3.7 Limiting Reactants - Theoretical Yields (1405334)

Current Score: 0/13

Question	1	2	3	4	Total
Points	0/3	0/4	0/4	0/2	0/13

1. 0/3 points BLB11 3.P.074. [970291]

One of the steps in the commercial process for converting ammonia to nitric acid is the conversion of NH_3 to NO.

$4\ NH_3(g) + 5\ O_2(g) \rightarrow 4\ NO(g) + 6\ H_2O(g)$

In a certain experiment, 2.90 g of NH_3 reacts with 4.76 g of O_2.

(a) Which is the limiting reactant?

- ○ [✓] O_2
- ○ NH_3

$$4.76\text{ g } O_2 \left|\frac{1\text{ mole } O_2}{32.0\text{ g } O_2}\right|\frac{4\text{ mole NO}}{5\text{ mole } O_2}\left|\frac{30.0\text{ g}}{1\text{ mole NO}}\right| = 3.57\text{ g NO}$$

$$2.90\text{ g } NH_3 \left|\frac{1\text{ mole } NH_3}{17.03\text{ g } NH_3}\right|\frac{4\text{ mole NO}}{4\text{ mole } NH_3}\left|\frac{30.0\text{ g NO}}{1\text{ mole NO}}\right| = 5.11\text{ g NO}$$

(b) How many grams of NO form?

[ ] [✓ 3.57119] g

(c) How many grams of the excess reactant remains after the limiting reactant is completely consumed? NH_3

[ ] [✓ 0.873] g

$$4.76\text{ g } O_2 \left|\frac{1\text{ mole } O_2}{32.0\text{ g } O_2}\right|\frac{4\text{ mole } NH_3}{5\text{ mole } O_2}\left|\frac{17.03\text{ g } NH_3}{1\text{ mole } NH_3}\right| = 2.027$$

$2.90 - 2.027 = .873$

2. 0/4 points BLB11 3.P.075. [970284]

Solutions of sodium carbonate and silver nitrate react to form solid silver carbonate and a solution of sodium nitrate. A solution containing 5.25 g of sodium carbonate is mixed with one containing 7.25 g of silver nitrate. How many grams of each of the following compounds are present after the reaction is complete?

$$2\ AgNO_3 + Na_2CO_3 \rightarrow Ag_2CO_3 + 2\ NaNO_3$$

sodium carbonate

[ ] [✓ 2.99] g

$$5.25\text{ g } Na_2CO_3 \left|\frac{1\text{ mole } Na_2CO_3}{106.0\text{ g}}\right|\frac{2\text{ mole NaNO}_3}{1\text{ mole } Na_2CO_3}\left|\frac{85.0\text{ g}}{1\text{ mole NaNO}_3}\right| = 8.42\text{ g}$$

silver nitrate

[ ] [✓ 0] g

silver carbonate

[ ] [✓ 5.88] g

sodium nitrate

[ ] [✓ 3.63] g

$$7.25\text{ g } AgNO_3 \left|\frac{1\text{ mole } AgNO_3}{169.9\text{ g } AgNO_3}\right|\frac{2\text{ mole NaNO}_3}{2\text{ mole } AgNO_3}\left|\frac{85.0\text{ g}}{1\text{ mole NaNO}_3}\right| = 3.627\text{ g}$$

L.R. → zero Left

On Back →

3. 0/4 points BLB11 3.P.076. [970271]

Solutions of sulfuric acid and lead(II) acetate react to form solid lead(II) sulfate and a solution of acetic acid. If 5.00 g of sulfuric acid and 5.00 g of lead(II) acetate are mixed, calculate the number of grams of each of the following present in the mixture after the reaction is complete.

$$H_2SO_4 + Pb(C_2H_3O_2)_2 \rightarrow PbSO_4 + 2\ HC_2H_3O_2$$

5.00 g 5.00 g

sulfuric acid

98.1

[ ] [✓ 3.49] g

lead(II) acetate

325.3

[ ] [✓ 0] g

lead(II) sulfate

303.3

[ ] [✓ 4.66] g

acetic acid

60.5

[ ] [✓ 1.85] g

$$5.00\text{ g } H_2SO_4 \left|\frac{1\text{ mole } H_2SO_4}{98.1\text{ g } H_2SO_4}\right|\frac{1\text{ mole } PbSO_4}{1\text{ mole } H_2SO_4}\left|\frac{303.3\text{ g}}{1\text{ mole } PbSO_4}\right| = 15.5\text{ g } PbSO_4$$

$$5.00\text{ g } Pb(C_2H_3O_2)_2 \left|\frac{1\text{ mole}}{325.3\text{ g}}\right|\frac{1\text{ mole } PbSO_4}{1\text{ mole } Pb(C_2H_3O_2)_2}\left|\frac{303.3\text{ g}}{1\text{ mole } PbSO_4}\right| =$$

(2)(Cont)

$$\frac{7.25\text{ g } AgNO_3}{} \left| \frac{1\text{ mole } AgNO_3}{169.9\text{ g } AgNO_3} \right| \frac{1\text{ mole } Na_2CO_3}{2\text{ mole } AgNO_3} \left| \frac{106.0\text{ g}}{1\text{ mole } Na_2CO_3} \right. = 2.26\text{ g used up}$$

Started $5.26\text{ g } Na_2CO_3$

Used $2.26\text{ g } Na_2CO_3$

Remains → $\boxed{3.00\text{ g } Na_2CO_3}$

$$\frac{7.25\text{ g } AgNO_3}{} \left| \frac{1\text{ mole } AgNO_3}{169.9\text{ g } AgNO_3} \right| \frac{1\text{ mole } Ag_2CO_3}{2\text{ mole } AgNO_3} \left| \frac{275.8\text{ g}}{1\text{ mole}} \right.$$

$$= \boxed{5.88\text{ g } Ag_2CO_3}$$

4. 0/2 points BLB11 3.P.078. [970282]

When ethane (C_2H_6) reacts with chlorine (Cl_2) the main product is C_2H_5Cl; but other products containing Cl (chlorine), such as $C_2H_4Cl_2$, are also obtained in small quantities. The formation of these other products reduces the yield of C_2H_5Cl. In a certain experiment 170. g of C_2H_6 reacts with 230. g of Cl_2.

(a) Assuming that C_2H_6 and Cl_2 react only to form C_2H_5Cl and HCl, calculate the theoretical yield of C_2H_5Cl.

[ ] [209] g

(b) Calculate the percent yield of C_2H_5Cl if the reaction produced 176 g of C_2H_5Cl.

[ ] [84.1] %

Assignment Details

$$C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$$

170. g 230. g

(A)

$$170\ g\ C_2H_6 \left| \frac{1\ mole\ C_2H_6}{30.07\ g\ C_2H_6} \right| \frac{1\ mole\ C_2H_5Cl}{1\ mole\ C_2H_6} \left| \frac{64.51\ g}{1\ mole\ C_2H_5Cl} \right| = 364.71\ g$$

$$230.\ g\ Cl_2 \left| \frac{1\ mole\ Cl_2}{70.91\ g\ Cl_2} \right| \frac{1\ mole\ C_2H_5Cl}{1\ mole\ Cl_2} \left| \frac{64.51\ g}{1\ mole\ C_2H_5Cl} \right| = \boxed{209.2\ g}$$

(3) $$\%\ yield = \frac{actual\ yield}{theoritical\ yield} = \frac{176\ g}{209.2\ g} \times 100\% = \boxed{84.1\ \%}$$