Chapter 12: Stoichiometry

12.1 Everyday Stoichiometry

Practice

Questions

Use the link below to answer the following questions:

1. What does stoichiometry help you figure out?
2. What are all reactions dependent upon?
3. If I have ten hydrogen molecules and three oxygen molecules, how many molecules of water can I make?
4. What will be left over and how much?

Answers

1. How much of a compound you need or how much you made in a chemical reaction.
2. How much stuff you have.
3. Three molecules.
4. You will have four hydrogen molecules left over.

Review

Questions

1. I don’t like pickles. What would my ideal ham sandwich be?
2. How does that change the equation?
3. Will this change affect the amounts of other materials?

Answers

1. My new ham sandwich is composed of 2 slices of ham (H), a slice of cheese (C), a slice of tomato (T), and 2 slices of bread (B).
2. \( 2H + C + T + 2B \rightarrow H_2CTB_2 \)
   The amounts of other materials have not been changed, but the final composition has changed.

12.2 Mole Ratios
Practice

Questions

Do problems 1-4 at the link below:

http://myweb.astate.edu/mdraganj/Moles1.html

Answers

Check the answers with the answer key at the bottom of the page.

Review

Questions

1. If a reactant is in excess, why do we not worry about the mole ratios involving that reactant?
2. What is the mole ratio of H to N in the ammonia molecule?
3. The formula for ethanol is CH₃CH₂OH. What is the mole ratio of H to C in this molecule?

Answers

1. Because there is more than enough of that material and its amount will not affect the mole ratios of other components of the reaction.
2. 3 moles H/1 mole N.
3. There are 6 H atoms and 2 C atoms in the molecule, so there are 6H/2C or a mole ratio of H:C of 3:1.

12.3 Mass-Mole and Mole-Mass Stoichiometry

Practice

Work problems 11-20 at the link below:

http://myweb.astate.edu/mdraganj/Moles1.html

Answers

See the answer key at the bottom of the page.

Review

Questions
1. In the first problem, what would happen if you multiply grams Sn by 118.69 grams/mole Sn?
2. Why is a balanced equation needed?
3. Does the physical form of the material matter for these calculations?

**Answers**

1. Your units would be grams$^2$/mole, which would be incorrect.
2. So you can calculate mole ratios correctly.
3. No, they are included for completeness (a good habit to get into).

**12.4 Mass-Mass Stoichiometry**

**Practice**

**Questions**

Read the material at the link below, then do the mass-mass problems at the link found at the bottom of the page:


**Answers**

Click on “Go to Answers” to find solutions.

**Review**

**Questions**

1. If matter is neither created nor destroyed, why can’t we just go directly from grams of reactant to grams of product?
2. Why is it important to get the subscripts correct in the formulas?
3. Why do the coefficients need to be correct?

**Answers**

1. Grams of reactant are not equivalent to grams of product. We need to know how many molecules are involved.
2. So the molar masses can be correctly calculated.
3. So the molar ratios will be correct.

**12.5 Volume-Volume Stoichiometry**
Practice

Questions

Read the material and work the Example One practice problems at the link below:


Answers

Answers are found at the end of the sheet.

Review

Questions

1. What is Avogadro’s hypothesis?
2. How much volume is occupied by one mole of a gas at STP?
3. In the sample problem above, assume we combust 1.3 L of propane. How much CO₂ will be produced?

Answers

1. Avogadro’s hypothesis states that equal volumes of all gases at the same temperature and pressure contain the same number of gas particles.
2. 22.4 L
3. 3.9 L

12.6 Mass-Volume and Volume-Mass Stoichiometry

Practice

Questions

Answer the questions at the link below:

http://www.docbrown.info/page04/4_73calcs/MVGmcTEST.htm

Answers

Answers are provided at the link.
Review

Questions

1. What are the conditions for all gases in these calculations?
2. How can you tell if all the ratios were set up correctly?
3. Why was 2 mol CaO/2mol SO\textsubscript{2} included in the second example if it did not affect the final number?

Answers

1. Gases are at STP.
2. Units will cancel and you will be left with only the desired units for the problem.
3. It did affect the units. If it were missing the SO\textsubscript{2} values would not have cancelled and the CaO would have cancelled.

12.7 Limiting Reactant

Practice

Questions

Watch the video at the link below and answer the following questions:

http://www.sophia.org/limiting-reactant-definition/limiting-reactant-definition--2-tutorial

1. What reaction is occurring?
2. How is the reaction measured?
3. What do the balloons tell us?

Answers

1. Mg + 2HCl → MgCl\textsubscript{2} + H\textsubscript{2}.
2. By observing the amount of gas in the balloon.
3. The amount of reaction depends on the amount of Mg present.

Review

Questions

1. In the Haber reaction illustrated above, how do we know that hydrogen is the limiting reactant?
2. What if hydrogen were left over?
3. Which material would be limiting if no hydrogen or nitrogen were left over?
12.8 Determining the Limiting Reactant

Practice

Questions

Carry out the calculations on the problem set at the link below:
http://msweb.asub.edu/haines/lim-reaq%20worksheet.pdf

Answers

Answers are found on the problem set.

Review

Questions

1. Why do all mass values need to be converted to moles before determining the limiting reactant?
2. If we used 0.7 moles Ag, would it still be the limiting reactant?
3. If we ran the reaction using the original amounts of Ag and S and had 5.22 grams S left over, what might we assume about the reaction?

Answers

1. The chemical equation gives the relationships among reactants as mole quantities.
2. No, we would now require 0.35 moles S and we only have 0.312 moles, so S would now become the limiting reactant.
3. The reaction may not have gone to completion.

12.9 Theoretical Yield and Percent Yield

Practice

Questions
Work the problems found on the link below:
http://science.widener.edu/svb/tutorial/percentyieldcsn7.html

Answers

Answers are given with each problem.

Review

Questions

1. What do we need in order to calculate theoretical yield?
2. If I spill some of the product before I weigh it, how will that affect the actual yield?
3. How will spilling some of the product affect the percent yield?
4. I make a product and weigh it before it is dry. How will that affect the actual yield?

Answers

1. A balanced equation and the amount of the starting materials.
2. It will weigh less.
3. The percent yield will also be lower.
4. The moisture will be weighed as part of the product, giving a falsely elevated actual yield.