Finding the Balance

Plan a fair test of an acid-base reaction

PS.6.d "Plan and carry out investigations concerning neutralization reactions and describe the properties of the reactants and products."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline properties of the acid, base, and final mixture, and circle measurements the team uses to judge whether neutralization occurred.

Two Clear Liquids

1. Two clear liquids on a lab bench can behave very differently. One beaker holds dilute hydrochloric acid, HCl, with a pH below 7. Another holds dilute sodium hydroxide, NaOH, with a pH above 7. Both can irritate skin and eyes, so a lab team wears goggles, uses small amounts, and never tastes a solution. When these liquids react, the acid and base form water, H_2O, and sodium chloride, NaCl, a salt that remains dissolved. The team wants to find how much base brings a measured acid sample close to neutral.

2. First, the team pours 20 milliliters of acid into a clean cup and records its starting pH. Using a dropper, they add base one milliliter at a time, stir, and measure pH after each addition. They record the total volume of base added and stop when the pH is close to 7. They use fresh acid for two more trials, keeping the acid volume and the concentrations of both solutions the same. The team rinses the pH probe between readings to avoid carrying one solution into the next. A teacher handles any spills and directs cleanup.

3. At the starting point, the acid sample has a pH below 7. As base is added, its pH usually rises because the acid is being consumed. Near the stopping point, the mixture contains dissolved sodium chloride and water and has a pH near 7. It is not automatically safe to drink or touch. If too much base is added, the pH can climb above 7. Comparing the base volumes from three trials helps the team spot an unusual result. A pH reading shows how the mixture changed, while the known reactants help identify the products.

2 ANSWER WITH EVIDENCE

Use the passage

1. Why does the team keep the acid volume and both solution concentrations the same in all three trials?

2. One trial ends at pH 10. What probably happened, and what does that pH tell you about the mixture?

3. How do the pH values describe the two reactants and the mixture near the stopping point?

4. A classmate says the mixture near pH 7 contains only water. How would you correct that claim?

3 YOUR TURN

Your own words

Plan a follow-up test to find out whether doubling the starting acid volume changes how much base is needed to reach pH near 7. State your two acid volumes, what you will keep the same, what you will measure and repeat, one safety step, and what the final mixtures will contain.

ANSWER KEY

Finding the Balance

PART 1 · READ AND MARK

Underline properties of the acid, base, and final mixture, and circle measurements the team uses to judge whether neutralization occurred. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Why does the team keep the acid volume and both solution concentrations the same in all three trials?	**Keeping them the same makes the trials comparable, so differences in the base volume needed are easier to spot.**
2	One trial ends at pH 10. What probably happened, and what does that pH tell you about the mixture?	**The team probably added too much base. The mixture is basic because its pH is above 7.**
3	How do the pH values describe the two reactants and the mixture near the stopping point?	**The acid has a pH below 7, the base has a pH above 7, and the mixture near the stopping point has a pH near 7.**
4	A classmate says the mixture near pH 7 contains only water. How would you correct that claim?	**The reaction forms water and sodium chloride, which remains dissolved in the mixture.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I will test 20 milliliters and 40 milliliters of acid. I will use the same concentrations of acid and base in every trial. Wearing goggles, I will add base one milliliter at a time and measure pH after stirring. I will record the total base volume needed to reach pH near 7 and repeat each test three times with fresh acid. Each final mixture will contain water and dissolved sodium chloride. I will compare the base volumes needed for the two starting acid volumes.

Accept plans that compare two acid volumes while holding both solution concentrations constant, measure base volume at a stated pH endpoint, repeat trials, include a safety step, and identify water and dissolved sodium chloride in the final mixtures.