International Baccalaureate
Baccalauréat International
Bachillerato Internacional

MARIETTA CITY SCHOOLS

Marietta City Schools

2024–2025 District Unit Planner

Grade & Course: 9-12 Chemistry	**Topic:** Atoms and Periodicity	**Duration:** 6 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.
c. Construct an explanation based on scientific evidence of the production of elements heavier than hydrogen by nuclear fusion.
d. Construct an explanation that relates the relative abundance of isotopes of a particular element to the atomic mass of the element.
e. Construct an explanation of light emission and the movement of electrons to identify elements.
f. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms (i.e. including atomic radii, ionization energy, and electronegativity).
g. Develop and use models, including electron configuration of atoms and ions, to predict an element's chemical properties.

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)

Option 1: Semiconductors are vital components in modern technology, playing crucial roles in a wide array of electronic devices and systems such as microprocessors, Wi-Fi routers, and mobile phones

Option 2: Nanotechnology involves manipulating matter at the atomic and molecular levels to create materials with novel properties and applications.

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:

Globalization and Sustainability

Approaches to Learning Skills:

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

Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)

- Element Formation
  - Nuclear Fusion
- Models of the Atom
  - Billiard Ball
  - Plum Pudding
  - Nuclear
  - Bohr
  - Quantum
- Element Identity
  - Subatomic Particles
    - Proton

Crosscutting Concepts: (KNOWLEDGE & SKILLS)

- Systems and System Models
- Structure and Function
- Patterns

MYP Key and Related Concepts:

- Systems
- Relationships
- Models
- Evidence
- Patterns

	● Neutron ● Electron ● Isotopes ● Isotopic Abundance ● Ions ● Electron Arrangement ● Orbital Notation ● Electron Configuration ● Full and Abbreviated ● Lewis Dot Diagram ● Light Emission ● Periodicity / Properties ● Atomic Mass ● Atomic Radii ● Ionization Energy ● Electronegativity ● Reactivity	

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
- protons are positive
- electrons are negative
- neutrons are neutral

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
- the number of each subatomic particle is always equal
- determining the charge of an ion (changing protons instead of electron)

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
Nuclear Fusion
Light Emission
Isotopic Abundance
Periodic Table
Atomic Radii

Ionization Energy
Electronegativity
Electron Configuration
Chemical Property

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?
- What occurs when two nuclei undergo nuclear fusion?
- How can we model nuclear fusion with an equation?
- What occurs when an atom absorbs energy from a flame or electricity? How does this result in the emission of light?
- What did the Bohr Model add to our understanding of electrons?
- What did the Quantum Model add to our understanding of electrons?
- How can we use the Periodic Table to determine the energy levels and sublevels that an atom's electrons occupy?
- How can we use the Periodic Table to construct models (Bohr, electron configuration, orbital notation) for atoms and ions?

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?
- How do the spectra of stars provide scientific evidence of nuclear fusion?
- How can we use observations of light emission to make predictions about the energy of electron transitions occurring within the atom?
- How can models (Bohr, electron configuration, orbital notation) be used to predict chemical properties of atoms and ions?

Debatable -

- Which model of the atom is the best representation based upon its merits and limitations?
- Should society have control/approval over nuclear fusion research?

MYP Objectives	**Summative assessment**	
Sciences	Criterion A: Knowing and Understanding ● Common Formative Assessment ● Common Summative Assessment Criterion B: Inquiring and Designing ● Common Laboratory Experience 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 periodicity 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	**Inquiry & Obtain: (LEARNING PROCESS)**	**Evaluate: (LEARNING PROCESS)**	**Communicate: (LEARNING PROCESS)**

Experiences			
Week 1: **Georgia Standard(s) of Excellence:** Construct an explanation based on scientific evidence of the production of elements heavier than hydrogen by nuclear fusion.			
Week 1:	Engage: Phenomena introduction (semiconductors and nanotechnology) Explore: Modeling nuclear fusion and lab safety and procedures	Evaluate: Lab Safety Quiz Evaluate: CER nuclear fusion modeling	Explain: CER nuclear fusion modeling peer review and presentations Elaborate: Application to material science: Developing materials that can withstand the intense conditions inside a fusion reactor.
Week 2: **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.			
	Engage: Atomic modeling Explore: Atomic modeling experimental data analysis	Evaluate: Atomic Structure Formative Assessment	Explain: Atomic Modeling CER based on evidence from historical experimentation and scientists Elaborate: Application to nanotechnology using carbon Nanotubes (link to phenomena).
Week 3-4: **Georgia Standard(s) of Excellence:** Construct an argument to support the claim that the proton (and not the neutron or electron) defines 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. Develop and use models, including electron configuration of atoms and ions, to predict an element's chemical properties.			
	Engage: Student discourse on average atomic mass Explore: Modeling, analyzing and summarizing ions vs isotopes vs atoms Lab: Isotope Lab, Flame Test	Evaluate: Lab Assessments Evaluate: CFA	Explain: Lab analysis and presentation Elaborate: Role of ions and isotopes in nanotech and semiconductors
Week 5-6: **Georgia Standard(s) of Excellence:** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms (i.e. including atomic radii, ionization energy, and electronegativity).			
	Engage: Compare and contrast discourse activity on periodic groups Explore: Research Periodicity Project	Evaluate: Periodicity Project Presentation	Explain: Periodicity Project Elaborate: Periodicity Project (MYP D)

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