Name: _____ Period: _____

Unit 14 Gas Laws Guided Notes

Properties of Gases:

- Can you name some common gases?
- Highest _____ of all states of matter
- There is a lot of _____ in a gas
- Gases can be _____ infinitely
- Gases _____ containers uniformly and completely
- Gases diffuse and mix rapidly

Gas Law Variables

- Gas properties can be modeled using math. Model depends on—
- V =
- T =
    - ALL temperatures in the entire chapter MUST be in _____!!! No Exceptions!
- n =
- P =
- R=

Kinetic Molecular Theory

- Kinetic Molecular Theory= a theory that describes the _____ of gas particles (_____ parts to the theory)

1. Gases consist of tiny _____ (atoms or molecules)
2. These particles are so small, compared with the distances between them, that the volume (size) of the individual particles can be assumed to be _____
3. These particles are in _____ _____ _____, colliding with the walls of the container. These collisions with the walls cause the _____ exerted by the gas.
4. The particles are assumed to not _____ or _____ each other.
5. The average kinetic energy of the gas particles is directly proportional to the _____ of the gas.

Diffusion and Effusion

- _____ is the gradual mixing of molecules of different gases.
    - Think about a person wearing perfume walking into a room

- _____ is the movement of molecules through a small hole.
    - Think about a tire with a small hole. What happens to the air in the tire?

STP

- STP stands for _____
- Gases behavior change when temperature and pressure are changed
- For this reason we have a standard temperature and pressure

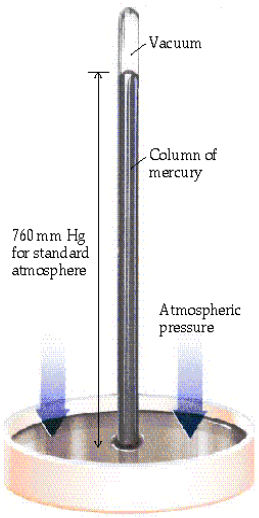
- STP allows us to _____gases
- Standard Temperature= _____ K
- Standard Pressure= _____ atmosphere
- At STP 1 mole of gas occupies _____ of space

Temperature

- _____ is a measure of average kinetic energy
- Temperature can be measured in ◦F , ◦C , or K
- Every problem this unit needs to be in units of _____
- K= ◦C + 273
- Matter cannot be cooled to temperature lower than -273 ◦C , therefore this temperature is called _____
  - -273 ◦C = 0 K
- Temperature at STP is _____

Pressure

- Pressure= how _____ and how _____ molecules collide with the container they are in
- Pressure of air is measured with a _____
  - Mercury (Hg) rises in tube until force of Hg (down) balances the force of atmosphere (pushing up). (Just like a straw in a drink)
  - Column height measures Pressure of atmosphere
- Units of pressure @ STP:
  - = 1 standard atmosphere (atm) *we use atm
  - = 760 mm Hg
  - = 760 torr
  - = 29.92 inches Hg
  - = 14.7 pounds/in2 (psi)
  - = 101.3 kPa
  - = about 34 feet of water!
- Recognize these different units of pressure
- We will use these values as conversion factors



A. What is 475 mm Hg expressed in atm?

B. The pressure of a tire is measured as 29.4 psi. What is this pressure in mm Hg?

C. What is 2 atm expressed in torr?

D. The pressure of a tire is measured as 32.0 psi. What is this pressure in kPa?

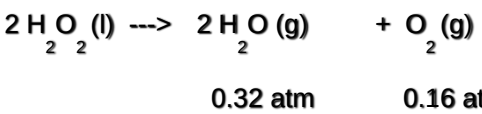
Dalton's Law of Partial Pressure

- The total pressure in the air is equal to the sum of all of the partial pressures caused by each gas in air
- $P_{Air} = P_{N2} + P_{O2} + P_{Ar} + P_{CO2}$
- P_{Air} =

Gases in the Air

The % of Gases in Air	Partial Pressure at STP
78.08% N_2	593.4 mm Hg
20.95% O_2	159.2 mm Hg
0.94% Ar	7.1 mm Hg
0.03% CO_2	0.2 mm Hg

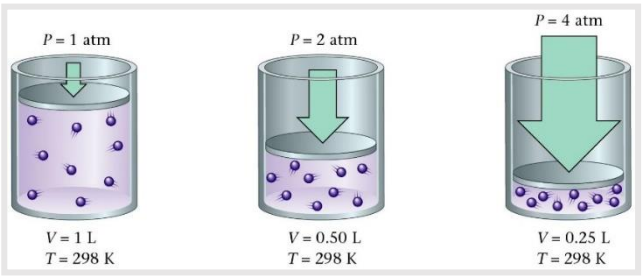
- Dalton's Law of Partial Pressures: The _____ pressure in a container is equal to the _____ of the partial pressures of each gas within the container
- P_{total} =
-
- Example 1: What is the total pressure in a flask containing the following:



- Example 2: Oxygen and chlorine gas are mixed in a container with partial pressures of 401 mmHg and 0.639 atm, respectively. What is the total pressure inside the container (in atm)?

- Example 3: Container A contains a gas under 3.24 atm of pressure. Container B contains a gas under 2.82 atm of pressure. Container C contains a gas under 1.21 atm of pressure. If all of these gases are put into Container D, what is the pressure in Container D?

Boyle's Law



- P α _____
- This means Pressure and Volume are _____ PROPORTIONAL if moles and temperature are constant (do not change). For example, P goes up as V goes down. WHY?
    - Formula:
- P_1V_1 = _____ pressure and volume
- P_2V_2 = _____ pressure and volume
- ____ and _____ are held constant

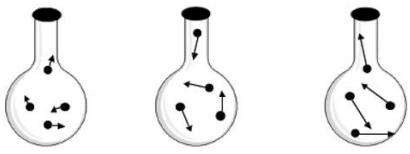
1) A sample of oxygen gas occupies a volume of 250 mL at 740 torr pressure. What volume will it occupy at 810 torr?

Charles's Law

- V α _____
- V and T are _____ proportional. They increase together and they decrease together. WHY?
- Formula:
- _____ and _____ are constant

2) A sample of nitrogen gas occupies a volume of 250 mL at 25 ˚C. What volume will it occupy at 95 ˚C?

Gay-Lussac's Law



- P α _____
- P and T are directly proportional. They increase together and they decrease together. WHY?
- Formula
- ___ and ___ are constant

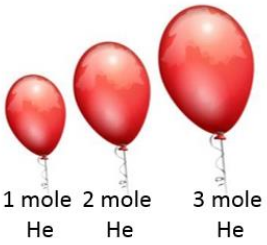
3) A sample of gas has at a pressure of 75kPa and 0°C . The pressure is increased to 125 kPa, what is the new temperature?

Combined Gas Law

- All of the gas laws can be can be combined into one gas law called the _____ Gas Law
- Formula:
- _____ is held constant

4) A gas occupies 3.0L of space at 1.5 atm and 20°C, if the pressure is increased to 2.5 atm and the temperature rises to 30°C , how much space will the gas occupy?

Avogadro's Hypothesis



- Equal volume of gases at the same T and P have the same number of molecules
- V α _____
- Formula:
- V and n are directly proportional. They increase together and they decrease together. WHY?
- _____ and ____ are constant

5) Suppose we have a 12.2 L sample containing 0.50 moles of oxygen gas, O_2 . If all of this O_2 is converted to ozone, O_3 what is the new volume of the gas? $3O_2$ (g) → $2O_3$ (g)

Ideal Gas Law

- An ideal gas is a _____ gas that exactly obeys the ideal gas law
- _____ gases are ideal, but treating them ideal allows us to do calculations
- Ideal Gas Law:
- R is the _____
- R=

6) How much space does 1 mole of oxygen gas occupy at STP? (SHOW WORK)

Summary Of Gas Laws

Name	Boyle's Law	Charles's Law	Gay-Lussac's Law	Avogadro's Law	Combined Gas Law
Law/ Equation					
Relationship between variables (direct or inverse)					X
Variables held constant					

Ideal Gas Law=

R=

Dalton's Law of Partial Pressure=