Quiz 7.2 – Calculations with Gases

STP has 2 common definitions so I use both here.

Name: *Key*

Problem 1 (1 point)

Consider the following reaction: $2\,KClO_3(s) \longrightarrow 2\,KCl(s) + 3\,O_2(g)$

$\rightarrow 0°C, 1.0\,atm$

$2.5\,g$ of $KClO_3$ are decomposed and the gas product is collected in a balloon. If the system is at STP, what volume of gas will be collected?

$$\frac{2.5\,g\,KClO_3}{} \cdot \frac{1\,mol\,KClO_3}{122.55\,g\,KClO_3} \cdot \frac{3\,mol\,O_2}{2\,mol\,KClO_3} = 0.0306\,\text{moles}\,O_2$$

$$PV = nRT \rightarrow V = \frac{nRT}{P} = \frac{0.0306\,moles \cdot 0.08206\,\frac{L\cdot atm}{mol\cdot K} \cdot 273\,K}{1.0\,atm} = 0.69\,L$$

Problem 2 (2 points)

What is the density (in g/L) of SF_6 gas at STP?

$\rightarrow 0°C, 1\,bar = 0.9869\,atm$

$\rightarrow M = 146.06\,g/mol$

$$d = \frac{P}{RT} \cdot M = \frac{0.9869\,atm}{0.08206\,\frac{L\cdot atm}{mol\cdot K} \cdot 273\,K} \cdot 146.06\,g/mol = 6.43\,g/L$$

Problem 3 (2 points)

A gas sample is found to have density of $1.53\,\frac{g}{L}$ at a pressure of $0.85\,atm$ and $25°C$. Give a reasonable guess for the chemical identity of the gas.

$$d = \frac{P}{RT} \cdot M \rightarrow M = \frac{dRT}{P} = \frac{1.53\,g/L \cdot 0.08206\,\frac{L\cdot atm}{mol\cdot K} \cdot 298\,K}{0.85\,atm} = 44.0\,g/mol$$

CO_2 has $M = 44.01\,g/mol$, so this is a reasonable guess.