Dougherty Valley HS Chemistry
Gas Laws – Introduction to Gases Reader

Worksheet #1

Name: **Period:** **Seat#:**

Directions: Read this page and take notes and/or annotate it. There is potentially information in here you may not be familiar with. If you come across anything you do not understand you need to ask about it! At the end there are questions to check that you were able to follow and grasp the material talked about here. These are selections of reading by various people, credit given when possible.

General Properties and Behaviors of Gases

1. Take the shape of their containers
2. Evenly distribute themselves within a container
3. Are fluid - particles easily flow past one another
4. Exert pressure when they collide with the walls of a container
5. Are low density - A substance in the gaseous state has 1/1000 the density of the same substance in the liquid or solid state
6. Can be compressed, decreasing the distance between particles, and decreasing the volume occupied by the gas
7. Gases *diffuse* - spontaneous mixing of particles of two substances caused by their random motion
8. Gases can *effuse* – escape through a small hole in the container it is held in.

Kinetic Molecular Theory (KMT)

Behaviors of gases can be explained using a simple theoretical model known as the Kinetic Molecular Theory. Gases that follow the KMT as known as Ideal Gases and follow the following assumptions:

1. Gases consist of small particles, spaced far apart
2. Collisions between are elastic – meaning no energy is lost during these collisions
3. Gas particles are in continuous, straight line motion
4. No attraction or repulsion between particles
5. Kinetic energy is directly related to temperature

**Note: KMT is a simplified theory that does not work for real gases, but is useful for studying the general behavior of gases.*

Real vs. Ideal Gases

While Ideal Gases are an imaginary concept that follow the assumptions of KMT, real gases do not completely behave according to those assumptions. It is important to note that real gases deviate significantly from Ideal Gas behavior at low temperatures and high pressures. Ideal gas molecules are assumed to have no volume,

but real gas molecules do take up space. Additionally, while we assume that Ideal Gases do not have attraction, we know that intermolecular forces play a role when molecules of gases interact. Real gases are most likely to behave like an idea gas when it is at high temperature, low pressure, and low number of moles of a small, non-polar gas.

Basic Gas Laws

Gases are defined by four quantities: pressure, volume, temperature, and the amount of a gas (moles). The following table shows the basic gas laws and their relationships among the various quantities.

Name	Variables	Equation
Boyle's Law	Pressure, Volume	$P_1V_1 = P_2V_2$
Charles' Law	Volume, Temperature	$\frac{V_1}{T_1} = \frac{V_2}{T_2}$
Gay-Lussac's Law	Pressure, Temperature	$\frac{P_1}{T_1} = \frac{P_2}{T_2}$
Avogadro's Law	Moles, Volume	$\frac{V_1}{n_1} = \frac{V_2}{n_2}$
Combined Gas Law	Pressure, Temp, Volume	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

Fill in the table to the right with arrows indicating what you think will happen to the unknown quantity if a change is made to the known quantity. For example, for Boyle's Law, if we increase the pressure, does the volume increase (↑) or does it decrease (↑)?

Ideal Gas Law

The Ideal Gas Law relates all quantities (temperature, volume, pressure, and amount) through the gas constant "R". The R value essentially adjusts the calculation to account for the various units we use. You will be required to memorize one value for use in this class, although there are others with varying units for pressure, volume, or temperature. You can either memorize the different versions of R for each pressure unit, or you can convert all your pressures to atmospheres and use the memorized R value. This is the R value you should memorize for this class:

$$R = 0.0821 \frac{L \bullet atm}{mol \bullet K}$$

Name	Known	Unknown
Boyle's Law	Pressure ↑	Volume _____
Charles' Law	Volume ↑	Temp _____
Gay-Lussac's Law	Pressure ↑	Temp _____
Avogadro's Law	Volume ↑	Moles _____
Combined Gas Law	Pressure ↑	Temp _____ Volume _____

NEXT:
Watch the video at this link and take general (non-KCQ) notes on a piece of binder paper about Real vs. Ideal Gases.
https://tinyurl.com/hu8nlfb

THEN:
Watch the video at this link and take general (non-KCQ) notes on a piece of binder paper about the Behaviors of Gases. https://tinyurl.com/yl85bzob