High School Science Virtual Learning

Chemistry
Percent Yield

April 21st, 2020

Chemistry
Lesson: April 21st 2020

Objective/Learning Target:
The learner will be able to calculate the theoretical yield and the percent yield, given an actual yield.

Bell Ringer

1. Balance the following equation

   ___ C_2H_6 + ___ O_2 → ___ CO_2 + ___ H_2O

2. During the combustion above 1.61 grams of water are produced. How much ethane, in grams, was in the sample?

Bell Ringer Answers:

1. $2\ C_2H_6\ +\ 7\ O_2\ \rightarrow\ 4\ CO_2\ +\ 6\ H_2O$

2. $1.61\ g\ H_2O\ \times\ \dfrac{1\ mol\ H_2O}{18.02\ g\ H_2O}\ \times\ \dfrac{2\ mol\ C_2H_6}{6\ mol\ H_2O}\ \times\ \dfrac{30.08\ g\ C_2H_6}{1\ mol\ C_2H_6}\ =\ 0.896\ g\ C_2H_6$

Lesson:

When we do our gram to gram stoichiometry we are calculating something called <u>theoretical yield</u>. Which is essentially if everything goes perfect, that is the result we would get. In reality, we have all done experiments and they never turn out perfectly, so we calculate something called <u>actual yield</u>. If we divide what we actually got (actual yield) by what we could have got (theoretical yield) then multiply by 100% we get <u>percent yield</u>. This can be a measure of how "good" the experiment went.

Lesson:

Watch the following video about calculating percent yield. Be sure to take notes over the content, so you can reference them later. Theoretical and Percent Yield- Organic Chem Tutor

For additional information, go this website.

1. Write the equation for the reaction of iron (III) phosphate with sodium sulfate to make iron (III) sulfate and sodium phosphate.

2. If I perform this reaction with 25 grams of iron (III) phosphate and an excess of sodium sulfate, how many grams of iron (III) sulfate can I make?

3. If 18.5 grams of iron (III) sulfate are actually made when I do this reaction, what is my percent yield?

4. Is the answer from problem #3 reasonable? Explain.

5. If I do this reaction with 15.0 grams of sodium sulfate and get a 65.0% yield, how many grams of sodium phosphate will I make?

1. $2\,FePO_4 + 3\,Na_2SO_4 \rightarrow 1\,Fe_2(SO_4)_3 + 2\,Na_3PO_4$

2. $25\text{ g } FePO_4 \times \dfrac{1\text{ mol } FePO_4}{150.82\text{ g } FePO_4} \times \dfrac{1\text{ mole } Fe_2(SO_4)_3}{2\text{ mol } FePO_4} \times \dfrac{399.88\text{ g } Fe_2(SO_4)_3}{1\text{ mol } Fe_2(SO_4)_3} = 33\text{ g } Fe_2(SO_4)_3$

3. (18.5 / 33) x 100% = 56%

4. Yes. Any yield under 100% is reasonable under the law of conservation of mass.

5. Start by calculating theoretical yield.

$$15.0 \; g \; Na_2SO_4 \; x \; \frac{1 \; mol \; Na_2SO_4}{142.04 \; g \; Na_2SO_4} \; x \; \frac{2 \; mol \; Na_3PO_4}{3 \; mol \; Na_2SO_4} \; x \; \frac{163.94 \; g \; Na_3PO_4}{1 \; mol \; Na_3PO_4} = 11.5 \; g \; Na_3PO_4$$

Then multiply the theoretical yield by the percent yield to get the actual yield.

$$11.5 \; x \; 0.650 = 7.48 \; g \; Na_3PO_4$$

Try this practice below.

Percent Yield Worksheet (Answers are at the bottom)

Theoretical Yield and Percent Yield from Arkansas State University (Answers are at the bottom)

Additional Practice.

Theoretical Yield Practice (Answers are at the bottom)

Actual Yield and % Yield Practice (Answers are at the bottom)

Additional video to help you out, with more examples.
Pause the video and try the problems, then watch the video to check your answers.

Problem #1 at Start
Problem #2 pause at 1:37
Problem #3 pause at 2:37
Problem #4 pause at 3:26
Problem #5 pause at 4:19