.2** Analyze properties of atoms and ions (e.g., metal/nonmetal/metalloid behavior, electrical/heat conductivity, electronegativity and electron affinity, ionization energy, and atomic/ionic radii) using periodic trends of elements based on the periodic table.  **CHE.3.3** Analyze the periodic table to identify quantum numbers (e.g., valence shell electrons, energy level, orbitals, sublevels, and oxidation numbers). | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Analyze and Interpret Data * Use Mathematical and Computational Thinking * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Energy and Matter *(Flows, Cycles, Conservation)* * Structure and Function * Stability and Change | Atomic Radius  Aufbau Principle  Electron Configuration  Electronegativity  Energy Level  Family  Group  Octet Rule  Orbital  Oxidation Number  Period  Periodic Trend  Quantum Number  Valence Electron |



| **TERM 2** | | | |
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| **UNIT OF STUDY**  (REAL-WORLD CONNECTIONS and PHENOMENA)  **q** | **MS CCR STANDARDS q** | **SCIENCE AND ENGINEERING PRACTICES  SCIENCE CROSSCUTTING CONCEPTS**  **q** | **VOCABULARY TERMS** CORE ACADEMIC  **q** |
| **BONDING**  **Chemical Bonds and Structures**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Identify various substances (coffee, alcohol, salt, etc.) and research their chemical structure. * Examine the structure of biological molecules (lipids, carbohydrates, proteins) and discuss how their structure defines and determines their function. | **CHE.4 Students will demonstrate an understanding of the types of bonds and resulting atomic structures for the classification of chemical compounds.**  **CHE.4.3** Predict the ionic or covalent nature of different atoms based on electronegativity trends and/or position on the periodic table.  **CHE.4.2** Use models such as Lewis structures and ball and stick models to depict the valence electrons and their role in the formation of ionic and covalent bonds.  **CHE.4.1** Develop and use models (e.g., Lewis dot, 3-D ball-stick, 3-D printing, or simulation programs such as PhET) to predict the type of bonding between atoms and the shape of simple compounds.  **CHE.4.4** Use models and oxidation numbers to predict the type of bond, shape of the compound, and the polarity of the compound.  **CHE.4.5** Use models of simple hydrocarbons to exemplify structural isomerism. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Scale, Proportion, and Quantity * Structure and Function * Stability and Change | Bond Angle  Covalent Bond  Ionic Bond  Isomer  Lattice Structure  Lewis Structure  Non-Polar  Oxidation Number Molecular Geometry  Polar  Valence Electrons  Valence Shell Electron-Pair Repulsion Theory |
| **BONDING**  **Chemical Bonds and Chemical Compositions**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Research coins to determine the percentages of metals found in them. Compare and contrast dated and newer coins * Compare molecular compounds with C, H, O, to show various percentages of each element results in compounds with distinctly different properties. | **CHE.4 Students will demonstrate an understanding of the types of bonds and resulting atomic structures for the classification of chemical compounds.**  **CHE.4.6** Use mathematical and computational analysis to determine the empirical formula and the percent composition of compounds.  **CHE.4.7** Use scientific investigation to determine the percentage of composition for a substance (e.g., sugar in gum, water and/or un-popped kernels in popcorn, percent water in a hydrate). Compare results to justify conclusions based on experimental evidence.  **CHE.4.8** Plan and conduct controlled scientific investigations to produce mathematical evidence of the empirical composition of a compound. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Plan and Conduct Investigations * Use Mathematical and Computational Thinking   **EMBEDDED CROSSCUTTING CONCEPTS**   * Scale, Proportion, and Quantity*)* * Structure and Function * Stability and Change | Empirical Formula  Molecular Formula  Formula Unit  Percent Composition  Mole  Relative Atomic Mass  Atomic Mass Unit  Avogadro’s Number |
| **NAMING COMPOUNDS**  **Chemical Nomenclature**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Determine the names of substances found in common household items and compare names to learned naming conventions. * Observe names of chemical compounds for patterns in nomenclature and devise a process for improving compound nomenclature. | **CHE.5 Students will investigate and understand the accepted nomenclature used to identify the name and chemical formulas of compounds.**  **CHE.5.1** Use the periodic table and a list of common polyatomic ions as a model to derive chemical compound formulas from compound names and compound names from chemical formulas.  **CHE.5.2** Generate formulas of ionic and covalent compounds from compound names. Discuss compounds in everyday life and compile lists and uses of these chemicals.  **CHE.5.3** Generate names of ionic and covalent compounds from their formulas. Name binary compounds, binary acids, stock compounds, ternary compounds, and ternary acids | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Construct Explanations and Design Solutions   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Scale, Proportion, and Quantity * Systems and System Models | Formula Unit  Cation  Anion  Ion  Nomenclature  Ionic Compound  Covalent Compound |
| **CHEMICAL REACTIONS**  **Types of Reactions and Balanced Equations**  **REAL-WORLD CONNECTIONS AND PHENOMENA**   * Demonstrate or use various media to observe double displacement reactions producing precipitates. * Observe oscillating reactions with respect to color change as an indicator of chemical change. Write the accompanying word equation for each reaction observed. | **CHE.6 Students will demonstrate an understanding of the types, causes, and effects of chemical reactions.**  **CHE.6.1** Develop and use models to predict the products of chemical reactions (e.g., synthesis reactions; single replacement; double displacement; and decomposition, including exceptions such as decomposition of hydroxides, chlorates, carbonates, and acids). Discuss and/or compile lists of reactions used in everyday life.  **CHE.6.2** Plan, conduct, and communicate the results of investigations to demonstrate different types of simple chemical reactions.  **CHE.6.4** Use mathematics and computational analysis to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. Give real-world examples (e.g., burning wood).  **CHE.6.5** Plan and conduct a controlled scientific investigation to produce mathematical evidence that mass is conserved. Use percent error to analyze the accuracy of results | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Plan and Conduct Investigations * Use Mathematical and Computational Thinking * Engage in Scientific Argument from Evidence * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Scale, Proportion, and Quantity * Stability and Change | Synthesis  Decomposition  Double Displacement  Single Displacement  Combustion  Oxidation-Reduction |
| **CHEMICAL REACTIONS**  **Stoichiometry**  **REAL-WORLD CONNECTIONS AND PHENOMENA**   * Research how Chemical Engineers use stoichiometry in the design of manufactured chemical goods. * Compare the process of baking various goods to reaction stoichiometry. | **CHE.6 Students will demonstrate an understanding of the types, causes, and effects of chemical reactions.**  **CHE.6.3** Use mathematics and computational analysis to represent the ratio of reactants and products in terms of masses, molecules, and moles (stoichiometry).  **CHE.6.6** Use mathematics and computational analysis to support the concept of percent yield and limiting reagent.  **CHE.6.7** Plan and conduct a controlled scientific investigation to produce mathematical evidence to predict and confirm the limiting reagent and percent yield in the reaction. Analyze quantitative data, draw conclusions, and communicate findings. Compare and analyze class data for validity. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Analyze and Interpret Data * Plan and Conduct Investigations * Use Mathematical and Computational Thinking   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Scale, Proportion, and Quantity * Stability and Change | Stoichiometry  Mole Ratio  Limiting Reagent  Percent Yield  Actual Yield  Theoretical Yield |

| **TERM 3** | | | |
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| **UNIT OF STUDY**  (REAL-WORLD CONNECTIONS and PHENOMENA)  **q** | **MS CCR STANDARDS q** | **SCIENCE AND ENGINEERING PRACTICES  SCIENCE CROSSCUTTING CONCEPTS**  **q** | **VOCABULARY TERMS** CORE ACADEMIC  **q** |
| **GAS LAWS**  **Behavior and Structure of Gases**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Explore and discuss how tire pressure can be affected by climate and/or weather conditions. * Research and discuss how the gas laws apply to breathing patterns in oxygen dependent organisms. | **CHE.7 Students will demonstrate an understanding of the structure and behavior of gases.**  **CHE.7.3** Analyze and interpret heating curve graphs to explain the energy relationship between states of matter (e.g., thermochemistry-water heating from -20oC to 120oC).  **CHE.7.1** Analyze the behavior of ideal and real gases in terms of pressure, volume, temperature, and number of particles.  **CHE.7.2 Enrichment:** Use an engineering design process to develop models (e.g., online simulations or student interactive activities) to explain and predict the behavior of each state of matter using the movement of particles and intermolecular forces to explain the behavior of matter. \* | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Use Mathematical and Computational Thinking * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Scale, Proportion, and Quantity * Systems and System Models * Energy and Matter *(Flows, Cycles, Conservation)* * Structure and Function * Stability and Change | Avogadro’s Law  Boyle’s Law  Charles’ Law  Combined Gas Law  Dalton’s Law  Ideal Gas Laws  Partial Pressure  Pressure  Temperature  Volume |
| **GAS LAWS**  **Gas Laws and Chemical Reactions**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Explain how the gas laws apply to underwater breathing or SCUBA diving. * Explain how ideal gas laws assist engineers in creating devices used to store gases, Oxygen tanks, etc. * Explore how gas laws are used to aid in the transportation and storage of propane used for propane stoves and grills | **CHE.7 Students will demonstrate an understanding of the structure and behavior of gases.**  **CHE.7.4** Use mathematical computations to describe the relationships comparing pressure, temperature, volume, and number of particles, including Boyle’s law, Charles’s law, Dalton’s law, combined gas laws, and ideal gas laws.  **CHE.7.6** Use the ideal gas law to support the prediction of volume, mass, and number of particles produced in chemical reactions (i.e., gas stoichiometry).  **CHE.7.7** Plan and conduct controlled scientific investigations to produce mathematical evidence that confirms that reactions involving gases conform to the law of conservation of mass.  **CHE.7.5 Enrichment:** Use an engineering design process and online simulations or lab investigations to design and model the results of controlled scientific investigations to produce mathematical evidence that confirms the gas-laws relationships. \* **All SEPs and CCCs are applicable**  **CHE.7.8 Enrichment:** Using gas stoichiometry, calculate the volume of carbon dioxide needed to inflate a balloon to occupy a specific volume. Use an engineering design process to design, construct, evaluate, and improve a simulated air bag. \* **All SEPs and CCCs are applicable** | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Plan and Conduct Investigations * Use Mathematical and Computational Thinking * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Scale, Proportion, and Quantity * Systems and System Models * Energy and Matter *(Flows, Cycles, Conservation)* * Structure and Function * Stability and Change | Avogadro’s Law  Boyle’s Law  Charles’ Law  Combined Gas Law  Dalton’s Law  Ideal Gas Laws  Partial Pressure  Pressure  Temperature  Volume |
| **SOLUTIONS**  **Properties of Solutions**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Explore the importance of temperature to the carbonation process in the beverage industry * Research electroplating and how this process is the automobile and other industries | **CHE.8 Students will demonstrate an understanding of the nature of properties of various types of chemical solutions.**  **CHE.8.2** Develop and use models (e.g., online simulations, games, or video representations) to explain the dissolving process in solvents on the molecular level.  **CHE.8.3** Analyze and interpret data to predict the effect of temperature and pressure on solids and gases dissolved in water.  **CHE.8.4** Design, conduct, and communicate the results of experiments to test the conductivity of common ionic and covalent compounds in solution. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Plan and Conduct Investigations * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Cause and Effect *(Mechanism and Explanation)* * Systems and System Models * Energy and Matter *(Flows, Cycles, Conservation)* * Stability and Change | Aqueous  Concentration  Dissociation  Dissolve  Molality  Molarity  Precipitate  Solubility  Solute  Solution  Solvent |
| **SOLUTIONS**  **Gas Laws and Chemical Reactions**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Research and discuss the effectiveness of common household cleaning solutions with respect to concentration of active ingredients. * Research Material Safety and Data documents on various solutions to determine what is safe and not safe for human use and consumption. Start with substances such as bleach, Washing detergents, etc. * Discuss the importance of water as a solvent. | **CHE.8 Students will demonstrate an understanding of the nature of properties of various types of chemical solutions.**  **CHE.8.1** Use mathematical and computational analysis to quantitatively express the concentration of solutions using the concepts such as molarity, percent by mass, and dilution.  **CHE.8.5** Use mathematical and computational analysis to analyze molarity, molality, dilution, and percentage dilution problems.  **CHE.8.6** Design, conduct, and communicate the results of experiments to produce a specified volume of a solution of a specific molarity and dilute a solution of a known molarity.  **CHE.8.7** Use mathematical and computational analysis to predict the results of reactions using the concentration of solutions (i.e., solution stoichiometry).  **CHE.8.8 Enrichment:** Investigate parts per million and/or parts per billion as it applies to environmental concerns in your geographic region, and reference laws that govern these factors. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Analyze and Interpret Data * Plan and Conduct Investigations * Use Mathematical and Computational Thinking * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Scale, Proportion, and Quantity * Energy and Matter *(Flows, Cycles, Conservation)* * Stability and Change | Aqueous  Concentration  Dissociation  Dissolve  Molality  Molarity  Precipitate  Solubility  Solute  Solution  Solvent |
| **ACIDS and BASES**  **Properties of Acid and Bases**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Research acid spills in Mississippi and discuss emergency management protocols and procedures for containing such spills based on acid-base interaction. * Research the importance of Salt compounds and their various uses. How are salts used to combat harsh winter conditions? How are salt compounds used to preserve foods for human consumption. | **CHE.9 Enrichment: Students will understand the nature and properties of acids, bases, and salt solutions.**  **CHE.9.1 Enrichment:** Analyze and interpret data to describe the properties of acids, bases, and salts.  **CHE.9.2 Enrichment:** Analyze and interpret data to identify differences between strong and weak acids and bases (i.e., dissociation).  **CHE.9.3 Enrichment:** Plan and conduct investigations using the pH scale to classify acid and base solutions.  **CHE.9.4 Enrichment:** Analyze and evaluate the Arrhenius, Bronsted-Lowry, and Lewis acid-base definitions.  **CHE.9.5 Enrichment:** Use mathematical and computational thinking to calculate pH from the hydrogen-ion concentration.  **CHE.9.6 Enrichment:** Obtain, evaluate, and communicate information about how buffers stabilize pH in acid-base reactions. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Analyze and Interpret Data * Plan and Conduct Investigations * Use Mathematical and Computational Thinking * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Structure and Function * Stability and Change | Acid  Arrhenius Acid/Base  Base  Bronsted-Lowry Acid/Base  Hydrogen Ion  Hydroxide Ion  Lewis Acid/Base  pH  pOH  Salt Compound (Salts)  Strong Acid  Strong Base  Weak Acid  Weak Base |

| **TERM 4** | | | |
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| **UNIT OF STUDY**  (REAL-WORLD CONNECTIONS and PHENOMENA)  **q** | **MS CCR STANDARDS q** | **SCIENCE AND ENGINEERING PRACTICES  SCIENCE CROSSCUTTING CONCEPTS**  **q** | **VOCABULARY TERMS** CORE ACADEMIC  **q** |
| **THERMOCHEMISTRY (ENRICHMENT)**  **Energy and Chemical Reactions**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Research and discuss how water is used as a coolant in plants because if its specific heat. * Observe heat releasing chemical reactions used in products such as hand-warmers used in cold temperatures. | **CHE.10 Enrichment: Students will understand that energy is exchanged or transformed in all chemical reactions.**  **CHE.10.1 Enrichment:** Construct explanations to explain how temperature and heat flow in terms of the motion of molecules (or atoms).  **CHE.10.2 Enrichment:** Classify chemical reactions and phase changes as exothermic or endothermic based on enthalpy values. Use a graphical representation to illustrate the energy changes involved.  **CHE.10.3 Enrichment:** Analyze and interpret data from energy diagrams and investigations to support claims that the amount of energy released or absorbed during a chemical reaction depends on changes in total bond energy.  **CHE.10.4 Enrichment:** Use mathematical and computational thinking to solve problems involving heat flow and temperature changes, using known values of specific heat and latent heat of phase change. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Plan and Conduct Investigations * Use Mathematical and Computational Thinking * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Energy and Matter *(Flows, Cycles, Conservation)* * Stability and Change | Calorimeter  Endothermic Reaction  Enthalpy  Entropy  Exothermic Reaction  Heat Capacity  Heat of Fusion  Heat of Reaction  Specific Heat |
| **EQUILIBRIUM (ENRICHMENT)**  **Chemical Equilibrium**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Research the chemical equilibrium concepts used to develop Mood Rings and color changing cosmetics. * Discuss how the human body maintains a chemical equilibrium and how the body responds to an imbalance. | **CHE.11 Enrichment: Students will understand that chemical equilibrium is a dynamic process at the molecular level.**  **CHE.11.1 Enrichment:** Construct explanations to explain how to use Le Chatelier’s principle to predict the effect of changes in concentration, temperature, and pressure**.**  **CHE.11.2 Enrichment:** Predict when equilibrium is established in a chemical reaction.  **CHE.11.3 Enrichment:** Use mathematical and computational thinking to calculate an equilibrium constant expression for a reaction. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Plan and Conduct Investigations * Use Mathematical and Computational Thinking * Construct Explanations and Design Solutions   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Systems and System Models * Energy and Matter *(Flows, Cycles, Conservation)* * Stability and Change | Temperature  Pressure  Concentration  LeChatelier’s Principle  Chemical Equilibrium |
| **ORGANIC NOMECLATURE (ENRICHMENT)**  **Characteristics of Organic Compounds**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Research the Carbon Bucky Ball; discuss its structure and uses in advances technology studies. * Research and identify organic compounds essential for human life and their importance to human survival. Pay special attention to structure and functions. | **CHE.12 Enrichment: Students will understand that the bonding characteristics of carbon allow the formation of many different organic molecules with various sizes, shapes, and chemical properties.**  **CHE.12.1 Enrichment:** Construct explanations to explain the bonding characteristics of carbon that result in the formation of basic organic molecules.  **CHE.12.2 Enrichment:** Obtain information to communicate the system used for naming the basic linear hydrocarbons and isomers that contain single bonds, simple hydrocarbons with double and triple bonds, and simple molecules that contain a benzene ring.  **CHE.12.3 Enrichment:** Develop and use models to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Scale, Proportion, and Quantity * Structure and Function | Organic Compound  Organic  Single/Double/Triple Bonds  Isomer  Functional Group  Carbohydrate  Nucleic Acids  Proteins  Amino Acids  Alcohols  Ketones  Ether  Ester |

1. https://tntp.org/assets/documents/TNTP\_The-Opportunity-Myth\_Web.pdf [↑](#footnote-ref-2)