Stoichiometry of Gases Worksheet

For each of the problems below follow these steps:

1. Write the balanced chemical equations for all questions.
2. Write down the given and required below formulas.
3. Then start solving the questions

Upload your solutions to our site https://onstudy.ca SCH3U: Unit 5, Lesson 5

Sample Problem

What volume of carbon dioxide is produced when 6.40 g of ethane gas, C_2H_6, reacts with excess oxygen? All gases are at 35.0˚C and 100.0 kPa.

$2C_2H_{6(g)}$ +	**$7O_{2(g)}$ →**	**4 $CO_{2(g)}$ +**	**6 $H_2O_{(g)}$**
m = 6.40 g M = 30.08 g/mol n = 0.213 mol		V = ? T= 35 C = 308.15 K P = 100 kPa	

Convert moles C_2H_6 to moles of CO_2 using mole ratio:

$$0.213 \text{ mol } C_2H_6 \times \frac{4\ mol\ CO_2}{2\ mol\ C_2H_6} = 0.426 \text{ mol } CO_2$$

Next, use Ideal Gas Law : PV = nRT and solve for V_{CO2}

$$V = \frac{nRT}{P} = \frac{(0.426\ mol\ CO_2)\left(8.314\frac{kPa \cdot L}{mol \cdot K}\right)(308.15\ K)}{(100\ kPa)}$$

V_{CO2} = 10.9 L

Practice Problems:

1. Hydrogen gas is produced when aluminum metal is added to hydrochloric acid. What mass of aluminum is necessary to produce 20.0 L of hydrogen at SATP?

Write the balance chemical equation:

$$\mathbf{2\ Al(s) + 6\ HCl(aq) \rightarrow 2\ AlCl_{3(aq)} + 3\ H_{2(g)}}$$

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A: 7.26 g Al

2. The first step in the industrial manufacture of sulfuric acid is the complete combustion of Octasulfur, $S_8(s)$. What mass of octasulfur is required to produce 112 L of sulfur dioxide at STP?

Write the balance chemical equation:

$$\mathbf{S_8(s) + 8O_2(g) \rightarrow 8SO_2(g)}$$

A: 160 g S_8

3. 7.5 kg of hydrogen gas and excess nitrogen gas is reacted in a vessel. What volume of ammonia at 450 kPa pressure and 80.0°C can be obtained from the complete reaction of nitrogen and hydrogen gas?

Write the balance chemical equation:

A: 1.6 x 10^4 L of NH_3

4. What volume of oxygen at STP is needed to completely burn 15.0 g of methanol (CH_3OH) in a burner?

Write the balance chemical equation:

$2\ CH_3OH(l) + 3\ O_2(g) \rightarrow 2\ CO_2(g) + 4\ H_2O(aq)$

A: 15. 8 L of O_2

5. Most combustion reactions use oxygen from the air (assume 20% oxygen). What mass of propane (C_3H_8) from a tank can be burned using 125 L of air at SATP?

   Write the balance chemical equation:

   $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(aq)$

   A: 8. 82 g of propane must be burned

6. What volume of oxygen gas at **<u>room conditions</u>** is obtained from the decomposition of 50.0 mL of 0.880 mol/L aqueous hydrogen peroxide (H_2O_2)?

   Write the balance chemical equation:

   $2\ H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$

   A: 0.545 L or 545 mL of O_2

7. What volume of oxygen at 40.0°C and 1.50 atm is necessary to burn 300 L of hydrogen gas measured at the same conditions?
   Hint: all reactants and products are at the same conditions thus use law of combining volumes.

   Write the balance chemical equation:

   $\_\_H_2(g) + \_\_ O_2(g) \dashrightarrow \_\_H_2O(aq)$

   A: 150 L of O_2