Krug Chemistry – Deep Run Daily Planning Guide

Date of Lesson: Q3 Day 14 –Gas Laws 5 - 8

Topic /Big Questions: (Question Stems & Question Creation Chart)

- **How does heat energy affect the movement of molecules?**
- **How are pressure, temperature, and volume related for ideal gases?**
- **How does the size of a gas molecule affect its velocity?**

State SOL	Unpacking the Standards (Video explanation shown at 3:18)
CH.6	CH.6 The student will investigate and understand that the phases of matter are explained by the Kinetic Molecular Theory. Key ideas include a) pressure and temperature define the phase of a substance; b) properties of ideal gases are described by gas laws; and c) intermolecular forces affect physical properties.

Visible Learning (For the three items with asterisks*, think from a student perspective. Use simple language)

***What am I learning today?** Ideal Gas Law, Combined Gas Law, Dalton's Laws, and Graham's Law

***Why is it important?** An ideal gas does not exist, but this concept is used to model gas behavior. A real gas exists, has intermolecular forces and particle volume, and can change states. The Ideal Gas Law states that PV = nRT and includes the relationship between pressure, volume, temperature and the number of moles. The combined gas law shows the before and after relationship for an ideal gas. Dalton's Laws explain the relationship of partial pressures, and Graham's Law explains the relationship between molar masses and velocity.

***How will I know I've learned it?** I will understand how energy affects the movement of molecules. I will understand the relationship between temperature, pressure, volume, and moles of an ideal gas at STP. I will solve the Combined Gas Law, Ideal Gas Law, Dalton's Laws, and Graham's Law equations.

Differentiation strategies:

Determining the Ideal Gas Constant
https://www.youtube.com/watch? v=127SMYwjU8I

PhET Gas Properties & Dalton's Law of Partial Pressures Lab
https://phet.colorado.edu/sims/html/gas-properties/latest/gas-properties_en.html

Diffusion of NH3 and HCl
https://www.youtube.com/watch?v=Rf9j0ztzcs4

Gas Law PowerPoint Presentation

Gas Law Practice Problems

Accommodations and/or modifications are being met for students with IEP's/504's.

frequent checks for understanding; materials available on Schoology; small group activities

Daily Plan/Sequence of Instruction:

Teacher will explain that an "ideal" gas does not really exist because the natural conditions are never perfect. Real gases approach "ideal" behavior when the temperature is high and the pressure is low. This allows them to move fast and spread out… favoring low intermolecular forces and high kinetic energy.

Teacher will explain that the gas law constant, R, shows the proportion of PV to nT. The value of R can be found experimentally by creating hydrogen gas as shown in this YouTube Video: **Determining the Ideal Gas Constant** https://www.youtube.com/watch? v=127SMYwjU8I. (9 minutes) While students watch the video, ask one student to look up the barometric pressure and convert it into atmospheres. Have another student convert the pressure into kPa. The volume at the end of the video is 85.5 ml, so ask a student to convert that into Liters. For moles, ask a student to do a gram to mole stoichiometry calculation based on the initial mass of the magnesium from the video, which was 0.12 grams. Use the balanced chemical equation: $Mg\ (s) + 2\ HCl\ (aq) \rightarrow MgCl_2\ (aq) + H_2\ (g)$. Have a student measure the room temperature and convert it into Kelvin. Now take all this information and set up two equations: 1) R = kpa L/ mol K and 2) R = atm L/ mol K. What is the percent error based on the accepted values of R for kPa and atm? Students will record values for P, V, n, T in their notebooks and show equation for R and final answer. Students will show % error for calculated R values.

Next Teacher will use **PhET Gas Properties** https://phet.colorado.edu/sims/html/gas-properties/latest/gas-properties_en.html to guide students through the **Dalton's Law of Partial Pressures Lab.** Teacher will use Gas Law PowerPoint to explain Dalton's other laws.

Finally, teacher will prepare the YouTube video: **Diffusion of NH_3 and HCl** https://www.youtube.com/watch?v=Rf9j0ztzcs4. Before showing the video, Teacher will ask students to calculate the molar mass of each gas and predict which gas will travel faster. Students will watch video to see if their hypothesis was accurate. Then teacher will use the **Gas Law PowerPoint Presentation** to show Graham's equation and more examples of Graham's Law problems.

Students will finish the **Gas Law Practice Problems** packet. Due next class.

Assessments (List all formative/summative assessments used to check for understanding during this lesson. Summative assessments may occur during a different class period.):

Video Demos and PhET Simulations - (formative)

Gas Law Practice Problems - (summative)

After assessing today's lesson are you and your students comfortable moving forward with your next objective?

Yes – students understand direct and indirect relationships between pressure, temperature, volume and moles.

No, remediation required to proceed – tutoring available during One Lunch

Teacher Reflection: