Chemistry - Unit 6 - Gas Laws

Unit Focus

Students begin this unit by conducting a series of experiments to investigate the variables of temperature, pressure and volume and develop an initial model of what is happening at the molecular level. Through various hands-on activities, students enhance and deepen their understanding of the kinetic molecular theory of gases and refer back to and revise their models using their new learnings. The final project culminates in an inquiry style lab where students determine the density of carbon dioxide gas and demonstrate their ability to describe gas behavior and the gas laws both qualitatively and mathematically.

Stage 1: Desired Results - Key Understandings

Standard(s)

Next Generation Science
High School Engineering Design: 9 - 12

- Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. *HS-ETS1-3*

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

Madison Public Schools Profile of a Graduate
Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)

Transfer

Students will be able to independently use their learning to...
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)
Students will understand that... **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.	*Students will keep considering...* **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? **Q3** How can we describe the motion of particles in different states of matter?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
Students will know... **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.	*Students will be skilled at...* **S1** Calculate pressure, volume, moles, and temperature of a gas using the gas law equations. **S2** Solve gas stoichiometry problems using dimensional analysis. **S3** Justify claims with scientific evidence.

Stage 1: Desired Results - Key Understandings		
Idea Generation: Studying a problem, need or model (mentor text, political piece, documents, art work, etc.) to consider limitations and imagine new solutions/transformations. (POG.2.1)	**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	