# Honors Chemistry Review Chapter 11

1. Find the density of ammonia at STP.
2. What is the mass of 750. ml of sulfur dioxide at STP?
3. What is the volume of 125 g of butane at 27 ° C and 780. mm Hg?
4. Find the pressure exerted by 0.635 moles of oxygen if it occupies 325 ml at 50.0°C.
5. What is the molar mass of a gas if 9.71 g occupies 560. ml at 22° C and 740. mm?
6. Ammonia reacts with oxygen to make nitrogen and water. What volume of oxygen is needed to produce 414 ml of nitrogen at STP?
7. What mass of hydrochloric acid must be reacted with calcium carbonate to make 50.0 ml of carbon dioxide at 24 °C and 1.15 atm?
8. Carbon dioxide reacts with calcium oxide to make calcium carbonate. How many grams of calcium carbonate can be formed from 50.0 L of a mixture of gases that is 53.0% by volume carbon dioxide at STP?
9. How many liters of hydrogen chloride can be made by reacting 15.0 L of hydrogen with 12.0 L of chlorine at STP?

Molar Volume (1 + 2)

Ideal Gas Law (3 + 4)

Molar Volume (5)

Gas Stoich. (6 – 9)

1. $NH_3$, STP $\quad 17.04\ \frac{g}{mol}\left(\frac{1\ mol\ NH_3}{22.41\ L}\right) = 0.7604\ \frac{g}{L}\ NH_3$

2. $750.\ mL\ SO_2\left(\frac{1.00\ L\ SO_2}{1000\ mL}\right)\left(\frac{1\ mol\ SO_2}{22.41\ L\ SO_2}\right)\left(\frac{64.07\ g\ SO_2}{1\ mol\ SO_2}\right) = 2.14\ g\ SO_2$

3. $PV = nRT$

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

$125\ g\ Butane,\ C_4H_{10}$

$125\ g\ C_4H_{10}\left(\frac{1\ mol\ C_4H_{10}}{58.14\ g\ C_4H_{10}}\right) = 2.15\ mol\ C_4H_{10}$

$= \frac{(2.15\ mol\ C_4H_{10})(0.08206\ \frac{L \cdot atm}{K \cdot mol})(300.\ K)}{(1.03\ atm)} = 51.4\ L\ C_4H_{10}$

4. $PV = nRT$

$P = \frac{nRT}{V} = \frac{(0.635\ mol\ O_2)(0.08206\ \frac{L \cdot atm}{K \cdot mol})(323\ K)}{(0.325\ L)} = 51.8\ atm$

5. MM $\quad 9.71\ g$

$\frac{V_1P_1}{T_1} = \frac{V_2P_2}{T_2} \qquad V_2 = \frac{V_1P_1T_2}{T_1P_2} = \frac{(560.\ mL)(740.\ mm\ Hg)(273.15\ K)}{(295\ K)(760.0\ mm\ Hg)} = 505\ mL$

$\frac{9.71\ g}{505\ mL}\left(\frac{1000\ mL}{1.00\ L}\right)\left(\frac{22.41\ L}{1\ mol}\right) = 431\ \frac{g}{mol}$ OR

$505\ mL\left(\frac{1.00\ L}{1000\ mL}\right)\left(\frac{1\ mol}{22.41\ L}\right) = 0.0225\ mol$

$MM = \frac{9.71\ g}{0.0225\ mol} = 432\ g/mol$

6. $4NH_3 + 3O_2 \longrightarrow 2N_2 + 6H_2O$ At STP

Volume? 414 ml

$$414\ ml\ N_2 \left(\frac{3\ ml\ O_2}{2\ ml\ N_2}\right) = 621\ ml\ O_2$$

$(0.621\ L\ O_2)$

7. $2HCl + CaCO_3 \longrightarrow CaCl_2 + H_2O + CO_2$

g? 50.0 ml

24°C → 297K

1.15 atm

$$PV = nRT \quad n = \frac{PV}{RT} = \frac{(1.15\ atm)(0.0500\ L\ CO_2)}{\left(0.08206 \frac{L \cdot atm}{K \cdot mol}\right)(297K)} = 0.00236\ mol\ CO_2$$

$$0.00236\ mol\ CO_2 \left(\frac{2\ mol\ HCl}{1\ mol\ CO_2}\right)\left(\frac{36.46\ g\ HCl}{1\ mol\ HCl}\right) = 0.172\ g\ HCl$$

8. $CO_2 + CaO \longrightarrow CaCO_3$ At STP

g?

50.0 L Mixture Gases

53.0% $CO_2$

$$50.0\ L\ Gas\ Mixture \left(\frac{53.0\ L\ CO_2}{100.\ L\ Gas\ Mixture}\right)\left(\frac{1\ mol\ CO_2}{22.41\ L\ CO_2}\right)\left(\frac{1\ mol\ CaCO_3}{1\ mol\ CO_2}\right)\left(\frac{100.09\ g\ CaCO_3}{1\ mol\ CaCO_3}\right)$$

$= 118\ g\ CaCO_3$

9. $H_2 + Cl_2 \longrightarrow 2HCl$ At STP

15.0 L 12.0 L L?

LR

$$15.0\ L\ H_2 \left(\frac{2\ L\ HCl}{1\ L\ H_2}\right) = 30.0\ L\ HCl$$

$$12.0\ L\ Cl_2 \left(\frac{2\ L\ HCl}{1\ L\ Cl_2}\right) = 24.0\ L\ HCl$$