MYP/3D Science Unit Planner

Marietta City Schools

Grade & Course: Physical Science	**Topic:** Periodic Table and Chemical Reactions	**Duration:** 5 weeks
Teachers: Physical Science Teachers	**Periodic Table** https://drive.google.com/file/d/0B63qqoYxItcTM3Z6NmZqaWczaEE/view?usp=sharing&resourcekey=0-k6sU386_S_CgYojcz2HRDw	

Georgia Standards and Content:

SPS1. Obtain, evaluate, and communicate information from the Periodic Table to explain the relative properties of elements based on patterns of atomic structure.

a. Develop and use models to compare and contrast the structure of atoms, ions, and isotopes.

(*Clarification statement:* Properties include atomic number, atomic mass and the location and charge of subatomic particles.)

b. Analyze and interpret data to determine trends of the following:
   - Number of valence electrons
   - Types of ions formed by main group elements
   - Location and properties of metals, nonmetals, and metalloids
   - Phases at room temperature

c. Use the Periodic Table as a model to predict the above properties of main group elements.

SPS2. Obtain, evaluate, and communicate information to explain how atoms bond to form stable compounds.

a. Analyze and interpret data to predict properties of ionic and covalent compounds.

(Clarification statement: Properties are limited to types of bonds formed, elemental composition, melting point, boiling point, and conductivity.)

b. Develop and use models to predict formulas for stable, binary ionic compounds based on balance of charges.

c. Use the International Union of Pure and Applied Chemistry (IUPAC) nomenclature for translating between chemical names and chemical formulas.

(Clarification statement: Limited to binary covalent and binary ionic, containing main group elements, compounds but excludes polyatomic ions.)

SPS3. Obtain, evaluate, and communicate information to support the Law of Conservation of Matter

a. Plan and carry out investigations to generate evidence supporting the claim that mass is conserved during a chemical reaction.

(Clarification statement: Limited to synthesis, decomposition, single replacement, and double replacement reactions.)

b. Develop and use a model of a chemical equation to illustrate how the total number of atoms is conserved during a chemical reaction.

(Clarification statement: Limited to chemical equations that include binary ionic and covalent compounds and will not include equations containing polyatomic ions.)

Narrative / Background Information

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)

Unit 1 Atomic Structure and Nuclear Reactions laid the foundation for completion of this unit.

The students rising to 9th grade in Fall 2021 may never have seen the 8th grade science classroom at all.
Link to GSE 8th Grade Science

These students have not been exposed to the 8th Science GSE that lay the foundation for the high school Physical Science standards.

Unit Phenomena (LEARNING PROCESS)

Changes to the chemistry of Flint Michigan's water supply created dangerous levels of lead in the drinking level. Students will explore the chemistry behind the removal of lead from homes and drinking water.

This Old House Video: Removal of Lead Paint

MYP Inquiry Statement: Scientific and technical advancements have enabled scientists to identify, model, and discover interactions, patterns, and relationships that exist between the natural world and human societies.

When particles of matter interact, chemical properties can be changed even though the mass of the system remains the same.

MYP Global Context:

Scientific and technical innovation

Approaches to Learning Skills:

SEP:

- Develop and use models
- Analyze and interpret data
- Use the Periodic Table as a model
- Use the International Union of Pure and Applied Chemistry (IUPAC)
- Plan and Carry out Investigations

ATL:

- Structure information in summaries, essays, and reports

Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)

By the end of grade 12

Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. Stable forms of matter are those in which the electric and magnetic field energy is minimized. A stable molecule has less energy, by an amount known as the binding energy, than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart.

How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?

Many substances react chemically with other substances to form new substances with different properties. This change in properties results from the ways in which atoms from the original substances are combined and rearranged in the new substances. However, the total number of each type of atom is conserved (does not change) in any chemical process, and thus mass does not change either. The property of conservation can be used, along with knowledge of the chemical properties of particular elements, to describe and predict the outcomes of reactions. Changes in matter in which the molecules do not change, but their positions and their motion relative to each other do change also occur (e.g., the forming of a solution,a change of state). Such changes are generally easier to reverse (return to original conditions) than chemical changes.

Crosscutting Concepts: (KNOWLEDGE & SKILLS)

Energy
Interactions
Patterns
Models
Structure and Function

MYP Key and Related Concepts:

Select one Key Concept:

Relationships
Change
Systems

Select one or more RC:

Energy
Interactions
Patterns
Models
Structure and Function
Transformation
Balance

	"Collision theory" provides a qualitative model for explaining the rates of chemical reactions. Higher rates occur at higher temperatures because atoms are typically moving faster and thus collisions are more frequent; also, a larger fraction of the collisions have sufficient energy to initiate the process. Although a solution or a gas may have constant chemical composition—that is, be in a steady state—chemical reactions may be occurring within it that are dynamically balanced with reactions in opposite directions proceeding at equal rates. Any chemical process involves a change in chemical bonds and the related bond energies and thus in the total chemical binding energy. This change is matched by a difference between the total kinetic energy of the set of reactant molecules before the collision and that of the set of product molecules after the collision (conservation of energy). Some reactions release energy (e.g., burning fuel in the presence of oxygen), and others require energy input (e.g., synthesis of sugars from carbon dioxide and water). Understanding chemical reactions and the properties of elements is essential not only to the physical sciences but also is foundational knowledge for the life sciences and the earth and space sciences. The cycling of matter and associated transfers of energy in systems, of any scale, depend on physical and chemical processes. The reactivity of hydrogen ions gives rise to many biological and geophysical phenomena. The capacity of carbon atoms to form the backbone of extended molecular structures is essential to the chemistry of life. The carbon cycle involves transfers between carbon in the atmosphere—in the form of carbon dioxide—and carbon in living matter or formerly living matter (including fossil fuels). The proportion of oxygen molecules (i.e., oxygen in the form O2) in the atmosphere also changes in this cycle.	

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)
Students may associate valence electron number with an element's period, rather than its group number.
Students tend to equate losing an electron with creating a negative, rather than positive, ion.
Students may confuse group numbers with an ion's charge.
Students may confuse the terms/definitions for atomic mass, mass number, and atomic number.
Students will often refer to atomic number and average atomic mass by their locations, rather than using the language of the standard.

Key Vocabulary: (KNOWLEDGE & SKILLS)
Atoms, protons, neutrons, nucleus, electron, electron cloud, energy levels, electron shells, valence shell, valence electrons, atomic number, atomic mass, mass number, periodic table, metal, nonmetal, metalloid, groups/families, period, representative elements, alkali metals, alkaline earth metals, halogens, noble gasses, cation, anion, covalent bonds, ion, element, compound, charge, chemical formula, subscript, coefficient, physical properties, chemical properties
Vocabulary Frayer Models Substitute Assignment if needed
https://docs.google.com/document/d/1F0Hu7rgLgZIEZaQyVV1Nc20GPxDVyIKTLYk5ROcj-Vg/edit?usp=sharing

Inquiry Questions:

Factual

What trends can be found in the periodic table? (# of valence electrons, types of ions formed, location and properties of metals/nonmetals/metalloids, phases at room temperature)

Conceptual

How can the periodic table be used to predict the properties of elements based on atomic structure patterns?

Debatable

Which shape of the periodic table best illustrates Periodic Law?

MYP Objectives	**Summative assessment**	
MYP BC - Law of Conservation of Mass Properties of Ionic and Covalent Bonding Lab MYP D Element Harmony Properties of Metals/Nonmetals/Metalloids	Assessment Task: Common Assessments (formative and summative) Title and Criterion: Trends on the Periodic Table Project (D) IUPAC Writing & Naming Assessment w/CR (A) Chemical Reactions Unit Assessment (A, D)	Relationship between summative assessment task(s) and statement of inquiry: Students are required to demonstrate their understanding of SPS1, SPS2, and SPS3, which includes the identification of patterns and relationships of atoms based upon the periodic table, through the completion of a project (MYP D) multiple-choice/short answer (MYP A), standards-aligned unit assessment that mimics the GA Milestones. Students will also demonstrate their understanding of atoms through a constructed response assessment which requires the writing and naming of compounds and formulas based on IUPAC nomenclature.

Unit Objectives: - Teaching and learning is focused on developing conceptual understanding

Learning Activities and Experiences	**Inquiry & Obtain: (LEARNING PROCESS)**	**Evaluate: (LEARNING PROCESS)**	**Communicate: (LEARNING PROCESS)**
Lesson 1: Periodic Table Properties	Review valence electrons, ions and Lewis Dot Structures Direct Instruction: Periodic Table Properties of Metals, Non metals, and metalloids	Formative Practice Activities MYP D Element Harmony Project Common Summative Assessment Study Guide Review	Schoology Discussion Prompts? Schoology Video Submissions? Gallery Walk? Group Project Presentation?

Lesson 2: Chemical Bonding	Ionic and Covalent Bonding Presentation Practice	Bonding Puzzle and Molecular Modeling Activities CSA over Lessons 1 & 2	Think Pair Share - Students use a provided textbook resource to answer questions provided, work in small groups and create Google slides to share with the class. Discussions
Lesson 3: Chemical Reactions		CFA Chemical Bonding CSA Part 2 Cumulative	

Resources (hyperlink to model lessons and/or resources): (click here for description)

Discovery Education: Chemistry Science Techbook
Holt Science Spectrum Physical Science Textbook

General DE Chapter Resources:
Interactive Periodic Table
Interactive Glossary
Engage & Explore Activities
Explorations
Virtual Labs
Skill Builders
Video Segments
CK12 High School Chemistry Flexbook/Adaptive Practice
Shared Physical Science Resources
https://marietta.schoology.com/group/5907148087/materials#/group/5907148087/materials

Reflection: Considering the planning, process and impact of the inquiry

Prior to teaching the unit	During teaching	After teaching the unit
- What does experience tell us about what to expect in this unit? • Students may struggle to discern between pure substances: elements, molecules, and compounds. • Students may associate valence electron number with an element's period, rather than its group number. • Students tend to equate losing an electron with creating a negative, rather than positive, ion. • Students may confuse group numbers with an ion's charge. • Students will often refer to atomic number and average atomic mass by their locations, rather than using the language of the standard.	- What can we adjust or change? - Did they do well on the CFA? - What do we need to reteach? - Spiral and reteach valence electrons (review SPS1a) - What do they need to practice more? procedural skills to be able to complete assignments - more explicit teaching of skills not just content	How well did the summative assessment task serve to distinguish levels of achievement?