STEM Sims™

Stoichiometry Bridge

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Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.

Start learning right now about stoichiometry. Take the following brief quiz to see how much you already know about this useful chemical method. See the bottom of page 4 to check your answers.

1. The Greek origin of stoichiometry is from their word, “stoikheion.” What did the word *stoikheion* mean?
   a. two at a time
   b. one of a row
   c. the measure of
   d. the distance of

2. Which chemist is credited with coining the word, “stoichiometry?”
   a. de Broglie
   b. Dalton
   c. Richter
   d. Avogadro

3. What does the term “mole” represent in chemistry?
   a. the grams of product formed
   b. the grams of reactant used
   c. the formula mass of a substance
   d. a specific number of things

4. If a mole (furry animal) could dig a mole of holes, how many holes could a mole of moles dig?
   a. 6.02×10^{23} holes
   b. 12.04×10^{46} holes
   c. 18.06×10^{69} holes
   d. 24.08×10^{92} holes

5. A new element with atomic number 119 was discovered that had an atomic weight of 297 atomic mass units. What would be the mass (in grams) of 6.02×10^{23} atoms of this new element?
   a. 119 grams
   b. 602 grams
   c. 1.000 gram
   d. 297 grams

Got Gas?

A common commercial remedy for an upset stomach is Alka-Seltzer™. The mass breakdown for each tablet is 30.85% citric acid, 59.12% sodium bicarbonate, and 10.03% aspirin. When added to water, the citric acid and sodium bicarbonate react to form carbon dioxide gas that is released into the air. Water and trisodium citrate are the other two products formed in the reaction. Your task is to find the mole-to-mole ratio of sodium bicarbonate to carbon dioxide for this reaction.

Materials Required

- 2- Alka-Seltzer™ tablets
- Water source
- 1- 500-mL cup or beaker
- 1- 100-mL graduated cylinder
- 1- stirring rod
- 1- balance

Procedure

1. Add about 100 mL of water to the cup.
2. Find and record in Table 1 the mass of the cup and the water.
3. Find and record in Table 1 the mass of the two tablets.
4. Add the masses from steps 3 and 4 and record this sum in Table 1.
5. Drop the two tablets into the cup. Stir gently until all the bubbles are released.
6. Find and record in Table 1 the new mass of the cup and substances.

Table 1.

Mass cup + water (grams)	
Mass two tablets (grams)	
Starting mass cup + water + two tablets (grams)	
Final mass cup + water after bubbling stops (grams)	

Calculations

1. **Calculate the mass of sodium bicarbonate in the two tablets using the % information.**
2. **Calculate the number of moles of sodium bicarbonate using the gram formula mass of sodium bicarbonate = 84.0 grams/mole.**
3. **Calculate the mass of carbon dioxide lost by subtracting the final mass (cup + water after bubbling stops) from the starting mass (cup + water + two tablets).**
4. **Convert the moles of carbon dioxide lost using the gram formula mass of carbon dioxide = 44.0 grams/mole.**
5. **Find the mole ratio of sodium bicarbonate to carbon dioxide by dividing the answer from calculation #2 by the answer from calculation #4.**

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Start Your Counting

The extremely small size of a typical atom means that even a very small measurable mass, such as the mass of a paper clip, would contain an unbelievably large number of atoms. A chemist named Avogadro helped resolve this large number problem by creating a term that describes a specific number of things. His term, called the mole, represents a tremendously massive number of things. In fact, one *mole* equals exactly 6.02×10^{23} things. In honor of the chemist, 6.02×10^{23} is often referred to as Avogadro's number.

Most people have a very tough time imagining this large number of things in their daily lives. For instance, how high do you think one mole of pennies stacked on top of each other would rise? A few hundred feet? A hundred or thousand miles up? Can you believe that one mole of stacked pennies would actually rise to a height of over 900,000,000,000,000,000 miles up from the surface of the earth? That distance is greater than the distance across our entire Milky Way galaxy!

Here is another example of the extreme size of one mole. There are currently about 327,000,000 people living in America. If every person started counting today and could count 100 numbers each minute every minute of each and every day, it would still take over 35 *million years* to count to Avogadro's number. That's how large the number called the mole is, which in turn, reflects how small atoms are in size.

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Answers: Page 2 Answers: 1) b, 2) c, 3) d, 4) b, 5) d. **Page 3 Got Gas? Answers:** The mole-to-mole ratio for sodium bicarbonate to carbon dioxide should be about 1:1.

The Science Fair Kits project was funded in part under the Department of Homeland Security Science and Technology Directorate grant contract #N10PC20003. Its contents are solely the responsibilities of the authors and do not necessarily represent the official views of the Department of Homeland Security.