1. Calculate the density of SO_2 gas at STP. (64)

2. If a balloon has a volume of 200 ml. at 700 mm Hg, what volume will it have at 500 mmHg?

3. The pressure in an aerosol can is 600 mm Hg at 20°C what temperature in °C will give the gas a pressure of 2500 mm Hg ?

4. Calculate the density of NH_3 has at 25°C and 550 mm Hg. (17)

5. Find the volume of 24.6 g. of CH_4 at 25°C and 675 mm Hg. (16)

6. What temperature (°Celsius) will cause 0.860 moles of gas to occupy 18.0 liters at 500mm Hg ?

7. At what pressure will 12.75 g. of N_2 gas occupy 12.5 liters at 35°C ? (28)

8. Write the balanced equation for the reaction of hydrogen gas and nitrogen gas to form Ammonia (NH3). How many liters of ammonia can be generated from the reaction of 16.6 g. of hydrogen gas ?

9. A gas sample has a mass of 0.0632 grams and it occupies 79.0 ml at 35°C and 675 mm Hg. Calculate the molar mass (formula weight) of this gas .

10. Use the following information to solve the given Bag problem.

Mass of empty bag	18.765 g.
Mass of Bag + O2 gas	18.925 g.
Mass of Bag + unknown	19.111g.
Volume of bag	1.165 liters
Temperature	22°C
Atmospheric pressure	613 mm Hg

a. Calculate the molar mass of the gas using Avogadro's Hypothesis.

b. Calculate the molar mass of the gas using molar volume

c. Calculate the molar mass of the gas using PV=nRT

11. A gas is collected over water at 24°C and 615 mmHg. The volume of the gas in the tube is 29.8 ml and the water level in the tube is 125 mm above the water level in the tub.
Find the volume of the gas at STP. The water vapor pressure at 24°C is 22.4 mm Hg.

12. A gas is collected over water at 20°C and 600 mmHg. The volume of gas in the tube is 39.5 ml and the water level in the tube is 145 mm above the level in the tub. The gas has a mass of 0.0285 g. Find the molar mass of the gas. The water vapor pressure at 20°C is 17.5 mm Hg.

64

1. Calculate the density of SO_2 gas at STP.

$d = \frac{M}{V} = \frac{64\,g}{22.4\,L} = 2.9\ g/L$

2. If a balloon has a volume of 200 ml. at 700 mm Hg, what volume will it have at 500 mmHg?

200 ml at 700 mm Hg ↓ 500 mm Hg

$200\,ml\left(\frac{700}{500}\right) = 280\,ml$

3. The pressure in an aerosol can is 600 mm Hg at 20°C what temperature in °C will give the gas a pressure of 2500 mm Hg ?

600 mm Hg at 293 °K ↓ 2500 mmHg ↓ ?

$293\,°K\left(\frac{2500}{600}\right) = 1220.8\,°K$

$-273 = 948\,°C$

17

4. Calculate the density of NH_3 has at 25°C and 550 mm Hg.

$d = \frac{m}{V}\ \frac{17\,g}{22.4\,L\ @\ STP} = .7589\ g/L$ at STP 273 K ↓ 298 K 760 mm Hg ↓ 550 mmHg

$.7589\ \frac{g}{L}\left(\frac{273}{298}\right)\left(\frac{550}{760}\right) = .50\ g/L$

16

5. Find the volume of 24.6 g. of CH_4 at 25°C and 675 mm Hg.

$PV = nRT \qquad V = \frac{nRT}{P} = \frac{1.5\,mol\,(62.4)(298)}{675} = 42\,L$

$24.6\,g\,CH_4 \mid \frac{1\,mol\,CH_4}{16\,g\,CH_4} = 1.5\,mol$

6. What temperature (°Celsius) will cause 0.860 moles of gas to occupy 18.0 liters at 500mm Hg ?

$PV = nRT \qquad T = \frac{PV}{nR} = \frac{500\,mm\,Hg\,(18.0\,L)}{62.4\ \frac{L\,mm\,Hg}{mol\,K}\ .860\,mol} = 167.7\,K$

$-273 = -105\,°C$

28

7. At what pressure will 12.75 g. of N_2 gas occupy 12.5 liters at 35°C ?

$PV = nRT \qquad 12.75\,g\,N_2 \mid \frac{1\,mol\,N_2}{28\,g\,N_2} = .45535\,mol\,N_2$

$P = \frac{nRT}{V} = \frac{.45535\,mol\,(62.4)(308\,K)}{12.5\,L} = 700\,mm\,Hg$

$3\,H_2 + N_2 \rightarrow 2\,NH_3$

8. Write the balanced equation for the reaction of hydrogen gas and nitrogen gas to form Ammonia (NH3). How many liters of ammonia can be generated from the reaction of 16.6 g. of hydrogen gas ?

$$16.6\text{ g } H_2 \left| \frac{1\text{ mol } H_2}{2.02\text{ g } H_2} \right. = 8.2178\text{ mol } H_2 \left| \frac{2\text{ mol } NH_3}{3\text{ mol } H_2} \right. = 5.4785\text{ mol } NH_3 \left| \frac{22.4\text{ L}}{1\text{ mol } NH_3} \right.$$

123 L @ STP

9. A gas sample has a mass of 0.0632 grams and it occupies 79.0 ml at 35°C and 675 mm Hg. Calculate the molar mass (formula weight) of this gas . 308 → 273 675 → 760

molar mass = $\frac{g}{mol} = \frac{.0632\text{ g}}{? \text{ mol}}$ ← $\left(\frac{22.8\text{ g}}{1\text{ mol}}\right)$ $.079\text{ L}\left(\frac{273}{308}\right)\left(\frac{675}{760}\right) = .06219\text{ L @ STP} \left| \frac{1\text{ mol}}{22.4\text{ L}} \right. = .00277\text{ mol}$

10. Use the following information to solve the given Bag problem.

Mass of empty bag	18.765 g.	295 → 273
Mass of Bag + O2 gas	18.925 g.	613 → 760
Mass of Bag + unknown	19.111g.	
Volume of bag	1.165 liters	
Temperature	22°C 295 K	
Atmospheric pressure	613 mm Hg	

$1.165\text{ L}\left(\frac{273}{295}\right)\left(\frac{613}{760}\right) = .8695\text{ L @ STP}$

$.8695\text{ L @ STP} \left| \frac{1.2929\text{ g air}}{1\text{ L @ STP air}} \right. = 1.1243\text{ g air displaced}$

18.925 g
− 18.765 g
= 1.16 g O_2 + 1.1243 g air displaced = 1.2843 g O_2

19.111
− 18.765
= .346 g X + 1.1243 g air displaced 1.4703 g X

$$\frac{1.4703\text{ g X}}{1.2843\text{ g } O_2} = \frac{\text{molar mass X}}{32\text{ g/mol}}$$

a. Calculate the molar mass of the gas using Avogadro's Hypothesis.

$$\frac{1.47029\text{ g X}}{1.28429\text{ g } O_2} = \frac{\text{molar mass X}}{31.9988\text{ g/mol}} \qquad X = 36.6\text{ g/mol}$$

b. Calculate the molar mass of the gas using molar volume 295 → 273 613 → 760

$1.165\text{ L}\left(\frac{273}{295}\right)\left(\frac{613}{760}\right) = .8695\text{ L @ STP} \left| \frac{\text{mol}}{22.4\text{ L @ STP}} \right. = .03882\text{ mol X}$

$\frac{1.4703\text{ g X}}{.03882\text{ mol X}} = 37.9\text{ g/mol}$

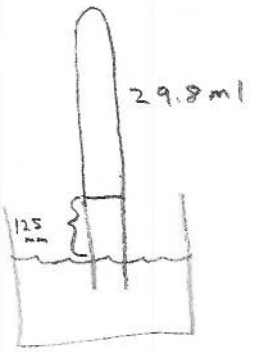
c. Calculate the molar mass of the gas using PV=nRT

$$n = \frac{PV}{RT} = \frac{613\text{ mm Hg}\ \ 1.165\text{ L}}{62.4\ \frac{\text{L mm Hg}}{\text{mol K}}\ (295\text{ K})} = .03879\text{ mol}$$

$$\text{Molar mass} = \frac{1.4703\text{ g X}}{.03879\text{ mol}} = 37.9\text{ g/mol}$$

Chemistry Practice Exam 10-11

11. A gas is collected over water at 24°C and 615 mmHg. The volume of the gas in the tube is 29.8 ml and the water level in the tube is 125 mm above the water level in the tub. Find the volume of the gas at STP. The water vapor pressure at 24°C is 22.4 mm Hg.



Pressure of dry gas = 615 mm Hg − 9.19 mm Hg − 22.4 mm Hg = 583.4 mm Hg

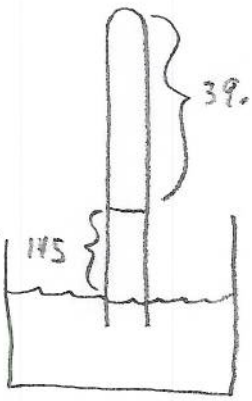
29.8 mL @ 583.4 mm Hg ↓ 760 and 297 K ↓ 273

$\frac{125 \text{ mm } H_2O}{13.6 \text{ mm } H_2O / \text{mm Hg}} = 9.19 \text{ mm Hg}$

$.02982 \text{ L} \left(\frac{583.4}{760 \text{ K}}\right)\left(\frac{273}{297 \text{ K}}\right) =$

= 21.02 mL @ STP = 21.0 ml

12. A gas is collected over water at 20°C and 600 mmHg. The volume of gas in the tube is 39.5 ml and the water level in the tube is 145 mm above the level in the tub. The gas has a mass of 0.0285 g. Find the molar mass of the gas. The water vapor pressure at 20°C is 17.5 mm Hg.



20°C = 293 K

pressure of dry gas = 600 mm Hg − 10.66 mm Hg − 17.5 mm Hg

= 571.84 mm Hg

39.5 ml @ 571.84 mm Hg and 293 °K ↓ 760 ↓ 273

$39.5 \text{ ml} \left(\frac{571.84}{760}\right)\left(\frac{273}{293}\right) = 27.69 \text{ ml}$ @ STP $= .02769 \text{ L} \left| \frac{1 \text{ mol}}{22.4 \text{ L}}\right.$

$= .001236 \text{ mol}$

mercury is 13.6 X heavier than H_2O

$\frac{145 \text{ mm } H_2O \left| 1 \text{ mm Hg}\right.}{13.6 \text{ mm } H_2O} = 10.66 \text{ mm Hg}$

molar mass $= \frac{.0285 \text{ g}}{.001236 \text{ mol}} = 23 \frac{\text{g}}{\text{mol}}$