Name Key

Date _____ Pd ___

Chemistry – Unit 8 Worksheet 2

1. What volume does 16.0 g of O_2 occupy at STP?

$PV = nRT$

$(101.1\ kPa)(V) = \left(\frac{16.9}{32g/m}\right)\left(8.31\ \frac{kPa\ L}{mol\ K}\right)(273K) =$

11.2 L

2. A mixture contains 5.00 g each of O_2, N_2, CO_2, and Ne gas. Calculate the volume of this mixture at STP

$\frac{5.0g}{32.0g/m} = .16\ mol\ O_2$ $\frac{5.0g}{28g/m} = .18\ m\ N_2$

$\frac{5.0g}{44.0g/m} = .11\ m\ CO_2$ $\frac{5.0\ g}{20.2g/m} = .25\ m\ Ne$

$(101.1\ kPa)(V) = (.16 + .18 + .11 + .25)\left(8.31\ \frac{kPa\ L}{mol\ K}\right)(273K)$

15.7 L

3. A 250 mL flask of hydrogen gas is collected at 763 mm and 35°C by displacement of water from the flask. The vapor pressure of water at 35°C is 42.2 mmHg. How many moles of hydrogen gas are in the flask?

4. When calcium carbonate is heated strongly, carbon dioxide gas is evolved.

$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$

If 4.74 g of calcium carbonate is heated, what volume of CO_2 (g) would be produced when collected at STP?

$4.74\ g\ CaCO_3 \times \frac{1\ mol}{100.1\ g} \times \frac{1\ mol\ CO_2}{1\ mol\ CaCO_3} = 0.047\ mol\ CO_2$

$PV = nRT$

$(101.1\ kPa)(V) = (0.047\ mol)\left(8.31\ \frac{kPa\ L}{mol\ K}\right)(273K)$

1.05 L CO_2

101.1 kPa

5. Zinc metal reacts vigorously with chlorine gas to form zinc chloride. What volume of chlorine gas at 25°C and 1.00 atm is required to react completely with 1.13 g of zinc?

$Zn + Cl_2 \rightarrow ZnCl_2$

$1.13\text{ g Zn} \times \frac{1\text{ mol Zn}}{65.4\text{ g}} \times \frac{1\text{ mol } Cl_2}{1\text{ mol Zn}} = 0.017\text{ mol } Cl_2$

$PV = nRT$

$(101.1\text{ kPa})(V) = (0.017\text{ mol})(8.31\ \frac{\text{kPa L}}{\text{mol K}})(298\text{ K})$

$0.42\text{ L } Cl_2$

6. Consider the following reaction:

$$P_4(s) + 6\,H_2(g) \longrightarrow 4\,PH_3(g)$$

What mass of P_4 will completely react with 2.50 L of hydrogen gas, at 0°C and 1.50 atm pressure?

$PV = nRT$

$\frac{1\text{ atm}}{101.1\text{ kPa}} = \frac{1.50\text{ atm}}{X} = 151.65\text{ kPa}$

$(151.65\text{ kPa})(2.50\text{ L}) = n(8.31\ \frac{\text{kPa L}}{\text{mol K}})(273\text{ K})$

$n = 0.167\text{ mol } H_2$

$\frac{6\text{ mol}}{1\text{ mol } P_4} = \frac{0.167\text{ mol}}{X}$

0.28 mol P_4

7. If water is added to magnesium nitride, ammonia gas is produced when the mixture is heated.

$$Mg_3N_2(s) + 3H_2O(l) \longrightarrow 3\,MgO + 2NH_3(g)$$

If 10.3 g of magnesium nitride is treated with water, what volume of ammonia gas would be collected at 20°C and 0.989 atm?

$10.3\text{ g } Mg_3N_2 \times \frac{1\text{ mol}}{100.9\text{ g}} \times \frac{2\text{ mol } NH_3}{1\text{ mol } Mg_3N_2} = .20\text{ mol } NH_3$

$\frac{1.0\text{ atm}}{101.1\text{ kPa}} = \frac{0.989\text{ atm}}{X} = 100\text{ kPa}$

$(100\text{ kPa})(V) = (0.20\text{ mol})(8.31\ \frac{\text{kPa L}}{\text{mol K}})(293)$

$V = 0.21\text{ L}$

8. Nitrogen gas and hydrogen gas combine to produce ammonia gas (NH_3). What volume of hydrogen gas at 25°C and 735 mm is required for the complete reaction of 10.0g of nitrogen?

$N_2 + 3H_2 \longrightarrow 2NH_3$

$10.0\text{ g } N_2 \times \frac{1\text{ mol}}{28\text{ g}} \times \frac{3\text{ mol } H_2}{1\text{ mol } N_2} = 1.07\text{ mol } H_2$

$\frac{101.1\text{ kPa}}{760\text{ mm}} = \frac{X}{735} = 97.8\text{ kPa}$

$(97.8\text{ kPa})(V) = (1.07\text{ mol})(8.31\ \frac{\text{kPa L}}{\text{mol K}})(298)$

25.6 L