GASES Review

List the characteristics of gases. Compressible, lots of space between particles, no def volume

Under what conditions do gases not behave ideally?
high P, low T

Which of these gases would probably exhibit the most ideal behavior? N_2, He, H_2O Which would be least ideal? Explain your reasoning. Larger molecules have more attractive forces(LDFs) and what is special about water?
Smallest, lowest IMFs

Explain the 2 corrections of the van der Waals equation.
a - corrects for IMFs / b - corrects for particle V

What is KMT? How does the KMT explain Charles' Law and Boyle's law?
T↑ V↑ P↑ V↓

Why MUST temperatures be converted from °C to K when completing gas law calculations?
Ex: What happens to the volume of a gas if the temperature goes from 20°C to 40°C? ***versus*** → Not double
What happens to the volume of a gas if the temperature goes from 200K to 400K? → Double

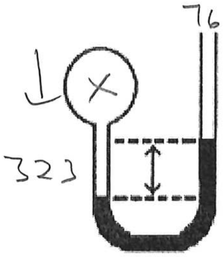
What ***elemental gas*** would have the highest rate of effusion? H_2 the lowest? Rn Explain your choices.
(don't forget some elements are diatomic)

Compare the KEs of these 2 gases at the same temperature. Explain. Same Temp = Same KE

slower = larger
A sample of unknown gas effuses at a rate that is ¼ the rate of Ne gas. What is the molar mass of this gas?
(Use Graham's Law) $\frac{1}{\frac{1}{4}} = \sqrt{\frac{x}{20}}$ or $\frac{4}{1} = \sqrt{\frac{x}{20}}$ $x = 320$ g/mol

6 moles of N_2 are mixed with 8 moles of Xe at a total pressure of 3atm. What is the partial pressure of each gas?
6+8 = 14 mol $\frac{6}{14} = 0.43 \cdot 3 = 1.29$ atm N_2 so 1.71 atm Xe

765



A gas vessel is attached to an open-end manometer filled with mercury as shown. The difference in heights of the liquid in the two sides of the manometer is 32.3*cm* when the atmospheric pressure is 765 mmHg. What is the pressure of the gas in the manometer? 323 mm

765 + 323 = 1088 mm Hg

How does a decreased temperature affect the pressure of a gas in a rigid container? How does KE change?
T↓ P↓ KE↓

Three different gases are in 3 separate 1L containers at the same temperature and pressure. What can be said about the moles of gas in each? Which one would have the lowest mass? mol are equal
lowest MM = lowest mass

A sample of carbon dioxide gas in a rigid 1L container at 20°C. Will EVERY molecule in the container have the EXACT same speed? Why/why not? No, some will be faster, some slower
The average is the reported speed

One container has 500 molecules of gas inside while another has 250 molecules inside. Both containers have the same volume and temperature. Which one has the lower pressure? Why? 250 molec - less collisions

A gas is collected over water during an experiment at 25°C. How would you determine the partial pressure of the "dry" gas in the container? Subtract vapor P

FRQs : Ideal Gas Law, Stoichiometry, Percent Error, Percent Yield, Redox, Daltons Law

*All FRQs require you to analyze data

A rigid 5.00 L cylinder contains 24.5 g of $N_2(g)$ and 28.0 g of $O_2(g)$. 2003 FRQ2

a) Calculate the total pressure, in atm, of the gas mixture in the cylinder at 298 K. *(2-4pts)*

$24.5\text{ g } N_2 \left| \frac{1\text{ mol } N_2}{28.02\text{ g } N_2} \right| = 0.875\text{ mol } N_2$

$28.0\text{ g } O_2 \left| \frac{1\text{ mol } O_2}{32.00\text{ g } O_2} \right| = 0.875\text{ mol } O_2$

1.75 total mol

$PV = nRT$

$(P)(5.00) = (1.75)(0.08206)(298)$

$\boxed{P = 8.56\text{ atm}}$

b) The temperature of the gas mixture in the cylinder is decreased to 280 K. Calculate each of the following.

i) The mole fraction of $N_2(g)$ in the cylinder *(1pt)*

$\frac{0.875\text{ mol } N_2}{1.75\text{ total mol}} = 0.500$

ii) The partial pressure, in atm, of $N_2(g)$ in the cylinder *(1-2pts)*

$T\downarrow \quad P\downarrow$

$PV = nRT$

$(P)(5.00) = (0.875)(0.08206)(280)$

$\boxed{P = 4.0\text{ atm}}$

c) If the cylinder develops a pinhole-sized leak and some of the gaseous mixture escapes, would the ratio $\frac{\text{moles of } N_2(g)}{\text{moles of } O_2(g)}$ $\downarrow$ in the cylinder increase, decrease, or remain the same? Justify your answer. *(1pt)*

N_2 would effuse faster (lower MM), so $\frac{\text{mol } N_2}{\text{mol } O_2}$ would $\downarrow$

A different rigid 5.00 L cylinder contains 0.176 mol of $NO(g)$ at 298 K. A 0.176 mol sample of $O_2(g)$ is added to the cylinder, where a reaction occurs to produce $NO_2(g)$.

d) Write the balanced equation for the reaction. *(1-2pts)*

$2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$

e) Calculate the total pressure, in atm, in the cylinder at 298 K after the reaction is complete. *(2-4pts)*

.176 mol   0.176 mol

$.176\text{ mol NO} \left| \frac{1\text{ mol } O_2}{2\text{ mol NO}} \right| = 0.088\text{ mol } O_2$ reacts

1:2 ratio so not all O_2 reacts

After rxn: 0.176 mol of NO_2 AND 0.088 mol O_2

(2:2 ratio)

$= 0.264$ mol Gases

$PV = nRT$

$(P)(5.00) = (0.264)(0.08206)(298)$

$\boxed{P = 1.29\text{ atm}}$