Phoenixville Area School District Understanding by Design (UbD) Science Template

Grade Level &/or HS Subject: 11/Chemistry **Unit Name: Atoms and the Periodic Table**

Stage 1 Desired Results

Overarching NGSS & PA Standards:

PA-SPM1: 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.

PA-WER3: Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave

Transfer

Students will be able to independently use their learning to…

- *Ask questions and/or define problems*
- *Develop and/or use models*
- *Plan and/or carry out investigations*
- *Analyze and interpret data using computational thinking*

Meaning-Making

Students will understand that…

- *Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons.*
- *Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features.*
- *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.*
- *Models can be used to predict the relationships between systems or between components of a system.*

ESSENTIAL QUESTIONS
Students will keep considering...

How can one explain the structure, properties, and interactions of matter?

How can periodic patterns be used to predict chemical interactions?

What forces hold nuclei together and mediate nuclear processes?

How can one explain the varied effects that involve light?

<table>
<tr><td rowspan="4">model or a particle model and that for some situations one model is more useful than the other.

Which branch(es) of science apply:

PS</td><td></td><td>What other forms of electromagnetic radiation are there?

How do atomic models relate to the real world?</td></tr>
<tr><td colspan="2">Knowledge and Skills Acquisition</td></tr>
<tr><td>UNDERSTANDINGS
Students will know…
Elements can be identified by their proton numbers.
Valence electrons determine an element’s chemical properties.
Isotopes result from differences in mass number and are used to calculate the atomic masses on the periodic table.
Elements are arranged in groups based on shared properties.
The periodic nature of the elements gives rise to electronegativity, ionization energy, and atomic radius.
Atoms can emit excess energy as light of a specific wavelength.
Orbital diagrams and electron configurations map an element’s electrons.
The different waves of the electromagnetic spectrum have corresponding wavelengths.
An EM wave’s frequency and wavelength can be used to calculate its energy.</td><td rowspan="2">Students will be skilled at…
Use a model to predict the relationships between systems or between components of a system.
Use mathematical representations of phenomena to support claims.
Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.</td></tr>
<tr><td>KEY VOCABULARY

Proton Neutron Electron Charge Orbital Energy Level Period Group Valence electron atomic mass Mass number Isotope Electromagnetic wave Frequency Wavelength Spectrum Trend Electronegativity Ionization energy Atomic radius
Atomic number Bohr model Photon Octet</td></tr>
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Stage 2 – Evidence		
Evaluative Criteria	***Assessment Evidence***	
Lab reports Student ECR(evidence, claim, reasoning) statements Student discussion and/or explanations of data Formative checks for understanding Visual checks of student constructed models.	PERFORMANCE TASK(S): • Students will use computer simulations to demonstrate the relationship between subatomic particles and the stability of an atom. • Students will use data from simulated atomic models to support their claims regarding the effect of removing or adding an atom's electrons. • Students will collaborate to build their own periodic tables using properties of elements provided. Students will describe trends that develop as they build their table. Each group will explain the rational behind their table and provide possible explanations for trends observed. Groups will have opportunities to look at other student made periodic tables to provide feedback. • Students will gather data by making observations of element flame tests. Students will use this as evidence when asked to identify unknown elements using emission spectra.	Differentiation Considerations: • Students may be allowed to build physical models of atoms rather than utilize simulations. • Scaffolds can be provided for atomic and wave calculations. • Guided notes should be provided when necessary. • EL students can be given more vocabulary intensive scaffolds. • When building their own periodic tables some elements can be identified ahead of time to provide a starting point.

Lab reports Summative and formative assessments Evidence supported claims during student discussion Predictions supported by data	OTHER EVIDENCE: • Common summative assessment: atomic structure and the periodic table • Homework and assigned readings • Class discussions and formative checks for understanding such as in and out questions • Additional labs: Candium lab, Chocolate wavelength lab • Student research on real world applications such as carbon dating	Differentiation Considerations: • Enrichment: students can propose solutions to the energy crisis by researching fusion and fission reactions and presenting their findings. • Difficulty of assignments can be tiered for students at different levels of mastery. • Students can be provided with sample ECR statements to help them formulate their own.