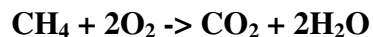


B. Determine the following [Show all math with canceled units and balanced equations]:

1. From the hood experiment, we learned that natural gas, Methane, will burn form carbon dioxide and water. How much water is formed from burning 50 g of Methane?
2. Sodium Hydroxide is used in rebreathers units to absorb carbon dioxide. The reaction of sodium hydroxide and carbon dioxide produces sodium carbonate and water. As we all know, since water is produced, the reaction will go to completion. How many grams of sodium hydroxide is needed to react with 1 pound of carbon dioxide?
How much Sodium Carbonate is formed?
3. Baking Soda will is slightly basic and will react with vinegar to form sodium acetate, water and carbon dioxide. Show the complete balanced reaction.
How many grams of vinegar is needed to react with a one pound box of baking soda?
4. 1.00 g of Hydrogen reacts with Oxygen to form water. 1.00 g of Hydrogen also can react with Nitrogen to form ammonia. Calculate the amounts of water and ammonia formed in each reaction?
5. From the above equations, 1.00 g of Hydrogen is reacted with 1.00 g of Oxygen. What reactant is in excess and by how much?
6. Aluminum reacts with Chlorine to form Aluminum Chloride. How much Aluminum Chloride is produced from 1.000 g of Aluminum assuming a 75% reaction yield?
7. Phosphorous Tri Chloride will react with water to produce Phosphorous Acid. What is the Theoretical Yield when using 5.000 g of Phosphorous Tri Chloride?

ANSWERS TO ABOVE

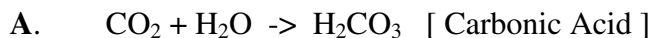
1. From the hood experiment, we learned that natural gas, Methane, will burn form carbon dioxide and water. How much water is formed from burning 50 g of Methane?



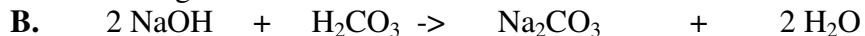
50 g $1 \text{ C} = 1 * 12.01 = 12.01 \text{ g/M}$ $4 \text{ H} = 4 * 1.008 = 4.032 \text{ g/M}$ $\text{Mw CH}_4 = 16.04 \text{ g/M}$	$\xrightarrow{\quad}$	$4 \text{ H} = 4 * 1.008 = 4.032 \text{ g/M}$ $2 \text{ O} = 2 * 16.00 = 32.00 \text{ g/M}$ $\text{Mw } 2\text{H}_2\text{O} = 36.032 = 36.03 \text{ g/M}$
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$$\frac{50 \text{ g Methane}}{16.04 \text{ g/M}} = \frac{X}{36.03 \text{ g/M}} = 112.312 \text{ g H}_2\text{O} = \mathbf{110 \text{ g H}_2\text{O} [2 \text{ sign digits}]}$$

2. Sodium Hydroxide is used in rebreathers units to absorb carbon dioxide. The reaction of sodium hydroxide and carbon dioxide produces sodium carbonate and water. As we all know, since water is produced, the reaction will go to completion. How many grams of sodium hydroxide is needed to react with 1 pound of carbon dioxide? How much Sodium Carbonate is formed?



Strong Base Weak Acid Sodium Carbonate Forms water - a driving force



Replace the H_2CO_3 in B with the Carbonic Acid in A above:

$2 \text{ NaOH} + \text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{Na}_2\text{CO}_3 + 2 \text{ H}_2\text{O}$ $X \quad 1 \text{ lb} \xrightarrow{\quad}$ $\text{Na } 2 * 22.99 = 45.98 \text{ g/M}$ $\text{O } 1 * 16.00 = 16.00 \text{ g/M}$ $\text{H } 1 * 1.008 = 1.008 \text{ g/M}$ $\text{Mw NaOH} = 62.99 \text{ g/M}$	$\xrightarrow{\quad}$	$\text{Na } 2 * 22.99 = 45.98 \text{ g/M}$ $\text{C } 1 * 12.01 = 12.01 \text{ g/M}$ $\text{O } 3 * 16.00 = 48.00 \text{ g/M}$ $\text{Mw Na}_2\text{CO}_3 = 195.99 \text{ g/M}$ $\text{C } 1 * 12.01 = 12.01 \text{ g/M}$ $\text{O } 2 * 16.00 = 32.00 \text{ g/M}$ $\text{Mw CO}_2 = 44.01 \text{ g/M}$
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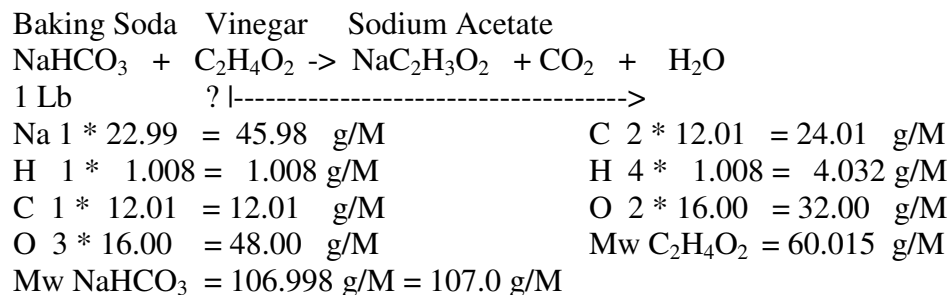
1 lb = 453.6 g of carbon dioxide

$$\frac{453.4 \text{ g CO}_2}{44.01 \text{ g/M}} = \frac{X}{62.99 \text{ g/M}} \quad \mathbf{X = 648.9 \text{ g NaOH} = 600 \text{ g NaOH} [1 \text{ sign digit}]}$$

$$\frac{453.4 \text{ g CO}_2}{44.01 \text{ g/M}} = \frac{X}{195.99 \text{ g/M}} \quad \mathbf{X = 2019.12 \text{ g Na}_2\text{CO}_3 = 2000 \text{ g [1 sign digit]}$$

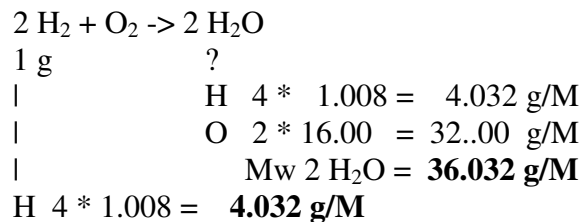
3. Baking Soda will is slightly basic and will react with vinegar to form sodium acetate, water and carbon dioxide. Show the complete balanced reaction. How many grams of vinegar is needed to react with a one pound box of baking soda?

Baking Soda = Sodium Bicarbonate = NaHCO_3 Vinegar = acetic acid = $\text{H}_3\text{C-COOH} = \text{C}_2\text{H}_4\text{O}_2$
 Sodium Acetate = $\text{H}_3\text{C-COO}^- \text{Na}^+ = \text{NaC}_2\text{H}_3\text{O}_2$

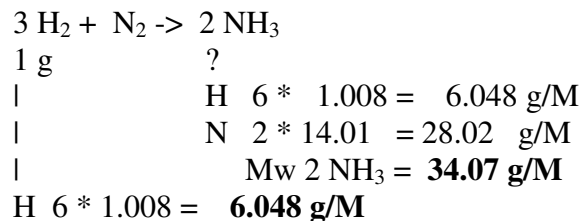


$$\frac{453.6 \text{ g NaHCO}_3}{107.0 \text{ g/M}} = \frac{x}{60.015 \text{ g/M}} \quad \mathbf{X = 254.56 \text{ g Vinegar} = 300\text{g [1 Sign Figure]}$$

4. 1.00 g of Hydrogen reacts with Oxygen to form water. 1.00 g of Hydrogen also can react with Nitrogen to form ammonia. Calculate the amounts of water and ammonia formed in each reaction?

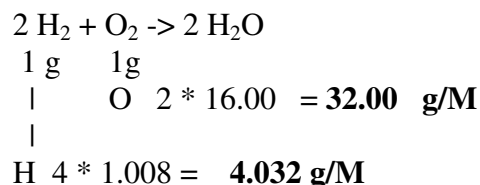


$$\frac{1 \text{ g}}{4.032 \text{ g/M}} = \frac{X}{36.032 \text{ g/M}} \quad \mathbf{X = 8.94 \text{ g Water [3 Sign Digits]}$$



$$\frac{1 \text{ g}}{6.048 \text{ g/M}} = \frac{X}{34.07 \text{ g/M}} \quad \mathbf{X = 5.63 \text{ G Ammonia [3 Sign Digits]}}$$

5. From the above equations, 1.00 g of Hydrogen is reacted with 1.00 g of Oxygen. What reactant is in excess and by how much?

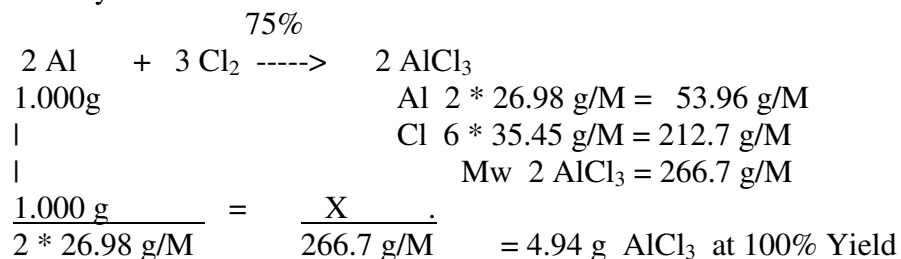


$$\text{H} = \frac{1 \text{ g}}{4.032 \text{ g/M}} = \mathbf{0.248 \text{ M [3 Sign Digits]}} \quad \text{O} = \frac{1 \text{ g}}{32.00 \text{ g/M}} = \mathbf{0.0313 \text{ M [3 Sign Digits]}}$$

There is more Molar Ratios of Hydrogen than Oxygen, so Hydrogen is in xcs.

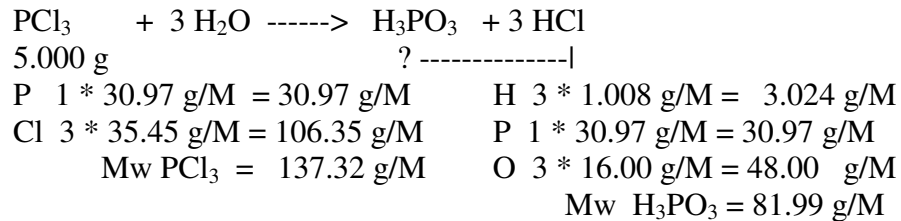
$$0.248 \text{ M H} - 0.0313 \text{ M O} = \mathbf{0.217 \text{ M H in xcs.}}$$

6. Aluminum reacts with Chlorine to form Aluminum Chloride. How much Aluminum Chloride is produced from 1.000 g of Aluminum assuming a 75% reaction yield?



$$4.94 \text{ g AlCl}_3 \text{ at 75\% Yield} = 4.94 \text{ g} * 0.75 = \mathbf{3.707 \text{ g AlCl}_3 [4 Sign Digits]}$$

7. Phosphorous Tri Chloride will react with water to produce Phosphorous Acid. What is the Theoretical Yield when using 5.000 g of Phosphorous Tri Chloride?



$$\frac{5.000\text{g}}{137.32 \text{ g/M}} = \frac{X}{81.99 \text{ g/M}} \quad \mathbf{X = 2.985 \text{ g H}_3\text{PO}_3 \text{ at 100\% Yield}}$$

[4 sign digits]