International Baccalaureate
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MARIETTA CITY SCHOOLS

Marietta City Schools

2023–2024 District Unit Planner

Grade & Course: Physical Science	**Topic:** Atomic Structure	**Duration: 4** weeks
Teachers: Physical Science Teachers		

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.

Narrative / Background Information

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

In fifth grade, students investigate the following:

S5P1. Obtain, evaluate, and communicate information to explain the differences between a physical change and a chemical change.

a. Plan and carry out investigations of physical changes by manipulating, separating, and mixing dry and liquid materials.
b. Construct an argument based on observations to support a claim that physical changes in the state of water are due to temperature changes, which cause small particles that cannot be seen to move differently.
c. Plan and carry out an investigation to determine if a chemical change occurred based on observable evidence (color, gas, temperature change, odor, new substance produced).

Link to GSE 8th Grade Science

These students have been exposed to the 8th Science GSE that lay the foundation for the high school Physical Science standards.

Unit Phenomena (LEARNING PROCESS)

How can you use carbon dating to estimate the age of organisms?

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.

MYP Global Context:

Scientific and technical innovation

Approaches to Learning Skills:	**Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)**	**Crosscutting Concepts: (KNOWLEDGE & SKILLS)**
● Make inferences and draw conclusions ● Organize and depict information logically ● Structure information in summaries, essays, and reports ● Collect, record, and verify data ● Practice analyzing and attributing causes for failure	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	Energy Interactions Patterns Models Structure and Function **MYP Key and Related Concepts:** **Select one Key Concept:** Relationships

● Use models and simulations to explore complex systems and issues ● Analyze complex concepts and synthesize to create new understanding	the bulk scale are determined by electrical forces within and between atoms. ● Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules. ● Chemical processes and properties of Developing and using models Analyzing and Interpreting Data Constructing Explanations Additional teacher notes are provided in the instructional segment Safety Elemental Na and Cl are dangerous and not appropriate in a classroom Chemicals should always be handled according to SDS By the end of this unit, students are using the following language in their speaking and writing during EXPLAIN or ELABORATE. -Atomic Structure -Properties -Patterns -Element -Trend -Compound -Stable -Properties ● Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. ● The strong and weak nuclear interactions are important inside atomic nuclei—for example, they determine the patterns of which nuclear isotopes are stable and what kind of decays occur for unstable ones.	**Select one or more RC:** Models

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

Inquiry Questions:

Factual

What are atoms, ions, and isotopes?
What are the types of subatomic particles, what are their charges, and where are they located within an atom?

Conceptual

How has the model of the atom evolved over time?
How can models be used to demonstrate the similarities and differences between atoms, ions, and isotopes?
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)?
How can the periodic table be used to predict the properties of elements based on atomic structure patterns?
How can I determine an element's atomic number and atomic mass, and what do these numbers represent?

Debatable

Radiocarbon dating is a key tool archaeologists use to determine the age of plants and objects made with organic material. But new research shows that commonly accepted radiocarbon dating standards can miss the mark, how does this new discovery call into question historical timelines?

Inaccuracies in radiocarbon dating.

MYP Objectives	**Formative/Summative assessment**	
MYP B/C: Atom in a Bag MYP A/D: CFA Constructive Response - Essay question on Isotope use for aging fossils	Assessment Task: CFA 1: Element Symbol Reading: Atomic #, Mass #, Avg. Atomic Mass, Atomic Structure CFA 2: Isotopes, Building an Atom CSA: Cumulative Summative	Relationship between summative assessment task(s) and statement of inquiry: Students are required to demonstrate their understanding of SPS1, which includes the identification of patterns and relationships of atoms based upon the periodic table, through the completion of a multiple-choice, 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)**
Matter Introduction **Lesson 1**	Introduction to Matter Guided Notes What is Matter Task Card Activity Matter POGIL Mystery Powders Lab/Density Activity (Video for Review)	Matter Teacher designed formative assessment Mystery Powders Lab/Density Activity Density Problems - Discovery Education	What is matter task card posters Class discussions Small Group Activities

Atomic Structure **Week 1:**	Week 1 Atomic Theory: Youtube Video Playlist Black Box Model Week 2: Introduce Atomic Structure - charge and location direct instruction p+/n0/e- Introducing Element Symbols: Atomic Race Activity Bohr Model - direct instruction Introducing Bohr Model Guided Notes	Week 1: Introduce guided note/notebooks for interactive notebooks Week 2: Socratic seminar or Think/Pair/Share - students point out patterns in the periodic table. Introduce discussion rules. Bell Ringer Formative Assessment - element identification Building Bohr Model atoms with manipulatives	
Week 2:	Introduce Valence Electrons - direct instruction Reinforce Bohr Model Introduce Lewis Dots & Ion Charges - guided notes Socratic Seminar - what is different about this model? (Carbon 12 and Carbon 13 and 14 as a model) Defining Isotopes - guided notes Naming Isotopes	Unit 1 CFA 1 - Atomic Structure and Element Symbols (incl. structure, particle charges, electron number, proton number, mass number, neutron number) practice drawing Lewis dots & finding ion charges (protons-electrons) Practice Naming Isotopes Practice Isotope Notation	Socratic Seminar - noting the similarities in groups (optional) Activity- Ion charges & Lewis dot Structures PhET Practice Isotopes & Ions

Week 3-4	PhET Inquiry: stable isotopes of the first 10 elements on PhET build an atom simulator Introduce Atom in a Bag	PhET atom game Atom in a Bag Opener CFA 2: Valence Electrons, Lewis Dots, Ion Charge, Isotope Symbols/Masses CSA 1 REVIEW CSA 1	Isotope Applications - Extension or On-level teacher's choice Groups to assign: C-13, O-18 (medicine), U-235, U-238, Atom in a Bag

Resources (hyperlink to model lessons and/or resources):
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/4621413779/materials?f=231800526#/group/4621413779/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 number 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. • Students struggle to recall element/molecule/compound vocab after weeks of atomic theory and periodic trends	- What can we adjust or change? - Did they do well on the CFA? - Overall students scored above 70% - What do we need to reteach? - Rewording of some questions to help students identify key terms and make connections - What do they need to practice more? - Using the periodic table as a tool	- How well did the summative assessment task serve to distinguish levels of achievement? Chunk NOS Unit 0 throughout first semester to align skills with applications Adjustments need to be to the wording for some questions on the CSA - remove the charge questions focus only on valence electrons Revamp the MYP A - remove rubric from within the test to a separate page students were overwhelmed with the verbiage on the pages. *Working with PLC members to make these changes now to be ready for next year Testing protocols were discussed and decided on set items to be used for assessments to make data analysis valid for example using the same periodic table with defined parameters for all assessments - all items added need to b agreed upon ahead of time