W-GC General Chemistry 1/19

Methane breaks down into carbon and hydrogen gas. How many grams of hydrogen is produced by the complete decomposition of 150. g of methane (CH_4)?

$$1\,CH_4 \longrightarrow C + 2H_2$$

$$150\,g\ CH_4 * \frac{1\ mol\ CH_4}{16.043\,g\ CH_4} * \frac{2\ mol\ H_2}{1\ mol\ CH_4} * \frac{2.016\,g}{1\ mol\ H_2}$$

$1\,C = 1 * 12.011 = 12.011$

$4\,H = 4 * 1.008 = 4.032$

16.043

37.6 g H_2

$H_2 = 2 * 1.008 = 2.016$

How many atoms?

$$150\,g\ CH_4 * \frac{1\ mol\ CH_4}{16.043\,g\ CH_4} * \frac{2\ mol\ H_2}{1\ mol\ CH_4} * \frac{6.022 * 10^{23}\ atoms}{1\ mol\ H_2}$$

H_2 gas — How many liters of H_2?

Molar volume → 1 mole of gas is 22.4 L

$$150\,g\ CH_4 * \frac{1\ mol\ CH_4}{16.043\,g\ CH_4} * \frac{2\ mol\ H_2}{1\ mol\ CH_4} * \frac{22.4\,L}{1\ mol\ H_2} = \boxed{419\,L}$$

86 g of Al_2O_3 decomposed into how many grams of Al?

$$\Rightarrow \{\ 2Al_2O_3 \longrightarrow 4Al + 3O_2\ \}$$

$$86\text{ g } Al_2O_3 * \frac{1\text{ mol } Al_2O_3}{101.961\text{ g } Al_2O_3} * \frac{4\text{ mol Al}}{2\text{ mol } Al_2O_3} * \frac{26.982\text{ g Al}}{1\text{ mol Al}}$$

Al $2 * 26.982 = 53.964$

O $3 * 15.999 = 47.997$

101.961

45.5 g Al

molar volume = 22.4 L

86 g Al_2O_3 produces how many liters of O_2 gas?

$$86\text{ g } Al_2O_3 * \frac{1\text{ mol } Al_2O_3}{101.96\text{ g } Al_2O_3} * \frac{3\text{ mol } O_2}{2\text{ mol } Al_2O_3} * \frac{22.4\text{ L } O_2}{1\text{ mol } O_2}$$

28.3 L O_2

Ammonia breaks down into nitrogen and hydrogen gas respectively. How many grams of H_2 would be produced from 200. g of NH_3. How many liters of N_2 gas would be created from the same amount?

22.4 L → 1 mol

$$2NH_3 \longrightarrow 1N_2 + 3H_2$$

$$200\text{g } NH_3 * \frac{1 \text{ mol } NH_3}{17.031 \text{ g } NH_3} * \frac{3 \text{ mol } H_2}{2 \text{ mol } NH_3} * \frac{2.016 \text{ g } H_2}{1 \text{ mol } H_2}$$

1N: 1 * 14.007 = 14.007
3H: 3 * 1.008 = 3.024
17.031

35.5 g H_2

$$200\text{g } NH_3 * \frac{1 \text{ mol } NH_3}{17.031 \text{ g } NH_3} * \frac{1 \text{ mol } N_2}{2 \text{ mol } NH_3} * \frac{22.4 \text{ L } N_2}{1 \text{ mol } N_2}$$

132 L