CHM151 Quiz 5a 25 Pts Spring 2017 Name: Key

Show all work to receive credit. $P_1V_1T_2 = P_2V_2T_1$ $PV = nRT$ $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $P_{total} = P_1 + P_2 + \ldots$

R = 0.0821L•atm/mol•K = 62.4L•torr/mol•K Molar masses: **C 12.01, S 32.07, H 1.008, N 14.01**

1 (4 Pts) A sample of carbon monoxide gas was collected in a 2.0 L flask by displacing water at 28°C and 810 mmHg. Calculate the number of moles CO in the flask. The vapor pressure of water at 28°C is 28.3 mmHg.

$P_{CO} = P_{total} - P_{H_2O}$

$P_{CO} = 810 - 28.3 = 781.7 \text{ mmHg}$

$n = \frac{PV}{RT}$

$n = \frac{(781.7 \text{ mmHg})(2.0 L)}{\left(\frac{62.4 L \cdot \text{mmHg}}{\text{mol} \cdot K}\right)(301 K)}$

n = 0.0832 moles CO

2 (4 Pts) Calculate the density of SO_2 gas, in grams per liter, at 55°C and 1.5 atm.

Density = g ÷ L

P = 1.5 atm

V =

n = Let's assume 1 mole (64.07 g)

$R = 0.0821 \frac{L \cdot atm}{mol \cdot K}$

T = 328 K

$V = \frac{nRT}{P}$

$V = \frac{(1 \text{ mole})\left(\frac{0.0821 L \cdot atm}{mol \cdot K}\right)(328 K)}{(1.5 atm)}$

V = 17.95 L

$\text{Density} = \frac{64.07 g}{17.95 L} = 3.57 \text{ g/L}$

3 (4 Pts) The following data describes an initial and final state for an ideal gas. Given that the amount of gas does not change in the process, what was the initial volume (L) of the gas?

		P	V	T
①	initial:	830 mmHg	?	35 °C (308K)
②	final:	720 mmHg	1.2 L	58 °C (331K)

$V_1 = \frac{P_2 V_2 T_1}{P_1 T_2} = \frac{(720 \text{ mmHg})(1.2 L)(308 K)}{(830 \text{ mmHg})(331 K)} = 0.97 L$

4 (4 Pts) Gases are sold in large cylinders for laboratory use. What pressure, in atmospheres, will be exerted by 2,500 g of oxygen gas (O_2) when stored at 22°C in a 40.0 L cylinder?

P = ?

V = 40.0 L

$n = \frac{2500 g\ O_2 \mid \text{mol}}{\mid 32 g} = 78.125 \text{ mol } O_2$

$R = 0.0821 \frac{L \cdot atm}{mol \cdot K}$

T = 295 K

$P = \frac{nRT}{V}$

$P = \frac{(78.125 \text{ mol})\left(\frac{0.0821 L \cdot atm}{mol \cdot K}\right)(295 K)}{(40. L)}$

P = 47.3 atm

MORE ON BACK

Key

5 (4 Pts) Calculate the molar mass of a gaseous substance if 0.125 g of the gas occupies 93.3 mL at 298 K and 1 atm.

molar mass = g ÷ moles

$P = 1\,atm$

$V = 0.0933\,L$

$R = 0.0821\,\frac{L \cdot atm}{mol \cdot K}$

$n = ?$

$T = 298\,K$

$$n = \frac{PV}{RT} = \frac{(1\,atm)(0.0933\,L)}{\left(0.0821\,\frac{L \cdot atm}{mol \cdot K}\right)(298\,K)}$$

$n = 0.00381$ moles

$$\text{molar mass} = \frac{0.125\,g}{0.00381\,moles} = 32.8\,g/mol$$

6 (6 Pts Ammonium nitrite undergoes decomposition to produce only gases as shown below.

$NH_4NO_2(s) \rightarrow N_2(g) + 2H_2O(g)$

How many liters of nitrogen gas will be produced by the decomposition of 32.0 g of NH_4NO_2 at 525°C and 1.5 atm?

$NH_4NO_2(s) \rightarrow N_2(g) + 2H_2O(g)$

32.0 g — ? L @ 525°C and 1.5 atm

? moles

$$\frac{32.0\,g\,NH_4NO_2}{} \times \frac{mol}{64.052\,g} \times \frac{1\,mol\,N_2}{1\,mol\,NH_4NO_2} = 0.500\,mol\,N_2$$

then: $V = \frac{nRT}{P}$

$$V = \frac{(0.500\,mol\,N_2)\left(0.0821\,\frac{L \cdot atm}{mol \cdot K}\right)(798\,K)}{(1.5\,atm)}$$

$V = 21.8\,L$