Honors Chemistry - Unit 4 - Gas Laws

Unit Focus

Students will begin the Gas Laws unit by observing what happens when various items are placed inside of a bell jar. They will record their observations and draw models of what they think is happening at the molecular level. Throughout the unit they will refer back to and revise their model using their understanding of gas laws. Students will understand how gas laws describe and predict the behavior of gases. Students will use online simulations to observe the behavior of gases under various conditions and will observe several other gas laws demonstrations. Students will participate in a laboratory investigation to calculate the molar volume of a gas. Students will enhance and deepen their understanding of the atomic theory of matter and the kinetic molecular theory of gases.

Stage 1: Desired Results - Key Understandings

Standard(s)

Next Generation Science
High School Physical Sciences: 9 - 12

- Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects). *HS-PS3-2*

Next Generation Science Standards (DCI)
Science: 11

- At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. *PS3.9.A3*

NGSS/NSTA Science & Engineering Practices
NGSS Science & Engineering Practices: 9-12

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims

Transfer

T1 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.
T2 Evaluate scientific claims and analyze issues to verify the credibility of the source, data, and/or approach.

Meaning

Understanding(s)	Essential Question(s)
U1 The Kinetic Molecular Theory (KMT) is a mathematical way of describing the behavior of gas molecules. **U2** Gas properties can be described, at any given time, by their pressure, volume, temperature and number of particles within a space.	**Q1** Based on the KMT and this scenario, do my calculations make sense? If not, how do I assess where I went wrong? **Q2** How do scientific principles help guide me to make sense of a real-world situation?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
K1 A gas has neither a definite volume nor a definite shape; because the effects of attractive forces are minimal, we usually assume that the particles move independently. **K2** Standard temperature and pressure (STP) is a special condition under which stoichiometry calculations can be performed.	**S1** Calculate pressure, volume, moles, and temperature of a gas using the gas law equations. **S2** Solve gas stoichiometry problems using dimensional analysis.

Stage 1: Desired Results - Key Understandings

or determine an optimal design solution. *SE.9-12.4.1* • Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data. *SE.9-12.4.3* • Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. *SE.9-12.5.3* • Apply techniques of algebra and functions to represent and solve scientific and engineering problems. *SE.9-12.5.4* • Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.). *SE.9-12.5.6* **Madison Public Schools Profile of a Graduate** *Critical Thinking* • Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2) *Collaboration/Communication* • Collective Intelligence: Working respectfully and responsibly with others, exchanging and evaluating ideas to achieve a common objective. (POG.3.1) • Product Creation: Effectively use a medium to communicate important information. (POG.3.2)	**K3** A gas in a mixture will behave the same and exert the same pressure as it would alone. **K4** The concept of an ideal gas is hypothetical, but under most temperature and pressure conditions, most gases behave ideally. **K5** The speed of gas molecules and the rate of diffusion and effusion is affected by its temperature and molar mass. **K6** Gas law equations: Boyle's, Charles', Gay-Lussac's, Avogadro's, Graham's, Dalton's, Combined, Ideal	