International Baccalaureate
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MYP/3D Science Unit Planner

Marietta City Schools

MARIETTA CITY SCHOOLS

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 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)

Fireworks light up the sky with incredible colors and patterns.

MYP Inquiry Statement:

Interactions between particles influence the properties and behavior of systems.

MYP Global Context:

Identities and Relationships

Approaches to Learning Skills:

- Communication skills: give and receive meaningful feedback
- Self Management skills: Develop new skills, techniques and strategies for effective learning

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
    - Neutron
    - Electron
  - Isotopes

Crosscutting Concepts: (KNOWLEDGE & SKILLS)

- Systems and System Models
- Structure and Function
- Patterns
- Energy and Matter

MYP Key and Related Concepts:

- Systems
- Relationships
- Models
- Evidence
- Patterns

	● 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**
● MYP Criterion A (i): explain scientific knowledge	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 Experiences	**Inquiry & Obtain: (LEARNING PROCESS)**	**Evaluate: (LEARNING PROCESS)**	**Communicate: (LEARNING PROCESS)**
Weeks 1 and 2: **Georgia Standard(s) of Excellence:** SC1(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. SC1(b) - Construct an argument to support the claim that the proton (and not the neutron or electron) defined the element's identity. SC1(d) - Construct an explanation that relates the relative abundance of isotopes of a particular element to the atomic mass of the element.			

Lesson 1 (Models of the Atom) **SC1(a)**	Engage: Atomic modeling Explore: Atomic modeling experimental data analysis	Evaluate: Atomic Structure Formative Assessment (daily)	Explain: Atomic Modeling CER based on evidence from historical experimentation and scientists Elaborate: Elaboration of elements and connection to global context
Lesson 2 (What Defines an Element's Identity?) **SC1(b)**	Engage: Periodic Table information Explore: What does the Periodic Table actually tell us?	Evaluate: Counting Particles Formative Assessment (daily)	Explain: Group and individual practice with atoms and ions Elaborate: Ions in real life
Lesson 3 (Relative Abundance and Atomic Mass) **SC1(d)**	Engage: Student discourse on average atomic mass Explore: Modeling, analyzing and summarizing ions vs isotopes vs atoms Lab: Isotope Lab (candium or pennium) - COMMON	Evaluate: Lab activity Evaluate: CFA Atoms and Electrons	Explain: Lab analysis and presentation Elaborate: Mass spectrometry
Weeks 3 to 5: **Georgia Standard(s) of Excellence:** SC1(e) - Construct an explanation of light emission and the movement of electrons to identify elements. SC1(g) - Develop and use models, including electron configuration of atoms and ions, to predict an element's chemical properties.			
Lesson 4 (Light Emission to Identify Elements) **SC1(e)**	Engage: Fireworks Explore: Where do colors come from in fireworks? Explore: Flame Test lab and experimenting with spectroscopes	Evaluate: Lab activity	Explain: Bohr model to explain light emission Elaborate: Use of spectroscopy in chemistry
Lesson 5 (Electron Configuration) **SC1(g)**	Engage: Importance of electrons Explore: Electron configuration and orbital diagrams	Evaluate: CFA Electron Configuration	Explain: Group and individual practice with electron configuration Elaborate: Ions and exceptions
Week 6: **Georgia Standard(s) of Excellence:** SC1(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).			
Lesson 6 (Periodicity) **SC1(f)**	Engage: Compare and contrast discourse activity on periodic groups Explore: Comparing elements and trends	Evaluate: MYP Task	Explain: Periodic trends and predicting Elaborate: Exceptions to the trends

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