Percent, Actual, and Theoretical Yield

1) $LiOH + KCl \rightarrow LiCl + KOH$

a) I began this reaction with 20 grams of lithium hydroxide. What is my theoretical yield of lithium chloride?

b) I actually produced 6 grams of lithium chloride. What is my percent yield?

2) $C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$

a) If I start with 5 grams of C_3H_8, what is my theoretical yield of water?

b) I got a percent yield of 75% How many grams of water did I make?

3) $Be + 2\ HCl \rightarrow BeCl_2 + H_2$

My theoretical yield of beryllium chloride was 10.7 grams. If my actual yield was 4.5 grams, what was my percent yield?

4) $2\ NaCl + CaO \rightarrow CaCl_2 + Na_2O$

What is my theoretical yield of sodium oxide if I start with 20 grams of calcium oxide?

5) $FeBr_2 + 2\ KCl \rightarrow FeCl_2 + 2\ KBr$

a) What is my theoretical yield of iron (II) chloride if I start with 34 grams of iron (II) bromide?

b) What is my percent yield of iron (II) chloride if my actual yield is 4 grams?

6) $TiS + H_2O \rightarrow H_2S + TiO$

What is my percent yield of titanium (II) oxide if I start with 20 grams of titanium (II) sulfide and my actual yield of titanium (II) oxide is 22 grams?

7) $U + 3\ Br_2 \rightarrow UBr_6$

What is my actual yield of uranium hexabromide if I start with 100 grams of uranium and get a percent yield of 83% ?

8) $H_2SO_4 \rightarrow H_2O + SO_3$

If I start with 89 grams of sulfuric acid and produce 7.1 grams of water, what is my percent yield?

Key

Percent, Actual, and Theoretical Yield

1) $LiOH + KCl \rightarrow LiCl + KOH$

a) I began this reaction with 20 grams of lithium hydroxide. What is my theoretical yield of lithium chloride?

$\frac{20\ g\ LiOH}{} \left| \frac{mol\ LiOH}{24\ g} \right. = .83\ mol\ LiOH \left| \frac{1\ LiCl}{1\ LiOH} \right. = .83\ mol\ LiCl \left| \frac{42\ g\ LiCl}{mol} \right. =$

34.86 g LiCl

b) I actually produced 6 grams of lithium chloride. What is my percent yield?

$\frac{6\ g}{34.86} =$ **17%**

2) $C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 +$ **4 H_2O**

a) If I start with 5 grams of C_3H_8, what is my theoretical yield of water?

$5\ g\ C_3H_8 \left| \frac{mol}{44\ g} \right. = .11\ mol\ C_3H_8 \left| \frac{4\ H_2O}{1\ C_3H_8} \right. = .44\ mol\ H_2O \left| \frac{18\ g\ H_2O}{1\ mol} \right. =$ **7.92 g H_2O** Theoretical

b) I got a percent yield of 75% How many grams of water did I make?

$7.92 * .75 =$ **5.94 g H_2O** Actual

3) $Be + 2\ HCl \rightarrow BeCl_2 + H_2$

My theoretical yield of beryllium chloride was 10.7 grams. If my actual yield was 4.5 grams, what was my percent yield?

$\frac{4.5}{10.7} * 100 =$ **42%**

4) $2\ NaCl + CaO \rightarrow CaCl_2 + Na_2O$

What is my theoretical yield of sodium oxide if I start with 20 grams of calcium oxide?

$20\ g\ CaO \left| \frac{mol}{56\ g} \right. = .36\ mol\ CaO \left| \frac{1\ Na_2O}{1\ CaO} \right. = .36\ mol\ Na_2O \left| \frac{62\ g\ Na_2O}{mol} \right. =$ **22.32 g Na_2O**

5) $FeBr_2 + 2\ KCl \rightarrow FeCl_2 + 2\ KBr$

a) What is my theoretical yield of iron (II) chloride if I start with 34 grams of iron (II) bromide?

$$34\ g\ FeBr_2 \left|\frac{mol}{216 g}\right. = .16\ mol\ FeBr_2 \left|\frac{1\ FeCl_2}{1\ FeBr_2}\right. = .16\ mol\ FeCl_2 \left|\frac{126\ g\ FeCl_2}{mol}\right. = \boxed{20.16\ g\ FeCl_2}$$

b) What is my percent yield of iron (II) chloride if my actual yield is 4 grams?

$$\frac{4\ g}{20.16} = \boxed{19.8\%}$$

6) $TiS + H_2O \rightarrow H_2S + TiO$ (20 g TiS; ? TiO)

What is my percent yield of titanium (II) oxide if I start with 20 grams of titanium (II) sulfide and my actual yield of titanium (II) oxide is 22 grams?

Calculate theoretical first:

$$20\ g\ TiS \left|\frac{mol}{80 g}\right. = .25\ mol\ TiS \left|\frac{1\ TiO}{1\ TiS}\right. = .25\ mol\ TiO \left|\frac{64\ g\ TiO}{mol}\right. = \boxed{16\ g\ TiO}$$

Use theoretical to find % yield:

$$\text{Actual} \rightarrow 22\ g \quad \text{Theoretical} \rightarrow 16\ g \qquad \frac{22}{16} * 100 = 137.5\%$$

7) $U + 3\ Br_2 \rightarrow UBr_6$ (100 g U; ? UBr_6)

What is my actual yield of uranium hexabromide if I start with 100 grams of uranium and get a percent yield of 83% ?

Find theoretical:

$$100\ g\ U \left|\frac{mol}{238 g}\right. = .42\ mol\ U \left|\frac{1\ UBr_6}{1\ U}\right. = .42\ mol\ UBr_6 \left|\frac{718\ g\ UBr_6}{mol}\right. = \boxed{301.56\ g\ UBr_6}\ \text{Theoretical}$$

Theoretical * % = Actual:

$$301.56 * .83 = \boxed{250.3\ g}\ \text{Actual}$$

8) $H_2SO_4 \rightarrow H_2O + SO_3$ (89 g; ? g)

If I start with 89 grams of sulfuric acid and produce 7.1 grams of water (Actual), what is my percent yield?

Find theoretical:

$$89\ g\ H_2SO_4 \left|\frac{mol}{98 g}\right. = .91\ mol\ H_2SO_4 \left|\frac{1\ H_2O}{1\ H_2SO_4}\right. = .91\ mol\ H_2O \left|\frac{18\ g}{mol}\right. = \boxed{16.38\ g\ H_2O}\ \text{Theoretical}$$

Calculate % yield:

$$\text{Actual} \rightarrow 7.1\ g \quad \text{Theoretical} \rightarrow 16.38\ g \qquad \frac{7.1}{16.38} * 100 = \boxed{43.3\%}$$