Non Sibi High School

Andover's Chem 300: Accelerated/Honors Chemistry

Chapter 4, Review Quiz 1 Answers

1

Balance the equation $N_2O_5 \longrightarrow NO_2 + O_2$ using the smallest possible whole-number coefficients.

$$N_2O_5 \longrightarrow 2NO_2 + O_2$$

$$N_2O_5 \longrightarrow 2NO_2 + \frac{1}{2}O_2$$

$$2N_2O_5 \longrightarrow 4NO_2 + O_2$$

2

The density of CS_2 is 1.26 g/mL. Given the unbalanced equation $CS_2 + O_2 \longrightarrow CO_2 + SO_2$, how many liters of CS_2 must react to produce 4.2×10^3 g of SO_2?

$$CS_2 + 3O_2 \longrightarrow CO_2 + 2SO_2$$

$$4.2 \times 10^3\,\mathrm{g\,SO_2}\left(\frac{1\,\mathrm{mol\,SO_2}}{64.07\,\mathrm{g\,SO_2}}\right)\left(\frac{1\,\mathrm{mol\,CS_2}}{2\,\mathrm{mol\,SO_2}}\right)\left(\frac{76.15\,\mathrm{g\,CS_2}}{1\,\mathrm{mol\,CS_2}}\right)\left(\frac{1\,\mathrm{mL\,CS_2}}{1.26\,\mathrm{g\,CS_2}}\right)\left(\frac{1\,\mathrm{L\,CS_2}}{1000\,\mathrm{mL\,CS_2}}\right) = 2.0\,\mathrm{L\,CS_2}$$

3

Given the unbalanced equation $CaCO_3 + HC_2H_3O_2 \longrightarrow Ca(C_2H_3O_2)_2 + CO_2 + H_2O$, if 16.8 grams of $CaCO_3$ is mixed with 11.0 grams of $HC_2H_3O_2$:

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

$$CaCO_3 + 2HC_2H_3O_2 \longrightarrow Ca(C_2H_3O_2)_2 + CO_2 + H_2O$$

$$16.8\,\mathrm{g\,CaCO_3}\left(\frac{1\,\mathrm{mol\,CaCO_3}}{100.1\,\mathrm{g\,CaCO_3}}\right)\left(\frac{1\,\mathrm{mol\,CO_2}}{1\,\mathrm{mol\,CaCO_3}}\right)\left(\frac{44.01\,\mathrm{g\,CO_2}}{1\,\mathrm{mol\,CO_2}}\right) = 7.39\,\mathrm{g\,CO_2}$$

$$11.0\,\mathrm{g\,HC_2H_3O_2}\left(\frac{1\,\mathrm{mol\,HC_2H_3O_2}}{60.05\,\mathrm{g\,HC_2H_3O_2}}\right)\left(\frac{1\,\mathrm{mol\,CO_2}}{2\,\mathrm{mol\,HC_2H_3O_2}}\right)\left(\frac{44.01\,\mathrm{g\,CO_2}}{1\,\mathrm{mol\,CO_2}}\right)=4.03\,\mathrm{g\,CO_2}$$

$HC_2H_3O_2$ produces less CO_2, so $HC_2H_3O_2$ is the limiting reagent and 4.03 g of CO_2 maximum can form.

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

$$4.03\,\mathrm{g\,CO_2}\left(\frac{1\,\mathrm{mol\,CO_2}}{44.01\,\mathrm{g\,CO_2}}\right)\left(\frac{1\,\mathrm{mol\,CaCO_3}}{1\,\mathrm{mol\,CO_2}}\right)\left(\frac{100.1\,\mathrm{g\,CaCO_3}}{1\,\mathrm{mol\,CaCO_3}}\right)=9.17\,\mathrm{g\,CaCO_3\,used\,up}$$

$$16.8\,\mathrm{g}-9.17\,\mathrm{g}=7.6\,\mathrm{g\,CaCO_3\,excess}$$

4

Given the unbalanced equation $Pb(NO_3)_2 + KI \longrightarrow PbI_2 + KNO_3$, if 4.1 grams of KI react with an excess of $Pb(NO_3)_2$ and then 4.9 grams of PbI_2 are actually collected, what is the percent yield of the reaction?

$$Pb(NO_3)_2 + 2KI \longrightarrow PbI_2 + 2KNO_3$$

$$4.1\,\mathrm{g\,KI}\left(\frac{1\,\mathrm{mol\,KI}}{166.0\,\mathrm{g\,KI}}\right)\left(\frac{1\,\mathrm{mol\,PbI_2}}{2\,\mathrm{mol\,KI}}\right)\left(\frac{461.0\,\mathrm{g\,PbI_2}}{1\,\mathrm{mol\,PbI_2}}\right)=5.7\,\mathrm{g\,PbI_2}=\mathrm{theoretical\,yield}$$

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

5

A 2.85 gram sample of a solid mixture contains MgH_2 as well as unreactive material. When added to water, only the MgH_2 in the mixture reacts to produce 0.0575 grams of H_2 according to the unbalanced equation $MgH_2 + H_2O \longrightarrow Mg(OH)_2 + H_2$. What is the percent by mass of MgH_2 in the mixture?

$$MgH_2 + 2H_2O \longrightarrow Mg(OH)_2 + 2H_2$$

$$0.0575\,\mathrm{g\,H_2}\left(\frac{1\,\mathrm{mol\,H_2}}{2.016\,\mathrm{g\,H_2}}\right)\left(\frac{1\,\mathrm{mol\,MgH_2}}{2\,\mathrm{mol\,H_2}}\right)\left(\frac{26.33\,\mathrm{g\,MgH_2}}{1\,\mathrm{mol\,MgH_2}}\right)=0.375\,\mathrm{g\,MgH_2}$$

$$\frac{0.375\,\mathrm{g\,MgH_2}}{2.85\,\mathrm{g\,mixture}}\times 100\%=13.2\%\,\mathrm{MgH_2\,by\,mass\,in\,mixture}$$

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