

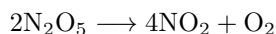
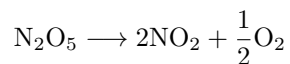
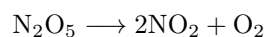
Non Sibi High School

Andover's Chem 550/580: Advanced Chemistry

Chapter 4, Review Quiz 1 Answers

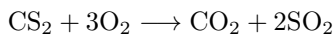
1

Balance the equation $\text{N}_2\text{O}_5 \rightarrow \text{NO}_2 + \text{O}_2$ using the smallest possible whole-number coefficients.



2

The density of CS_2 is 1.26 g/mL. Given the unbalanced equation $\text{CS}_2 + \text{O}_2 \rightarrow \text{CO}_2 + \text{SO}_2$, how many liters of CS_2 must react to produce 4.2×10^3 g of SO_2 ?



$$4.2 \times 10^3 \text{ g SO}_2 \left(\frac{1 \text{ mol SO}_2}{64.07 \text{ g SO}_2} \right) \left(\frac{1 \text{ mol CS}_2}{2 \text{ mol SO}_2} \right) \left(\frac{76.15 \text{ g CS}_2}{1 \text{ mol CS}_2} \right) \left(\frac{1 \text{ mL CS}_2}{1.26 \text{ g CS}_2} \right) \left(\frac{1 \text{ L CS}_2}{1000 \text{ mL CS}_2} \right) = 2.0 \text{ L CS}_2$$

3

Given the unbalanced equation $\text{CaCO}_3 + \text{HC}_2\text{H}_3\text{O}_2 \rightarrow \text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2 + \text{CO}_2 + \text{H}_2\text{O}$, if 16.8 grams of CaCO_3 is mixed with 11.0 grams of $\text{HC}_2\text{H}_3\text{O}_2$:

- a. Which is the limiting reagent and what maximum mass of CO_2 can form?



$$16.8 \text{ g CaCO}_3 \left(\frac{1 \text{ mol CaCO}_3}{100.1 \text{ g CaCO}_3} \right) \left(\frac{1 \text{ mol CO}_2}{1 \text{ mol CaCO}_3} \right) \left(\frac{44.01 \text{ g CO}_2}{1 \text{ mol CO}_2} \right) = 7.39 \text{ g CO}_2$$

$$11.0 \text{ g HC}_2\text{H}_3\text{O}_2 \left(\frac{1 \text{ mol HC}_2\text{H}_3\text{O}_2}{60.05 \text{ g HC}_2\text{H}_3\text{O}_2} \right) \left(\frac{1 \text{ mol CO}_2}{2 \text{ mol HC}_2\text{H}_3\text{O}_2} \right) \left(\frac{44.01 \text{ g CO}_2}{1 \text{ mol CO}_2} \right) = 4.03 \text{ g CO}_2$$

HC₂H₃O₂ produces less CO₂, so HC₂H₃O₂ is the limiting reagent and 4.03 g of CO₂ maximum can form.

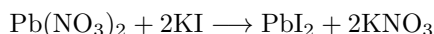
b. What mass of the excess reagent remains when the reaction is complete?

$$4.03 \text{ g CO}_2 \left(\frac{1 \text{ mol CO}_2}{44.01 \text{ g CO}_2} \right) \left(\frac{1 \text{ mol CaCO}_3}{1 \text{ mol CO}_2} \right) \left(\frac{100.1 \text{ g CaCO}_3}{1 \text{ mol CaCO}_3} \right) = 9.17 \text{ g CaCO}_3 \text{ used up}$$

$$16.8 \text{ g} - 9.17 \text{ g} = 7.6 \text{ g CaCO}_3 \text{ excess}$$

4

Given the unbalanced equation $\text{Pb}(\text{NO}_3)_2 + \text{KI} \rightarrow \text{PbI}_2 + \text{KNO}_3$, if 4.1 grams of KI react with an excess of $\text{Pb}(\text{NO}_3)_2$ and then 4.9 grams of PbI_2 are actually collected, what is the percent yield of the reaction?

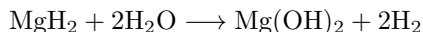


$$4.1 \text{ g KI} \left(\frac{1 \text{ mol KI}}{166.0 \text{ g KI}} \right) \left(\frac{1 \text{ mol PbI}_2}{2 \text{ mol KI}} \right) \left(\frac{461.0 \text{ g PbI}_2}{1 \text{ mol PbI}_2} \right) = 5.7 \text{ g PbI}_2 = \text{theoretical yield}$$

$$\frac{4.9 \text{ g}}{5.7 \text{ g}} \times 100\% = 86\% \text{ yield}$$

5

A 2.85 gram sample of a solid mixture contains MgH₂ as well as unreactive material. When added to water, only the MgH₂ in the mixture reacts to produce 0.0575 grams of H₂ according to the unbalanced equation $\text{MgH}_2 + \text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2 + \text{H}_2$. What is the percent by mass of MgH₂ in the mixture?



$$0.0575 \text{ g H}_2 \left(\frac{1 \text{ mol H}_2}{2.016 \text{ g H}_2} \right) \left(\frac{1 \text{ mol MgH}_2}{2 \text{ mol H}_2} \right) \left(\frac{26.33 \text{ g MgH}_2}{1 \text{ mol MgH}_2} \right) = 0.375 \text{ g MgH}_2$$

$$\frac{0.375 \text{ g MgH}_2}{2.85 \text{ g mixture}} \times 100\% = 13.2\% \text{ MgH}_2 \text{ by mass in mixture}$$



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