

Station 1

Nitromethane burns according to the reaction:



a) What mass of H_2O is produced when 0.150g of CH_3NO_2 is burned?

$$0.150 \text{g CH}_3\text{NO}_2 \times \frac{1 \text{ mol CH}_3\text{NO}_2}{61.05 \text{g CH}_3\text{NO}_2} \times \frac{6 \text{ mol H}_2\text{O}}{4 \text{ mol CH}_3\text{NO}_2} \times \frac{18.02 \text{g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = 0.0664 \text{g H}_2\text{O}$$

b) What combined volume of gas at STP is produced if 0.316g of CH_3NO_2 is burned?

$$0.316 \text{g CH}_3\text{NO}_2 \times \frac{1 \text{ mol CH}_3\text{NO}_2}{61.05 \text{g CH}_3\text{NO}_2} \times \frac{4 \text{ mol CO}_2}{4 \text{ mol CH}_3\text{NO}_2} \times \frac{22.4 \text{ L CO}_2}{1 \text{ mol CO}_2} = 0.116 \text{ L CO}_2$$

$$\underbrace{\hspace{10em}}_{\text{"}} \times \frac{2 \text{ mol N}_2}{4 \text{ mol CH}_3\text{NO}_2} \times \frac{22.4 \text{ L N}_2}{1 \text{ mol N}_2} = 0.0580 \text{ L N}_2$$

$$0.116 \text{ L CO}_2 + 0.0580 \text{ L N}_2 = \boxed{0.174 \text{ L CO}_2 \text{ and N}_2}$$

c) What volume of O_2 at STP is required to produce 0.250g of CO_2 ?

$$0.250 \text{g CO}_2 \times \frac{1 \text{ mol CO}_2}{44.01 \text{g CO}_2} \times \frac{3 \text{ mol O}_2}{4 \text{ mol CO}_2} \times \frac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} = \boxed{0.0954 \text{ L O}_2}$$

Not so great

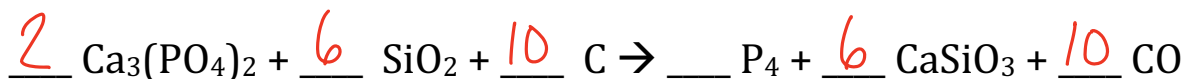
Feel a bit unsure

Confident

Super confident

Station 2

Consider the following reaction:



- a) What mass of P_4 is produced when 41.5g of $\text{Ca}_3(\text{PO}_4)_2$, 26.5g of SiO_2 and 7.80g of C are reacted?

$$41.5 \text{g Ca}_3(\text{PO}_4)_2 \times \frac{1 \text{ mol Ca}_3(\text{PO}_4)_2}{310.18 \text{ g Ca}_3(\text{PO}_4)_2} \times \frac{1 \text{ mol P}_4}{2 \text{ mol Ca}_3(\text{PO}_4)_2} \times \frac{123.88 \text{ g P}_4}{1 \text{ mol P}_4} = 8.29 \text{ g P}_4$$

$$26.5 \text{g SiO}_2 \times \frac{1 \text{ mol SiO}_2}{60.09 \text{ g SiO}_2} \times \frac{1 \text{ mol P}_4}{6 \text{ mol SiO}_2} \times \frac{123.88 \text{ g P}_4}{1 \text{ mol P}_4} = 9.11 \text{ g P}_4$$

$$7.80 \text{g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g C}} \times \frac{1 \text{ mol P}_4}{10 \text{ mol C}} \times \frac{123.88 \text{ g P}_4}{1 \text{ mol P}_4} = \boxed{8.05 \text{ g P}_4}$$

- b) How many grams of each excess reactant will remain unreacted?

$$7.80 \text{g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g C}} \times \frac{2 \text{ mol Ca}_3(\text{PO}_4)_2}{10 \text{ mol C}} \times \frac{310.18 \text{ g Ca}_3(\text{PO}_4)_2}{1 \text{ mol Ca}_3(\text{PO}_4)_2} = 40.3 \text{g}$$

$$41.5 \text{g} - 40.3 \text{g} = \boxed{1.2 \text{ g Ca}_3(\text{PO}_4)_2}$$

$$7.80 \text{g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g C}} \times \frac{6 \text{ mol SiO}_2}{10 \text{ mol C}} \times \frac{60.09 \text{ g SiO}_2}{1 \text{ mol SiO}_2} = 23.4 \text{g SiO}_2$$

$$26.5 \text{g} - 23.4 \text{g} = \boxed{3.1 \text{ g SiO}_2}$$

Not so great

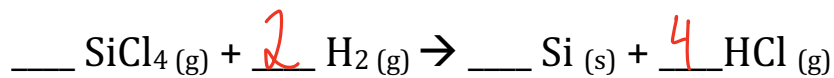
Feel a bit unsure

Confident

Super confident

Station 3

A sample of high purity silicon is prepared by strongly heating a mixture of hydrogen and silicon tetrachloride in a sealed tube:



If exactly 1.00g of silicon is ^{produced} required and the reaction is a 73.8% yield, what mass of each of SiCl₄ and H₂ must react?

$$\% \text{ yield} = \frac{\text{actual}}{\text{theoretical}} \times 100\%$$

$$73.8\% = \frac{1.00}{x} \times 100\%$$

$$\frac{1.00\text{g}}{0.738} = x = 1.36 \text{ g}_{\text{Si}} \text{ (theoretical)}$$

$$1.36 \text{ g}_{\text{Si}} \times \frac{1 \text{ mol}_{\text{Si}}}{28.09 \text{ g}_{\text{Si}}} \times \frac{1 \text{ mol}_{\text{SiCl}_4}}{1 \text{ mol}_{\text{Si}}} \times \frac{169.89 \text{ g}_{\text{SiCl}_4}}{1 \text{ mol}_{\text{SiCl}_4}} = \boxed{8.23 \text{ g}_{\text{SiCl}_4}}$$

$$1.36 \text{ g}_{\text{Si}} \times \frac{1 \text{ mol}_{\text{Si}}}{28.09 \text{ g}_{\text{Si}}} \times \frac{2 \text{ mol}_{\text{H}_2}}{1 \text{ mol}_{\text{Si}}} \times \frac{2.02 \text{ g}_{\text{H}_2}}{1 \text{ mol}_{\text{H}_2}} = \boxed{0.196 \text{ g}_{\text{H}_2}}$$

Not so great

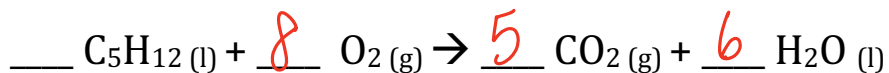
Feel a bit unsure

Confident

Super confident

Question #4:

What volume of $\text{CO}_2(\text{g})$ at STP can be made when 0.0250 L of $\text{C}_5\text{H}_{12}(\text{l})$ (density = 626.0 g/L), is reacted with 40.0 L of $\text{O}_2(\text{g})$ at STP, according to the reaction:



$$0.0250 \text{ L C}_5\text{H}_{12} \times \frac{626.0 \text{ g C}_5\text{H}_{12}}{1 \text{ L C}_5\text{H}_{12}} \times \frac{1 \text{ mol C}_5\text{H}_{12}}{72.17 \text{ g C}_5\text{H}_{12}} \times \frac{5 \text{ mol CO}_2}{1 \text{ mol C}_5\text{H}_{12}} \times \frac{22.4 \text{ L CO}_2}{1 \text{ mol CO}_2} = \boxed{24.3 \text{ L CO}_2}$$

$$40.0 \text{ L O}_2 \times \frac{1 \text{ mol O}_2}{22.4 \text{ L O}_2} \times \frac{5 \text{ mol CO}_2}{8 \text{ mol O}_2} \times \frac{22.4 \text{ L CO}_2}{1 \text{ mol CO}_2} = 25.0 \text{ L CO}_2$$

How much of the excess reactant will be left over?

$$24.3 \text{ L CO}_2 \times \frac{1 \text{ mol CO}_2}{22.4 \text{ L CO}_2} \times \frac{8 \text{ mol O}_2}{5 \text{ mol CO}_2} \times \frac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} = 38.8 \text{ L O}_2$$

$$40.0 \text{ L O}_2 - 38.8 \text{ L O}_2 = \boxed{1.2 \text{ L O}_2}$$

Not so great

Feel a bit unsure

Confident

Super confident