Name : ______________________ Date : ______________

GAS STOICHIOMETRY PROBLEMS

1. 156 grams of potassium metal reacts with excess water to form potassium hydroxide and hydrogen gas. Balance the reaction. What volume of hydrogen gas, in liters, is formed?

$$K (s) + \quad H_2O (l) \rightarrow \quad KOH (aq) + H_2 (g)$$

2. Baking soda decomposes at 200 °C to sodium carbonate, water, and carbon dioxide, as shown in the unbalanced reaction below.

$$NaHCO_3 (s) \rightarrow Na_2CO_3 (s) + CO_2 (g) + H_2O (g)$$

Balance the reaction. 42 grams of baking soda is used in the reaction? What volumes of carbon dioxide and water are produced in the reaction?

3. For the following reaction:

$$2\ CO(g) + O_2 (g) \rightarrow 2\ CO_2 (g)$$

1.5 mol of CO and 2.0 mol of oxygen react in a closed 10 L vessel.

a. How many moles of CO, O_2, and CO_2 are present at the end of the reaction?

b. What will be the total pressure in the flask at 273 K?

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GAS STOICHIOMETRY PROBLEMS

Answers

1. 156 grams of potassium metal reacts with excess water to form potassium hydroxide and hydrogen gas. Balance the reaction. What volume of hydrogen gas, in liters, is formed?

$$2 K (s) + 2 H_2O (l) \rightarrow 2 KOH (aq) + H_2 (g)$$

156 g K x (1 mol K/39.03 g K) x (1 mol H_2/2 mol K) x (22.4 L H_2/1 mol H_2) = 44.07 L H_2

2. Baking soda decomposes at 200 °C to sodium carbonate, water, and carbon dioxide, as shown in the unbalanced reaction below.

$$2 NaHCO_3 (s) \rightarrow Na_2CO_3 (s) + CO_2 (g) + H_2O (g)$$

Balance the reaction. 42 grams of baking soda is used in the reaction? What volumes of carbon dioxide and water are produced in the reaction?

42 g $NaHCO_3$ x (1 mol $NaHCO_3$ x 89.01 g $NaHCO_3$) x (1 mol CO_2/2 mol $NaHCO_3$) x (22.4 L CO_2/1 mol CO_2) = 5.6 L CO_2

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3. For the following reaction:

$$2 CO(g) + O_2 (g) \rightarrow 2 CO_2 (g)$$

1.5 mol of CO and 2.0 mol of oxygen react in a closed 10 L vessel.

a. How many moles of CO, O_2, and CO_2 are present at the end of the reaction?

1.5 mol CO x (2 mol CO_2/2 mol CO) = 1.5 mol CO_2

2 mol O_2 x (2 mol CO_2/1 mol O_2) = 4 mol CO_2

The lower number of moles is the amount of CO_2 produced

1.5 mol CO x (1 mol O_2/2 mol CO) = 0.75 mol O_2 used

2 mol O_2 – 0.75 mol = 1.25 mol O_2 remaining

b. What will be the total pressure in the flask at 273 K?

Total number of moles of the gas = 1.5 mol + 1.25 mol = 2.75 mol

P = nRT/V = (2.75 mol x 0.082 L-atm mol^{-1} K^{-1} x 273 K)/10 L = 6.156 atm