Neutralizing an Acid and a Base

Balancing Act

Part 1 – Making predictions

1. Write your predictions for the following:

   a. Is it possible to neutralize baking soda with vinegar?

   b. If so, how many drops do you predict it will take to neutralize 0.5 gram of baking soda? If you double the amount of baking soda to 1.0 grams, how many drops will it take to neutralize the 1.0 grams?

Answers will vary. One group answered as follows: We think we will be able to neutralize the baking soda if we carefully add the right amount of vinegar. For 0.5 gram of baking soda, we predict it will take 17 drops of vinegar. Since 1.0 is the double of 0.5, we predict it will take double the number of drops, which will be 34 drops.

Part 2 – Can a solution of baking soda be neutralized with vinegar?

Table 1: Initial and final pH readings when adding vinegar to baking soda (mass 1)

Mass of Baking Soda	Initial pH	Final pH	Drops of Vinegar
0.5 g	8.54	7.05	90

Part 3 – Neutralizing double the concentration of baking soda

Table 2: Initial and final pH readings when adding vinegar to baking soda (mass 2)

Mass of Baking Soda	Initial pH	Final pH	Drops of Vinegar
1.0 g	8.54	7.05	176

Answering the Question

Analysis

1. How did your predictions in Part 1 compare to your results in Parts 2 and 3?

   Answers will vary. One group answered as follows: It took a lot more vinegar than we predicted to neutralize our baking soda solutions. We predicted 17 drops for 0.5 grams, but it actually took 90 drops! Then, we predicted 34 drops for 1.0 grams, and it actually took 176 drops. The only part of our prediction that was even close was that we thought it would take double the vinegar to neutralize double the baking soda.

2. For Part 2, were you able to neutralize the baking soda? How many drops did it take?

   Answers will vary. One group answered as follows: We were able to neutralize the baking soda, with 90 drops of vinegar. We are not 100% positive it was exactly 90 drops, because some drops clung to the pipet and would not fall in until they got bigger, so they could have been bigger than one whole drop.

3. For Part 3 were you able to neutralize the double concentration of baking soda? How many drops did it take?

We did get the double amount of baking soda neutralized. It took 176 drops.

4. How did the number of drops compare between Parts 2 and 3?

It was almost double the number of drops between Parts 2 and 3, because 90 x 2 = 180, and we used 176 drops for neutralizing the baking soda in part 3.

5. What does neutralization mean to you?

Neutralization means to make the pH get as close to 7.0 as possible by adding exactly the right amount of acid to the base. It is like canceling out a base with an acid.

6. How did the endpoints for Parts 2 and 3 compare?

For part 2 the endpoint was 7.05, and for part 3 it was 7.03. If we had added more drops, the pH might have gone below 7.0, but we were trying to get exactly 7.0, which was difficult.

Multiple Choice

Circle the best answer or completion to each of the questions or incomplete statements below.

1. When an acid is_____with a base, a salt is formed.

   A. De-mineralized
   B. Neutralized
   C. Revived

2. We used the_____to determine when the acidic solution is neutralized.

   A. pH sensor
   B. Motion sensor
   C. Neutral sensor

3. We added acid to the base until its pH_____and we measured a pH of 7.

   A. De-mineralized
   B. Neutralized
   C. Revived

4. Water is a neutral solution and is neither a/an_____or base.

   A. Neutron
   B. Base
   C. Acid

5. A basic substance has a_____of 9.

   A. pH
   B. pH sensor
   C. Base

Key Term Challenge

Fill in the blanks from the randomly ordered words below. Note that words may be used more than once:

acid	neutralize	pH scale	pH neutral
pH sensor	base	salt	de-mineralize

1. A/an pH sensor is used to measure the pH of a solution.

2. A/an base is a substance that forms hydroxide ions (OH^-) in water and has a pH above 7.

3. A compound formed by a metal such as sodium and a halogen such as chlorine, often as a result of an acid-base neutralization, is called a/an salt.

4. The pH scale measures how acidic or basic a solution is.

5. Any substance with a pH of 7 is called neutral.

6. A substance or solution that tastes sour, and has a pH below 7 is called a/an acid.

7. To neutralize means to bring an acidic or basic solution to a pH of 7.