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

**Grade Level &/or HS Subject: 11/Chemistry** **Unit Name: Gases**

## Stage 1 Desired Results

**Overarching NGSS & PA Standards:**

HS-PS1-1.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.

HS-PS1-7.Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

PA. PS1. Structure and Properties of Matter. 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. PS4. Structure and Properties of Matter. Communicate scientific

### *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…*

- *PS1.A: Structure and Properties of Matter. 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. (HS-PS1-1)*
- *CC. Patterns. Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1 ),(HS-PS1-2),(HS-PS1-3),(HS-PS1-5)*
- *SEP. Developing and Using Models. Models can be developed based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8)*
- *SEP. Developing and Using Models. Models can be used to predict the relationships between systems or between components of a system. (HS-PS1-1)*
- *SEP. Using Mathematics and Computational Thinking. Mathematical representations of phenomena can be used to support claims. (HS-PS1-7)*

ESSENTIAL QUESTIONS
*Students will keep considering...*

*How can patterns be used to predict results and solve problems?*

*What is the relationship between patterns and natural phenomena?*

*How can you use identified patterns to justify claims?*

*Why is understanding cause and effect (such as the effect of temperature on pressure, and vice versa) important in your life?*

*How can mathematical models be used to understand*

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<td>and technical information about why the molecular-level structure is important in the functioning of designed materials.<br><br>Which branch(es) of science apply:<br><br>LS PS E&SS</td>
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<td>and/or predict scientific events?<br><br>When and how can mathematical ideas and data be generalized</td>
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<td rowspan="3"></td>
<td colspan="2">Knowledge and Skills Acquisition</td>
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<td>UNDERSTANDINGS<br>Students will know…<ul><li>Why gases are easier to compress than solids or liquids</li><li>The three factors that affect gas pressure</li><li>There is a relationship between temperature, pressure, volume and amount (moles) of gas</li><li>Unknowns can be identified based on their molar masses using the Ideal Gas Law</li><li>There is a difference in properties between real gases and ideal gases</li><li>The total pressure of a mixture of gases is dependent on the partial pressures of the component gases</li><li>The molar mass of a gas affects the rate at which the gas diffuses and effuses</li></ul></td>
<td rowspan="2">Students will be skilled at…<br><br>SEP. Developing and Using Models. Developing models based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8)<br><br>SEP. Developing and Using Models. Using models to predict the relationships between systems or between components of a system. (HS-PS1-1)<br><br>SEP. Using Mathematics and Computational Thinking. Using mathematical representations of phenomena to support claims. (HS-PS1-7)<br><br>CC. Patterns. Observing and interpreting patterns in a gaseous system to provide evidence for causality in explanations of phenomena.<br><br>MP.2. Reasoning abstractly and quantitatively.</td>
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<td>KEY VOCABULARY<br><br>Compressibility<br>Charles’ Law<br>Ideal Gas Law<br>Effusion<br>Diffusion<br>Kinetic Molecular Theory<br>Gay-Lussac’s Law<br>Dalton’s Law of Partial Pressures<br>Boyle’s Law<br>Combined Gas Law<br>Graham’s Law of</td>
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| | | *MP.4. Modeling with mathematics.*<br><br>*HSN-Q.A.1. Using units as a way to understand problems and to guide the solution of multi-step problems; choosing and interpreting units consistently in formulas; choosing and interpreting the scale and the origin in graphs and displays.*<br><br>*HSN-Q.A.3. Choosing a level of accuracy appropriate to limitations on measurement when reporting quantities.* |

| **Stage 2 – Evidence** | | |
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| **Evaluative Criteria** | ***Assessment Evidence*** | |
| Various lab report rubrics<br><br>Performance/participation points<br><br>Graphing scoring rubric<br><br>Balloon construction rubric | PERFORMANCE TASK(S):<br>• Students will observe the effect of temperature on the volume of a gas, using ice water and the heat of a hair dryer on balloons. Students can formulate a prediction, then test it by setting up data tables with appropriate units of their choice, etc. Ask students to relate this to events of fire, when flammable gases are present and why extra safety precautions must be taken to extinguish the growing volume of gas.<br><br>• Students will perform a lab inquiry, testing out the properties of gases and postulates of the Kinetic Molecular Theory. (Station examples may include an imploding can, balloon in a bottle, juice box fountain, suction through straws, how aerosol cans work, Cartesian diver, heavy gases, etc.)<br><br>• Students will analyze graphs of data created for Boyle's and Charles' Law to show causality of one effect on another. They will create graphs using modeling software and then create trendlines to analyze data computationally. | Differentiation Considerations:<br><br>• Inflate a deflated object with a pump and ask students to predict what will happen when you remove the air. This will aid visual learners.<br>• Less proficient readers can make a list of assumptions about gases in kinetic theory. Review the list and ask for a behavior of gases related to each assumption.<br>• Gifted students: analyze graphs in terms of volume |

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| | • Construct a balloon made of materials that can float when filled with heated air. Compare these to weather balloons which can predict temperature and pressure changes in the air. Students can answer various questions about these and determine their level of buoyancy.<br><br>• Students can measure the amount of carbon dioxide given off when antacid tablets dissolve in water, by using a balloon, and doing measurements of its circumference. They can relate this to Avogadro's law, which states that moles of gas are proportional to volume. | and temperature and volume and pressure and describe mathematical equations that can be derived into the chemistry gas laws.<br>• EL students: Make a list of terms they do not understand and pair them with a student who can use paraphrasing to explain the terms. |
| Proficiency Score Ratings<br><br>Proficient Point Values<br><br>Teacher monitoring tasks/engagement checkmarks | OTHER EVIDENCE:<br><br>Computational Problems and Conceptual Problem Sets<br><br>Quizzes (Teacher Formatives)<br><br>Common Summatives<br><br>Class Discussions/Case Studies | Differentiation Considerations:<br><br>Chunking and choice of questions<br><br>Modified assessments with chunked topics and less choices of answers<br><br>Choice of writing a description of a class discussion case study, oral defenses or drawing illustrations to describe a concept |