Balancing Equations and Simple Stoichiometry-KEY

Balance the following equations:

1) $1\ N_2 + 3\ F_2 \rightarrow 2\ NF_3$

2) $2\ C_6H_{10} + 17\ O_2 \rightarrow 12\ CO_2 + 10\ H_2O$

3) $1\ HBr + 1\ KHCO_3 \rightarrow 1\ H_2O + 1\ KBr + 1\ CO_2$

4) $2\ GaBr_3 + 3\ Na_2SO_3 \rightarrow 1\ Ga_2(SO_3)_3 + 6\ NaBr$

5) $3\ SnO + 2\ NF_3 \rightarrow 3\ SnF_2 + 1\ N_2O_3$

Using the following equation:

$$2\ NaOH + H_2SO_4 \rightarrow 2\ H_2O + Na_2SO_4$$

6) How many grams of sodium sulfate will be formed if you start with 200 grams of sodium hydroxide and you have an excess of sulfuric acid?

? g Na_2SO_4 = 200 g NaOH → mol NaOH → mol Na_2SO_4 → g Na_2SO_4

$$200\text{ g NaOH} \times \frac{1\text{ mol NaOH}}{40.00\text{ g NaOH}} = 5\text{ mol NaOH} \times \frac{1\text{ mol }Na_2SO_4}{2\text{ mol NaOH}} = 2.5\text{ mol }Na_2SO_4$$

$$2.5\text{ mol }Na_2SO_4 \times \frac{142\text{ g }Na_2SO_4}{1\text{ mol }Na_2SO_4} = \boxed{355\text{ g }Na_2SO_4}$$

7) Using the following equation:

$$Pb(SO_4)_2 + 4\ LiNO_3 \rightarrow Pb(NO_3)_4 + 2\ Li_2SO_4$$

How many grams of lithium nitrate will be needed to make 250 grams of lithium sulfate, assuming that you have an adequate amount of lead (IV) sulfate to do the reaction?

Molar masses: $LiNO_3$ = 68.95 g/mol & Li_2SO_4 = 109.9 g/mol
? g $LiNO_3$ = 250 g Li_2SO_4 → mol Li_2SO_4 → mol $LiNO_3$ → g $LiNO_3$

$$250\text{ g }Li_2SO_4 \times \frac{\text{l mol }Li_2SO_4}{109.9\text{ g }Li_2SO_4} = 2.27\text{ mol }Li_2SO_4 \times \frac{4\text{ mol }LiNO_3}{2\text{ mol }Li_2SO_4} = 4.54\text{ mol }LiNO_3$$

$$4.55\text{ mol }LiNO_3 \times \frac{68.95\text{ g }LiNO_3}{1\text{ mol }LiNO_3} = \boxed{314\text{ g }LiNO_3}$$

Using the following equation to answer questions 8-11:

$$2\ C_6H_{10} + 17\ O_2 \rightarrow 12\ CO_2 + 10\ H_2O$$

8) If I do this reaction with 35 grams of C_6H_{10} and 45 grams of oxygen, how many grams of carbon dioxide will be formed?

When you do this calculation for 35 grams of C_6H_{10}, you find that 113 grams of CO_2 will be formed. When you do the calculation for 45 grams of oxygen, you find that 43.7 grams of CO_2 will be formed. Because 43.7 grams is the smaller number, oxygen is the limiting reagent, forming 43.7 grams of product.

9) What is the limiting reagent for problem 8? **oxygen**

10) How much of the excess reagent is left over after the reaction from problem 8 is finished?
21.5 grams of C_6H_{10} will be left over.

11) If 35 grams of carbon dioxide are actually formed from the reaction in problem 8, what is the percent yield of this reaction?
80.1%

12) Write the balanced equation for the reaction of acetic acid with aluminum hydroxide to form water and aluminum acetate:

$$3\ C_2H_3O_2H + Al(OH)_3 \rightarrow Al(C_2H_3O_2)_3 + 3\ H_2O$$

13) Using the equation from problem #1, determine the mass of aluminum acetate that can be made if I do this reaction with 125 grams of acetic acid and 275 grams of aluminum hydroxide.

Two calculations are required. One determines the quantity of aluminum acetate that can be made with 125 grams of acetic acid and the other determines the quantity of aluminum acetate that can be made using 275 grams of aluminum hydroxide. The smaller of these two answers is correct, and the reagent that leads to this answer is the limiting reagent. Both calculations are shown below – the correct answer is circled.

$$125\,g\ C_2H_3O_2H \times \frac{1\,mol\ C_2H_3O_2H}{60\,g\ C_2H_3O_2H} \times \frac{1\,mol\ Al(C_2H_3O_2)_3}{3\,mol\ C_2H_3O_2H} \times \frac{204\,g\ Al(C_2H_3O_2)_3}{1\,mol\ Al(C_2H_3O_2)_3}$$

$$= 141\,g\ Al(C_2H_3O_2)_3$$

$$275\,g\ Al(OH)_3 \times \frac{1\,mol\ Al(OH)_3}{78\,g\ Al(OH)_3} \times \frac{1\,mol\ Al(C_2H_3O_2)_3}{1\,mol\ Al(OH)_3} \times \frac{204\,g\ Al(C_2H_3O_2)_3}{1\,mol\ Al(C_2H_3O_2)_3}$$

$$= 719\ \text{grams}\ Al(C_2H_3O_2)_3$$

14) What is the limiting reagent in problem #2?

Acetic acid.

15 How much of the excess reagent will be left over after the reaction is complete?

$$275\,g\ Al(OH)_3 - \left[275\,g\ Al(OH)_3 \left(\frac{141\,g}{719\,g}\right)\right] = 221\,g\ Al(OH)_3$$