Solutions

Molar Volume Worksheet

1. Find the volume in the problems below. Assume they are gasses at STP.

a. 4.5 moles of H_2

$$4.5 \text{ mol } H_2 \times \frac{22.4 \text{ L } H_2}{1 \text{ mol } H_2} = 100.8 \approx 1.0 \times 10^2 \text{ L}$$

b. 56.0 grams of O_2

$$56.0 \text{ g } O_2 \times \frac{1 \text{ mol } O_2}{31.9988 \text{ g } O_2} \times \frac{22.4 \text{ L } O_2}{1 \text{ mol } O_2} = 39.2012 \approx 39.2 \text{ L}$$

c. 0.0023 moles of CO_2

$$0.0023 \text{ mol } CO_2 \times \frac{22.4 \text{ L } CO_2}{1 \text{ mol } CO_2} = 0.05152 \approx 0.052 \text{ L}$$

d. 5.2×10^{25} molecules of CH_4

$$5.2 \times 10^{25} \text{ mc. } CH_4 \times \frac{1 \text{ mol } CH_4}{6.022 \times 10^{23} \text{ mc. } CH_4} \times \frac{22.4 \text{ L } CH_4}{1 \text{ mol } CH_4} = 19302.41 \approx 19000 \text{ L}$$

2. Find the molecules in the problems below.

a. 500 moles of Cl_2

$$500 \text{ mol } Cl_2 \times \frac{6.022 \times 10^{23} \text{ mc. } Cl_2}{1 \text{ mol } Cl_2} = 3.01 \times 10^{26} \approx 3 \times 10^{26} \text{ molecules}$$

b. 20.484 grams of H_2O

$$20.484 \text{ g } H_2O \times \frac{1 \text{ mol } H_2O}{18.0153 \text{ g } H_2O} \times \frac{6.022 \times 10^{23} \text{ mc. } H_2O}{1 \text{ mol } H_2O} = 6.847216 \times 10^{23} \approx 6.8472 \times 10^{23} \text{ molecules}$$

c. 75.0 liters of F_2 at STP

$$75.0 \text{ L } F_2 \times \frac{1 \text{ mol } F_2}{22.4 \text{ L } F_2} \times \frac{6.022 \times 10^{23} \text{ mc. } F_2}{1 \text{ mol } F_2} = 2.0163 \times 10^{24} \approx 2.02 \times 10^{24} \text{ molecules}$$

3. Find the mass in the problems below

a. 9.0×10^{17} molecules of He gas at STP

$$9.0 \times 10^{17} \text{ mc. } He \times \frac{1 \text{ mol } He}{6.022 \times 10^{23} \text{ mc. } He} \times \frac{4.0026 \text{ g } He}{1 \text{ mol } He} = 5.98197 \times 10^{-6} \approx 6.0 \times 10^{-6} \text{ g } He$$

b. 11.5 liters of Cl_2 gas at STP

$$11.5 \text{ L } Cl_2 \times \frac{1 \text{ mol } Cl_2}{22.4 \text{ L } Cl_2} \times \frac{70.9060 \text{ g } Cl_2}{1 \text{ mol } Cl_2} = 36.4026 \approx 36.4 \text{ g } Cl_2$$

c. 75.0 moles of Argon gas at STP

$$75.0 \text{ mol } Ar \times \frac{39.9480 \text{ g } Ar}{1 \text{ mol } Ar} = 2996.1 \approx 3.00 \times 10^3 \text{ g } Ar$$

4. Find the moles of hydrogen in the problems below

a. 4 moles of CH_4 b) 32 grams CH_4 c) 3.01×10^{23} molecules of CH_4 d) 44.8 liters CH_4

$4 \text{ mol } CH_4 \times \frac{4 \text{ mol H}}{1 \text{ mol } CH_4}$

16 mol H

b) $32 \text{ g } CH_4 \times \frac{1 \text{ mol } CH_4}{16.042 \text{ g } CH_4} \frac{4 \text{ mol H}}{1 \text{ mol } CH_4}$

$= 8 \text{ mol H}$

c) $3.0 \times 10^{23} \text{ m.c. } CH_4 \times \frac{1 \text{ mol } CH_4}{6.022 \times 10^{23} \text{ m.c. } CH_4} \times \frac{4 \text{ mol H}}{1 \text{ mol } CH_4}$

$= 2 \text{ mol H}$

d) $44.8 \text{ L } CH_4 \times \frac{1 \text{ mol } CH_4}{22.4 \text{ L } CH_4} \times \frac{4 \text{ mol H}}{1 \text{ mol } CH_4} = 8 \text{ mol H}$

5. Do the problems below. Show all you work

a. Find the volume of 3.0×10^{25} molecules of Neon gas at STP

$3.0 \times 10^{25} \text{ m.c. Ne} \times \frac{1 \text{ mol Ne}}{6.022 \times 10^{23} \text{ m.c. Ne}} \times \frac{22.4 \text{ L Ne}}{1 \text{ mol Ne}} = 1115.9083$

$\approx 1100 \text{ L Ne}$

b. You have 36.0 grams of Iron. How many moles of iron do you have?

$36.0 \text{ g Fe} \times \frac{1 \text{ mol Fe}}{55.845 \text{ g Fe}} = 0.64464 \approx 0.645 \text{ mol Fe}$

c. Calculate the number of molecules in 17.0 liters of oxygen gas at STP

$17.0 \text{ L } O_2 \times \frac{1 \text{ mol } O_2}{22.4 \text{ L } O_2} \times \frac{6.022 \times 10^{23} \text{ m.c. } O_2}{1 \text{ mol } O_2} = 4.5703 \times 10^{23}$

$\approx 4.57 \times 10^{23} \text{ m.c. } O_2$

d. Jim has 300 grams of sulfur dioxide. How many moles of oxygen are in Jim's sulfur dioxide?

$300 \text{ g } SO_2 \times \frac{1 \text{ mol } SO_2}{64.0638 \text{ g } SO_2} \times \frac{2 \text{ mol O}}{1 \text{ mol } SO_2} = 9.366$

$\approx 9 \text{ mol O}$

e. Billy has 5.6×10^{24} molecules of Helium gas to fill balloons at a ballgame. If each balloon holds 1.5 liters, how many balloons can he fill? Assume STP

$5.6 \times 10^{24} \text{ m.c. He} \times \frac{1 \text{ mol He}}{6.022 \times 10^{23} \text{ m.c. He}} \times \frac{22.4 \text{ L He}}{1 \text{ mol He}} \times \frac{1 \text{ balloon}}{1.5 \text{ L He}} = 138.87$

≈ 138 balloons

(a little left over, not enough to fill another balloon)