

Boyle's Law: Volume + Pressure

- ① A balloon at 2.3 atm has a volume of 28 L. What will volume be at 1.0 atm? (Assume constant temp)
- ② A gas at 740 mm Hg has volume 720 L. What pressure in atm is needed to reduce the volume to 175 L? (Assume constant temp)
- ③ The volume of a gas increases from 3.0 \rightarrow 9.0 L. If the original pressure was 3 atm, what is the final pressure?

(10-1) (10-2)

Charles' Law Volume + Temp

① What is the volume if 75.0 L of gas is heated from $20^{\circ}\text{C} \rightarrow 100^{\circ}\text{C}$?

Avogadro's Law Volume + Moles

② A container with 1.0 mol of $\text{CO}_2(\text{g})$ has a volume of 22.4 L. What will be the

- a) volume if 2 more moles is added?
- b) If one mole of $\text{N}_2(\text{g})$ is added?
- c) If 0.5 mol escapes through a leak?

③ A balloon with 12 g of $\text{CO}_2(\text{g})$ would have what volume?

④ with 12g of $\text{CH}_4(\text{g})$?

The Combined Law Volume, Pressure, & Temp

- ① What is the final volume if 100L of gas at 222 mm Hg and 27°C is warmed to 127°C at 444 mm Hg?

The Ideal Gas Law

- ① What is volume for 12g of N_2 at 1.2 atm and 25°C ?

- ② How many moles are in a 4.0 L sample of gas at 600 mm Hg and 25°C ?

- Note: does it matter which gas?

STP: Standard Temperature + Pressure

$$[273^{\circ}\text{K} = 0^{\circ}\text{C} \quad 1.00 \text{ atm}]$$

memorize!!

- ① Calculate the volume of one mole of gas (any gas!) at STP.

At STP, all gases have the same
volume per mole L/mol

Key Conversion Factor: $1 \text{ mol} = \text{L}$

- ② What is the mass of 12.2 L of N_2 at STP?

- ③ What is the volume of 1.6 mol of O_2 at STP?
What is the volume of 16 g of O_2 at STP?

More Ideal Gas Law

① What is pressure of 14g Ar(g) (39.9 g/mol) at 52°C in a 4.6 L container?

② What is the temperature (in $^\circ\text{C}$) of ~~neon~~ 14g neon gas (20.2 g/mol) in a 12 L container at 726 mm Hg pressure?

10.6,7 Using Gas Laws to Calculate Other Things

A. Gas Mass (from Volume)

① How many grams in a 6.3 L sample of CO_2 (44 g/mol) at STP?

② How many grams of O_2 (32 g/mol) in 11.4 L container at 30°C and 0.80 atm?

B. Gas Density + Molar Mass at STP

$$\text{density} = \frac{g}{L} \quad \text{molar mass} = \frac{g}{\text{mol}}$$

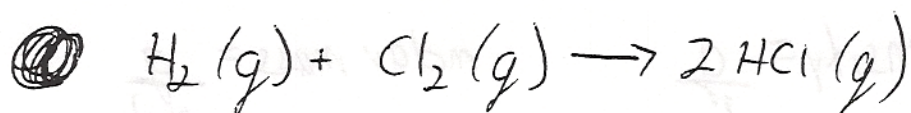
① What is the density of Ar (40 g/mol) at STP?

② What is the density of O_2 (32 g/mol) at STP?

③ What is the molar mass of a gas whose density is 0.714 g/L at STP?

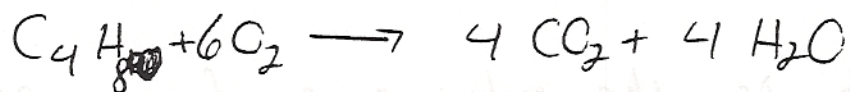
④ What is molar mass if density is 1.96 g/L at STP?

C. Gases + Stoichiometry



① How many liters of $\text{Cl}_2(\text{g})$ are needed to react with 12 L of H_2 ?
6.3 L H_2 ? 14.8 L H_2 ?

② How many liters of $\text{H}_2(\text{g})$ are needed to produce 12 L of HCl ?



③ How many liters of CO_2 are produced from 16 g C_4H_{10} (56 g/mol) at STP?

④ If 36 L of O_2 react, how many grams of C_4H_{10} were burned?