

CHM136 General Chemistry II
Gas Laws Worksheet 2

Fundamentals

1. Arrange the following gases in order of increasing density:

CO₂, CH₄, N₂ lowest $\frac{\text{CH}_4}{16}$, $\frac{\text{N}_2}{28}$, $\frac{\text{CO}_2}{44}$ highest density

2. Arrange the following gases in order of increasing rates of effusion:

Ar, Ne, CH₄ lowest $\frac{\text{Ar}}{40}$, $\frac{\text{Ne}}{20}$, $\frac{\text{CH}_4}{16}$ highest rate of effusion

3. Convert the following:

a. -35°C = 238 K b. 890 torr = 1.17 atm c. STP = 273 K, 1 atm

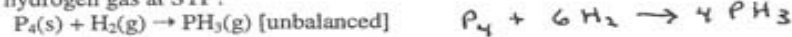
Problems

4. A sample of CO₂ gas was collected over water at 21°C in a gas buret. The water inside the buret was leveled with the water in the container. The volume of the gas was 35.3 mL and the barometric pressure was 752 torr. How many moles of CO₂ were collected?

(P_{water vapor} = 18 torr at 21°C) P_{CO₂} = 752 torr - 18 torr = 734 torr

$$n_{\text{CO}_2} = \frac{PV}{RT} = \frac{\left(\frac{734}{760} \text{ atm}\right)(0.0353 \text{ L})}{\left(0.0821 \frac{\text{L atm}}{\text{mol K}}\right)(294 \text{ K})} = 0.00141 \text{ mol}$$

5. How many grams of phosphine (PH₃) can form by the reaction of 15.5 g phosphorus with 42.0 L hydrogen gas at STP?



limiting reactant

$$42.0 \text{ L H}_2 \times \frac{1 \text{ mol H}_2}{22.4 \text{ L H}_2} \times \frac{1 \text{ mol P}_4}{6 \text{ mol H}_2} \times \frac{124 \text{ g P}_4}{1 \text{ mol P}_4} = 38.8 \text{ g P}_4 \quad (\text{P}_4 \text{ is limiting})$$

$$15.5 \text{ g P}_4 \times \frac{1 \text{ mol P}_4}{124 \text{ g P}_4} \times \frac{4 \text{ mol PH}_3}{1 \text{ mol P}_4} \times \frac{34.0 \text{ g PH}_3}{1 \text{ mol PH}_3} = 17.0 \text{ g PH}_3$$

6. Compare the rates of effusion of the SF₆(g) and CH₄(g). Clearly note which gas effuses faster.

$$\frac{\text{Rate CH}_4}{\text{Rate SF}_6} = \frac{\sqrt{146}}{\sqrt{16.0}} = 3.02$$

$$\text{Rate CH}_4 : \text{SF}_6 \\ 3.02 : 1.00$$