12/9/2010

$2\ C_3H_7OH + 9\ O_2 \longrightarrow 6\ CO_2 + 8\ H_2O$

How many grams of O_2 are needed to completely burn 100g of propanol, C_3H_7OH

$$100\text{g } C_3H_7OH \times \frac{1\text{ mol}}{60.11\text{ g}} \times \frac{9\text{ mol } O_2}{2\text{ mol } C_3H_7OH} \times \frac{32\text{ g}}{1\text{ mol}}$$

$$= 239.56\text{ g } O_2 \Rightarrow 240\text{ g } O_2$$

How many grams of CO_2 are produced? (Also known as the "theoretical yield")

$$100\text{g} \times \frac{1\text{ mol}}{60.11\text{ g}} \times \frac{6\text{ mol } CO_2}{2\text{ mol } C_3H_7OH} \times \frac{44.01\text{ g } CO_2}{1\text{ mol}} =$$

$$= 219.65 \Rightarrow 220\text{ g } CO_2$$

If only 180g of CO_2 are made, what is the percent yield?

$$\frac{180\text{g}}{220\text{g}} \times 100\% = 82\%\text{ yield}$$

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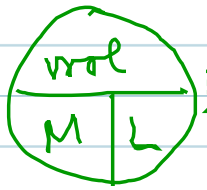


$3Mg^{2+}(NO_3)^-_{2\,(aq)} + 2K^+_3PO_4^{3-}{}_{(aq)} \longrightarrow Mg^{2+}_3(PO_4)^{3-}_{2\,(s)} + 6KNO_{3\,(aq)}$

If I needed to make 200g of $Mg_3(PO_4)_2$, how many milliliters of 2.0M $Mg(NO_3)_2$ solution should I use?

$$200\,g\,Mg_3(PO_4)_2 \times \frac{1\,mol}{262.87\,g} \times \frac{3\,mol\,Mg(NO_3)_2}{1\,mol\,Mg_3(PO_4)_2}$$

$$\equiv 2.28\,mol\,Mg(NO_3)_2$$

$$L = \frac{mol}{M} = \frac{2.28\,mol}{2.0\,M} = 1.14\,L \rightarrow 1,140\,mL \text{ of } 2.0M\ Mg(NO_3)_2$$

How many milliliters of 3.0M K_3PO_4 should I use?

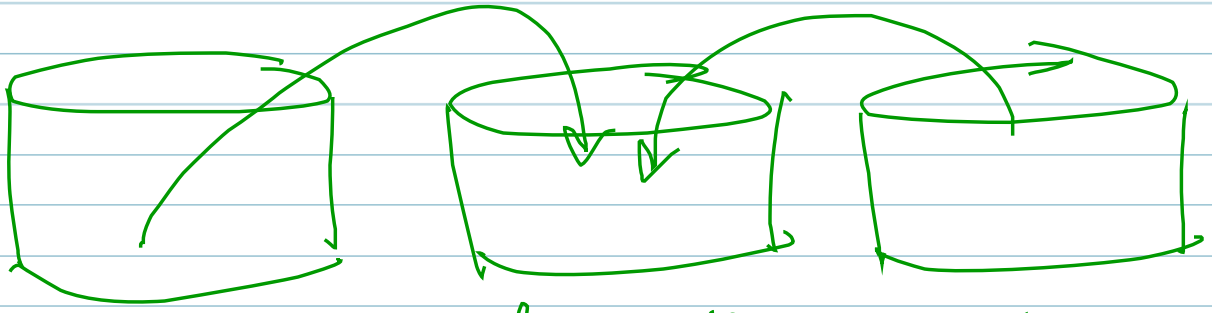
$$200\,g\,Mg_3(PO_4)_2 \times \frac{1\,mol}{262.87\,g} \times \frac{2\,mol\,K_3PO_4}{1\,mol\,Mg_3(PO_4)_2} = 1.52\,mol\ K_3PO_4$$

$$L = \frac{1.52\,mol}{3.0\,M} = 0.507 = 507\,mL \text{ of } 3.0M\ K_3PO_4$$

What is the molarity of the KNO_3 solution produced?

$M = \frac{mol}{L}$

$200\,g\ Mg_3(PO_4)_2 \times \frac{1\ mol}{262.87\ g} \times \frac{6\ mol\ KNO_3}{1\ mol\ Mg_3(PO_4)_2} = 4.56\ mol$



1140 mL
2.0 $Mg(NO_3)_2$

Volume = 1647 mL
= 1.647 L

507 mL
3.0 M K_3PO_4

$M = \frac{4.56\ mol}{1.647\ L} = 2.77\ M\ KNO_3$