Reaction Detectives

Plan comparisons and use evidence to explain chemical changes

CHE.6.2 "Plan, conduct, and communicate the results of investigations to demonstrate different types of simple chemical reactions."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline an observed change at each station, circle its comparison setup, and number the three reaction patterns in the order the stations demonstrate them.

Three Stations, Three Changes

1 In a classroom investigation, students compare three ways substances can change. In synthesis, simpler reactants combine; in decomposition, one compound breaks apart; in single replacement, an element takes the place of another in a compound. At the first station, each group puts equal tufts of steel wool in two jars. They moisten one tuft and leave the other dry, then loosely cover both jars and place them side by side. Two days later, the moist wool has a reddish-brown coating, while the dry wool remains mostly gray. Iron has reacted with oxygen in the air to form iron oxides.

2 At the second station, groups pour equal amounts of 3% hydrogen peroxide into two clear cups. They add a small amount of yeast to one cup and leave the other without yeast. The yeast cup bubbles rapidly; the comparison cup has few visible bubbles during the same minute. A teacher's oxygen sensor confirms that oxygen builds up above the bubbling liquid. Hydrogen peroxide can break down into water and oxygen, and an enzyme in yeast speeds that change. Students wear goggles and never taste the liquids. They record how long each cup bubbles instead of calling all bubbles proof of oxygen.

3 At the third station, students place a clean iron nail in blue copper sulfate solution. A matching cup of the same solution contains no nail. After ten minutes, a reddish copper coating appears on the nail, and the liquid around it becomes paler. The comparison cup stays blue. Iron atoms enter solution as iron ions while copper ions become copper metal on the nail. Students wear goggles and gloves, then give both cups to the teacher for chemical waste collection. Their report separates observations, such as the coating, from an explanation about which element replaced another.

2 ANSWER WITH EVIDENCE

Use the passage

1. Which reaction type fits the steel wool station? Explain how the dry tuft helps students interpret the reddish-brown coating.

2. Which reaction type fits the hydrogen peroxide station? Give one observation that shows a change occurred and the evidence that identifies the gas.

3. At the nail station, which element takes the place of another? Use two reported results to support your answer.

4. A student writes, “Bubbles prove that the yeast produced oxygen.” Revise this claim using the investigation’s evidence.

3 YOUR TURN

Your own words

Plan a new investigation using vinegar and baking soda to study a gas-producing reaction. Describe a comparison, steps and safety precautions, then predict what you would observe and explain what that observation could and could not prove.

ANSWER KEY

Reaction Detectives

HIGH SCHOOL · CHE.6.2

PART 1 · READ AND MARK

Underline an observed change at each station, circle its comparison setup, and number the three reaction patterns in the order the stations demonstrate them. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Which reaction type fits the steel wool station? Explain how the dry tuft helps students interpret the reddish-brown coating.	**Synthesis: iron combines with oxygen to form iron oxides. The mostly gray dry tuft provides a comparison that supports the conclusion that moistening the wool affected the change.**
2	Which reaction type fits the hydrogen peroxide station? Give one observation that shows a change occurred and the evidence that identifies the gas.	**Decomposition: hydrogen peroxide breaks down into water and oxygen. Rapid bubbling shows a change, and the oxygen sensor identifies the gas.**
3	At the nail station, which element takes the place of another? Use two reported results to support your answer.	**Iron takes the place of copper in the solution, a single replacement reaction. Copper coats the nail, and the blue solution around it becomes paler.**
4	A student writes, "Bubbles prove that the yeast produced oxygen." Revise this claim using the investigation's evidence.	**The bubbling shows that gas is being released, but bubbles alone do not identify it. The teacher's oxygen sensor provides evidence that the gas is oxygen.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would put equal amounts of vinegar in two open cups and add a measured spoonful of baking soda to only one. I would wear goggles and keep both cups on a tray. I predict that the cup with baking soda would fizz while the vinegar-only cup would not. The comparison would help show that mixing the substances caused gas to form. Fizzing would not prove which gas formed, so I would report its identity as unconfirmed without another test.

Accept answers that connect each reaction pattern to the reported evidence and use the comparisons appropriately. In Part 3, students should distinguish a predicted observation from a result they actually collected.