International Baccalaureate
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MARIETTA CITY SCHOOLS

Marietta City Schools

2023–2024 District Unit Planner

Grade & Course: 9-12 Chemistry	**Topic:** Atoms and Moles	**Duration:** 4 weeks

Georgia Standards and Content:

SC1. Obtain, evaluate, and communicate information about the use of the modern atomic theory and periodic law to explain the characteristics of atoms and elements.

a. Evaluate merits and limitations of different models of the atom in relation to relative size, charge, and position of protons, neutrons, and electrons in the atom.

b. Construct an argument to support the claim that the proton (and not the neutron or electron) defined the element's identity.

d. Construct an explanation that relates the relative abundance of isotopes of a particular element to the atomic mass of the element.

SC3. Obtain, evaluate, and communicate information about how the Law of Conservation of Matter is used to determine chemical composition in compounds and chemical reactions.

c. Use mathematics and computational thinking to apply concepts of the mole and Avogadro's number to conceptualize and calculate ● percent composition, ● empirical/molecular formulas, ● mass, moles, and molecules relationships

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.

d. Develop models (e.g., atomic-level models, including drawings, and computer representations) by analyzing patterns within the periodic table that illustrate the structure, composition, and characteristics of atoms (protons, neutrons, and electrons) and simple molecules.

Year-Long Anchoring Phenomena: (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 Phenomena (LEARNING PROCESS)

When a drop of food coloring is added to a glass of water, it disperses and gradually spreads throughout the water, demonstrating the presence of particles moving and interacting with water.

MYP Inquiry Statement:

All substances are composed of tiny, discrete particles that interact to shape the properties and behavior of materials in the world around us.

MYP Global Context:

Orientation in Space and Time

Approaches to Learning Skills:

- Communication skills
- Social skills
- Self Management skills
- Research skills
- Thinking skills

Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)

- Early Atomic Models
- Atomic Structure
- Isotopes and Ions
- Relative Abundance and Atomic Mass
- Avogadro's # and Moles
- Percent Composition
- Empirical and Molecular Formulas
- Mass, Moles, and Molecules Relationships

Crosscutting Concepts: (KNOWLEDGE & SKILLS)

- Systems and System Models
- Structure and Function
- Scale, Proportion, and Quantity

MYP Key and Related Concepts:

- Key Concepts: Systems and Relationships
- Related Concepts: Models and Evidence

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

Students should have a basic understanding that:

- atoms are the building blocks of matter
- atoms contain protons, neutrons, and electrons
- protons and neutrons are located in the nucleus
- electrons are located in the electron cloud

Students might have misconceptions involving:

- the existence of multiple models of the atom with varying merits and limitations
- identifying the location of varying subatomic particles within the atom
- the varying sizes of subatomic particles within the atom and the subsequent implications of that size

Key Vocabulary: (KNOWLEDGE & SKILLS)

Atom
Billiard Ball Model
Plum Pudding Model
Nuclear Model
Bohr Model
Nucleus
Electron Cloud
Subatomic Particle
Proton
Neutron
Electron
Mass Number
Isotope
Relative Abundance
Atomic Mass
Ion
Nuclear Charge
Particles
Avogadro's Number
Mole
Molar Mass
Percent Composition
Empirical and Molecular Formula

Inquiry Questions:

Factual -

- What are the three subatomic particles in an atom?
- What changes to the subatomic particles lead to the formation of an isotope?
- What changes to the subatomic particles lead to the formation of an ion?
- How can we determine the atomic mass of an element from the relative abundance of its isotopes?
- How can we determine the percent composition using the mole and Avogadro's number?
- How can we determine the empirical/molecular formula using the mole and Avogadro's number?
- How can we convert between mass, moles, and particles using the mole and Avogadro's number?

Conceptual -

- How did each new model of the atom contribute to our current understanding of the relative charge, size, and position of the subatomic particles?
- What evidence supports the claim that the proton (and not the neutron or the electron) defines the element's identity?
- How might the presence of different isotopes impact the resulting atomic mass value?
- How do the mole and Avogadro's number interrelate?

Debatable -

- Which model of the atom is the best representation based upon its merits and limitations?

MYP Objectives	Summative assessment	
Sciences **Sciences**	Criterion A: Knowing and Understanding ● Common Summative Assessment Criterion B: Inquiring and Designing Criterion C: Processing and Evaluating ● Common Laboratory Experience	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)
Week 1: **Georgia Standard(s) of Excellence:** Evaluate merits and limitations of different models of the atom in relation to relative size, charge, and position of protons, neutrons, and electrons in the atom			
Week 1:	Engage: Thinking about Development of the Atomic Theory Explore: How did the atomic theory evolve from ancient Greece to modern day, and which key scientists made which contributions? Hands-On Lab: Development of the Atomic Theory	Evaluate: Formative Assessment - Atomic Model Evaluate: Constructed Response - Development of the Atomic Theory	Explain: How did scientists use the work of earlier scientists and the contributions of their peers to develop the atomic theory? Elaborate: Legends and Rumors - Where did the term atom come from?
Week 2: **Georgia Standard(s) of Excellence:** Construct an argument to support the claim that the proton (and not the neutron or electron) defined the element's identity. Construct an explanation that relates the relative abundance of isotopes of a particular element to the atomic mass of the element.			
Week 2:	Engage: Discovering Energy from inside the Atom Explore: How Can the Subatomic Parts of an Atom Be Used to Identify It? Hands-On Lab: Determining Average Atomic Mass	Evaluate: Formative Assessment - Isotopes Evaluate: Constructed Response - Parts of the Atom	Explain: What information about an atom can be determined from its parts? Elaborate: Artificially Made - What elements on the periodic table were discovered in the laboratory?

Week 3 and Week 4: **Georgia Standard(s) of Excellence:** Use mathematics and computational thinking to apply concepts of the mole and Avogadro's number to conceptualize and calculate ● percent composition, ● empirical/molecular formulas, ● mass, moles, and molecules relationships			
	Engage: Understanding the Importance of Mathematics of Formulas and Equations Explore: How is Molar Mass Calculated and Why Is It Useful? Hands-On Lab: Empirical Formula Determination	Evaluate: Formative Assessment - Percent Composition Evaluate: Constructed Response - Mathematics of Formulas and Equations	Explain: How can you use average atomic masses from the periodic table to find the formula mass and the molar mass of ammonia, NH3, and the percent composition of each element in ammonia?

Resources (hyperlink to model lessons and/or resources):
Discovery Education Science Techbook
Hands-On Lab: Development of the Atomic Theory
Hands-On Lab: Determining Average Atomic Mass
Hands-On Lab: Empirical Formula Determination

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

Prior to teaching the unit	During teaching	After teaching the unit