International Baccalaureate
Baccalauréat International
Bachillerato Internacional

MYP/3D Science Unit Planner

Marietta City Schools

MARIETTA CITY SCHOOLS

Grade & Course: 9-12 Chemistry	**Topic:** Properties and Bonding	**Duration:** 6 weeks

Georgia Standards and Content:
SC2. Obtain, evaluate, and communicate information about the chemical and physical properties of matter resulting from the ability of atoms to form bonds.
a. Plan and carry out an investigation to gather evidence to compare the physical and chemical properties at the macroscopic scale to infer the strength of intermolecular and intramolecular forces.
b. Construct an argument by applying principles of inter- and intra- molecular forces to identify substances based on chemical and physical properties.
c. Construct an explanation about the importance of molecular-level structure in the functioning of designed materials. (Clarification statement: Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.)
d. Develop and use models to evaluate bonding configurations from nonpolar covalent to ionic bonding.
(Clarification statement: VSEPR theory is not addressed in this element.)
e. Ask questions about chemical names to identify patterns in IUPAC nomenclature in order to predict chemical names for ionic (binary and ternary), acidic, and inorganic covalent compounds.
f. Develop and use bonding models to predict chemical formulas including ionic (binary and ternary), acidic, and inorganic covalent compounds.

Narrative / Background Information

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)
S8P1. Obtain, evaluate, and communicate information about the structure and properties of matter.
f. Construct an explanation based on evidence to describe conservation of matter in a chemical reaction including the resulting differences between products and reactants. (Clarification statement: Evidence could include models such as balanced chemical equations.)

Year-Long Anchoring Phenomenon: (LEARNING PROCESS)
Changes to the measurement of chemicals added to Flint Michigan's water supply created dangerous levels of lead contamination in the drinking water.

Unit Phenomenon (LEARNING PROCESS)
Hydrophobic coatings repel water while preserving the natural behavior of raindrops.

MYP Inquiry Statement:
Forces between particles determine structure and behavior.

MYP Global Context:
Orientation in Space and Time

Approaches to Learning Skills:
- Self Management skills: Identify strengths and weaknesses of personal learning strategies (self-assessment)
- Research skills: Process data and report results

Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)
- Materials
- Intramolecular Forces
- Metallic Bonding
  - Electron Sea Model
- Ionic Bonding
  - Types of Ions
  - Crystal Lattice
  - Nomenclature
  - Chemical Formulas
  - Polyatomic Ions
- Intermolecular Forces

Crosscutting Concepts: (KNOWLEDGE & SKILLS)
- Structure and Function
- Stability and Change
- Patterns
- Energy and Matter
- Systems and System Models

MYP Key and Related Concepts:
- Systems
- Patterns
- Form

	● Covalent Bonding ● Lewis Structure ● Nomenclature (including acids/bases) ● Chemical Formulas ● Polarity ● Physical and Chemical Properties ● Electrical Conductivity	● Consequences ● Interaction

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)

Electrons orbit the nucleus similarly to planets orbiting the sun.

Electrons are fixed on specific energy levels (rings) and do not move between levels.

Key Vocabulary: (KNOWLEDGE & SKILLS)

Physical properties
Chemical properties
Intermolecular force
Intramolecular force
Electrical conductivity
Bonding configuration
Nonpolar covalent bond
Polar covalent bond
Ionic bond
IUPAC nomenclature
Binary
Ternary
Anion
Cation
Lewis structure
Bond energy
Endothermic
Exothermic

Inquiry Questions:

Factual -

- What are the observable differences between physical and chemical properties of matter?
- How can we compare the strength of intermolecular and intramolecular forces based on the physical and chemical properties of substances?
- What are the key differences between intermolecular and intramolecular forces?
- Which chemical and physical properties can be used to identify a substance?
- Why are some materials flexible and durable, and how does this relate to their molecular structure?
- How is the design of pharmaceuticals influenced by the molecular-level structure?
- What are the characteristics of nonpolar covalent, polar covalent, and ionic bonds?
- How do bonding configurations differ between nonpolar covalent, polar covalent, and ionic compounds?
- What patterns can be observed in the IUPAC nomenclature for ionic, acidic, and covalent compounds?
- How can chemical names be predicted based on the rules of IUPAC nomenclature?
- How can bonding models help in determining the chemical formulas of different compounds?
- What factors influence the chemical formula of an ionic compound?

Conceptual -

- How do intermolecular and intramolecular forces influence the macroscopic properties of materials?
- In what ways can the strength of molecular forces impact the behavior of substances in different environments?
- How can understanding molecular forces improve our ability to predict the properties and behaviors of unknown substances?
- How do the principles of intermolecular and intramolecular forces help us identify and categorize different substances?
- How can altering the molecular structure of a material change its properties and uses?
- What are some examples of how molecular-level design leads to advancements in technology and medicine?
- How do different types of chemical bonds (nonpolar covalent, polar covalent, ionic) affect the overall properties of a

compound?

- How do patterns in IUPAC nomenclature reflect the underlying structure and bonding in chemical compounds?
- How can the rules of chemical naming guide us in identifying and classifying new or unfamiliar compounds?
- How does understanding bonding models contribute to advancements in chemical synthesis and material design?

Debatable -

- To what extent do macroscopic properties provide an accurate representation of the strength of intermolecular and intramolecular forces?
- Can we rely solely on macroscopic observations to understand the underlying molecular interactions, or are there significant limitations?
- Are intermolecular forces more critical than intramolecular forces in determining the physical and chemical properties of substances?
- Is it possible to accurately identify a substance based solely on its molecular forces, or do other factors play an equally important role?
- Should the molecular structure be considered the most important factor in material design, or are there other aspects that are equally or more significant?
- Can the benefits of designing materials with specific molecular structures outweigh the potential risks and costs associated with such designs?
- Can the current models of bonding configurations fully capture the complexity of chemical interactions, or are they oversimplified?
- Should the IUPAC nomenclature be revised to reflect modern chemical discoveries, or is the current system sufficient?
- Can bonding models truly predict chemical formulas with high accuracy, or do they fall short in the face of complex compounds?
- Should the use of bonding models in predicting chemical formulas be prioritized in chemical education, or should other methods be equally emphasized?

MYP Objectives	**Summative assessment**
● MYP Criterion A (iii): analyse and evaluate information to make scientifically supported judgments	Relationship between summative assessment task(s) and statement of inquiry: Students will perform tasks and respond to assessment items that will gauge their mastery of atoms and moles as required by the Georgia Standards of Excellence. Mastery of these concepts is necessary to move forward in our study of particulate properties and behavior.

Learning Activities and Experiences	**Inquiry & Obtain: (LEARNING PROCESS)**	**Evaluate: (LEARNING PROCESS)**	**Communicate: (LEARNING PROCESS)**
Weeks 1 to 3: **Georgia Standard(s) of Excellence:** SC2(d) - Develop and use models to evaluate bonding configurations from nonpolar covalent to ionic bonding. (Clarification statement: VSEPR theory is not addressed in this element.) SC2(e) - Ask questions about chemical names to identify patterns in IUPAC nomenclature in order to predict chemical names for ionic (binary and ternary), acidic, and inorganic covalent compounds. SC2(f) - Develop and use bonding models to predict chemical formulas including ionic (binary and ternary), acidic, and inorganic covalent compounds.			
Lesson 1 (Intro to Bonding) **SC2(d)**	Engage - electronegativity difference between metals and nonmetals Explore - Bonding Triangles Explore - Properties Ionic vs. Covalent	Explain - Practice with bonding triangles and electronegativity difference - ionic vs. covalent Elaborate - choice assignment	Evaluate - Ticket out the Door
Lesson 2 (Ionic Bonding and	Engage - Ask Questions about Ionic	Explain - Practice with nomenclature	Evaluate - MYP Bonding with a Classmate Activity

Nomenclature) **SC2(d)** **SC2(e)** **SC2(f)**	Explore - Ionic nomenclature notes and examples (binary, ternary, with Roman numerals)		
Lesson 3 (Covalent Bonding and Nomenclature) **SC2(d)** **SC2(e)** **SC2(f)**	Engage - Ask Questions about Covalent Explore - Covalent nomenclature notes and examples	Explain - Practice with nomenclature	Evaluate - Common Formative Assessment on Nomenclature
Weeks 4 and 5: **Georgia Standard(s) of Excellence:** SC2(a) - Plan and carry out an investigation to gather evidence to compare the physical and chemical properties at the macroscopic scale to infer the strength of intermolecular and intramolecular forces. SC2(b) - Construct an argument by applying principles of inter- and intra- molecular forces to identify substances based on chemical and physical properties. SC2(c) - Construct an explanation about the importance of molecular-level structure in the functioning of designed materials. (Clarification statement: Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.) SC2(d) - Develop and use models to evaluate bonding configurations from nonpolar covalent to ionic bonding. (Clarification statement: VSEPR theory is not addressed in this element.)			
Lesson 4 (Lewis Structures) **SC2(d)**	Engage - comparing ionic vs. covalent structures Explore - notes and examples of drawing Lewis structures for simple molecules (up to 4 electron domains)	Explain - practice with Lewis Elaborate - 5 or 6 electron domains, polyatomic ions	Evaluate - Ticket out the Door
Lesson 5 (Polarity) **SC2(a)** **SC2(b)**	Engage - Properties of polar vs. nonpolar covalent Explore - examples of determining polar vs. nonpolar bonds AND molecules	Explain - practice with determining polar/nonpolar Elaborate - connect with drawing Lewis Structures	Evaluate - Ticket out the Door
Lesson 6 (Intermolecular Forces) **SC2(a)** **SC2(b)**	Engage - importance of H bonding (use unit standard of hydrophobic coatings) Explore - difference between IMFs (London, dipole-dipole, hydrogen bonding)	Explain - practice with IMFs Explain/Elaborate - connect this with properties (boiling point of H_2O, etc.)	Evaluate - Common Formative on Properties and Bonding
Lesson 7 (Materials) **SC2(c)**	Engage/Explore - Materials exploration	Explain/Elaborate - Materials MYP Project	Evaluate - MYP Project
Week 6: **Georgia Standard(s) of Excellence:** SC2(a) - Plan and carry out an investigation to gather evidence to compare the physical and chemical properties at the			

macroscopic scale to infer the strength of intermolecular and intramolecular forces. SC2(b) - Construct an argument by applying principles of inter- and intra- molecular forces to identify substances based on chemical and physical properties.			
MYP Properties Lab	Engage - how do properties and IMFS relate? Explore - design lab	Explain/Elaborate - conduct lab	Evaluate - present lab

Resources (hyperlink to model lessons and/or resources):
Discovery Education Science Techbook

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

Prior to teaching the unit	During teaching	After teaching the unit