REVIEW-Gases Name:_____
Date: _____

Outline

1. Kinetic Molecular Theory & Concepts
2. Gas Laws Calculations
3. Gas Stoichiometry

Gas Laws

Gas Law	Equation
Boyle's	$P_1V_1=P_2V_2$
Charles's	$\frac{V_1}{T_1}=\frac{V_2}{T_2}$
Gay Lussac's	$\frac{P_1}{T_1}=\frac{P_2}{T_2}$
Combined	$\frac{P_1V_1}{T_1}=\frac{P_2V_2}{T_2}$
Dalton's	$P_{total}=P_1+P_2+\ldots$ $P_{total}=P_{H2O}+P_{gas}$
Avogadro's	$\frac{n_1}{V_1}=\frac{n_2}{V_2}$ 22.4L= 1 mol at STP
Ideal Gas	**PV=nRT** $R = 0.0821\frac{\text{atm}\bullet\text{L}}{\text{mol}\bullet\text{K}} = 8.315\frac{\text{kPa}\bullet\text{L}}{\text{mol}\bullet\text{K}} = 62.4\frac{\text{mmHg}\bullet\text{L}}{\text{mol}\bullet\text{K}}$
Graham's	**Larger molar mass → slower it moves**

Conversions:

1 atm = 760 mmHg = 760 torr = 101.3 kPa = 1.01 x 10^5 Pa

K = ˚C + 273.15

Rules of Significant Figures

- multiplication/division → least sig figs
- addition/subtraction → least decimal places
- use Kelvin, not Celsius for significant figures
- molar mass and mole ratios to the hundredths place

I. Kinetic Molecular Theory & Gas Laws Concepts

1. What are the five assumptions of kinetic molecular theory?

2. Convert the following pressure values:

   2.45atm ➔ Pa

   12,300Pa ➔ torr

   659mmHg ➔ atm

   805 torr ➔ mmHg

3. Convert the following Celsius temperatures to Kelvin:

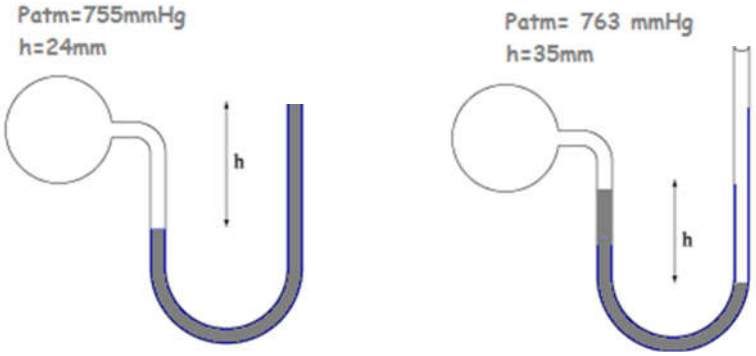
   a. 200.0 ˚C

   b. 27.0 ˚C

4. Explain how increasing the number of gas molecules in a container is related to collisions of gas molecules and pressure

5. What is the relationship between pressure and altitude?

6. What is the name of the devices below? Determine the pressure for both.



7. What is meant by STP? What are the values?

8. What units does temperature have to be in in order to use the gas laws equations? What is the equation for this conversion?

9. If two containers have the same volume of gas at STP, what do you know about the number of moles (and therefore molecules) of gas in the containers?

10. What is molar volume? What is it used for? Under what conditions can molar volume be used for?

11. How do you know which gas constant, R, value to use in the ideal gas law?

12. What is the relationship for the following conditions:

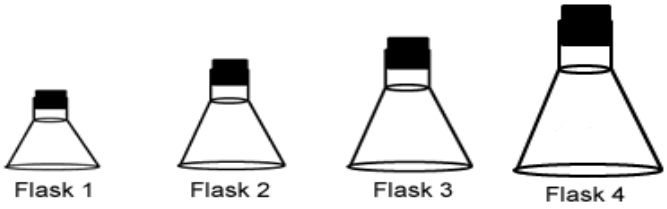
Constant	**Compared conditions**	**Relationship**
P	V & T	
V	P & T	
T	P & V	

13. Why does a balloon shrink in size when it is taken outside on a cold day?

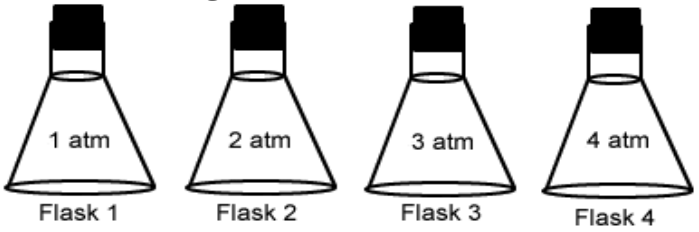
14. Which Gas Law is involved when a balloon pops after being sat on?
a. Charles Law b. Boyle's Law c. Gay-Lussac's Law d. Ideal Gas Law

15. As the volume of confined gas decreases at constant temperature, the pressure exerted by the gas _____.
a. decreases b. increases c. stay the same d. fluctuates

16. Each of these flasks contains the same number of gas molecules. In which container is the pressure the highest?



17. Each of these flasks is the same size and at the same temperature. Which one contains the most gas molecules?



18. Assuming that the temperature remains constant. How can you increase the pressure of a gas?
    a. Increase the container volume
    b. Add more molecules of the gas
    c. Decreases the container volume
    d. None of the above

19. Consider two gases, A and B, in containers of equal volume. Both are at the same volume, temperature and pressure.

A	**B**

a. mass: **0.34 g** **0.48 g**

Are the following statements true or false? ***Why?***

_____a) The number of molecules of A is equal to the number of molecules of B

_____b) The molar mass of A is greater than the molar mass of B

_____c) Both samples have the same average kinetic energy.

_____d) The molecules of A collide with the container walls more frequently than the molecules of B

20. Compare the rates of effusion of oxygen gas to fluorine gas.

21. Rank the gases from lowest to highest kinetic energy: He, Kr, I_2, SO_2

22. ***Know how Boyle's Law is applied to respiration; questions from your case study (scuba) may also appear on your test.**

Gas Law Problem Solving Practice

Gas Law Word Problem	List all <u>known</u> variables (P, V, T or n) in this problem	Name AND Formula of Gas Law	Plug & Chug	Final Answer is… (check your work!)
EXAMPLE How many moles of gas does it take to occupy 120 liters at a pressure of 2.3 atmospheres and a temperature of 340 K?	*Known:* $V = 120\ L$ $P = 2.3\ atm$ $T = 340\ K$ *Unknown:* $n = X$	*Ideal Gas Law* $PV = nRT$	$(2.3atm)(120L) = X\,(0.0821\ \frac{L*atm}{mol*K})\,(340K)$	$n = 9.9\ mol$
I've got a car with an internal volume of 12,000 L. If I drive my car into the river and it implodes, what will be the volume of the gas when the pressure goes from 1.0 atm to 1.4 atm?	Known: Unknown:			**8600 L**
A sample of oxygen gas is collected at 22ºC and 98.8 kPa. The following day, the temperature has risen to 30.ºC. What is the new pressure of the gas?	Known: Unknown:			**101 kPa**

Gas Law Word Problem	List all <u>known</u> variables (P, V, T or n) in this problem	Name AND Formula of Gas Law	Plug & Chug	Final Answer is… (check your work!)
If 25 liters of carbon dioxide are collected at 1200^0 C, what will the volume of this gas be after it cools to 25^0 C?	Known: Unknown:			**5.1 L**
A toy balloon has an internal pressure of 1.05 atm and a volume of 5.0 L. If the temperature where the balloon is released is $20.^0$ C, what will happen to the volume when the balloon rises to an altitude where the pressure is 0.65 atm and the temperature is -15^0 C?	Known: Unknown:			**7.1 L**
If I have a 1.0 liter canister that holds 2.0 moles of gas, and I place it in a campfire where the temperature is 1400^0 C, what is the pressure in kPa inside the canister?	Known: Unknown:			**28000 kPa**

Gas Law Word Problem	**List all <u>known</u> variables (P, V, T or n) in this problem**	**Name AND Formula of Gas Law**	**Plug & Chug**	**Final Answer is… (check your work!)**
I have added 15 L of air to a balloon at sea level (1.0 atm). If I take the balloon with me to Denver, where the air pressure is 0.85 atm, what will the new volume of the balloon be?	Known: Unknown:			**18 L**
If a sample of gas occupies 57.3 L at STP, how many moles of gas are present?	Known: Unknown:			**2.56 mol**
During a lab experiment, a sample of gas is collected over water. If the water vapor pressure is 25.5 mmHg and the barometric pressure is 762 mmHg, what is the pressure of the dry gas?	Known: Unknown:			**737 mmHg**

Gas Law Word Problem	List all <u>known</u> variables (P, V, T or n) in this problem	Name AND Formula of Gas Law	Plug & Chug	Final Answer is… (check your work!)
A mixture of gases in a balloon contains CO_2, H_2O, and N_2. If the individual pressures are 1.5 atm, 8.3 atm, and 0.26 atm respectively, what is the total pressure inside of the balloon?	Known: Unknown:			**10.1 atm**
$2KClO_3 \rightarrow 2KCl + 3O_2$ The reaction above is performed at STP. How many liters of oxygen will be produced during the decomposition of 1.03 moles of $KClO_3$?	Known: Unknown:			**34.6 L**
$2KClO_3 \rightarrow 2KCl + 3O_2$ The reaction above is performed at 213°C and 2.14 atm. How many liters of oxygen will be produced during the decomposition of 1.03 moles of $KClO_3$?	Known: Unknown:			**28.8 L**