

**CHEMLAB****6**

# Explore Chemical Changes

**Background** Most reactions can be classified into five major types. As you carry out this investigation, you'll observe examples of each of these types. In doing so, you will also learn to recognize many of the physical changes that accompany reactions.

## QUESTION

What are some of the physical changes that indicate that a reaction has occurred?

## OBJECTIVES

- **Observe** physical changes that take place during chemical reactions.
- **Compare** changes that take place during different types of chemical reactions.

## MATERIALS

125-mL flasks (4)	large test tube and one-hole stopper with glass tube and rubber tubing attached
balance	calcium carbonate
hot plate	test-tube clamp
watch glass	0.1M CuSO <sub>4</sub>
spatula	granular copper (Cu)
stirring rod	powdered sulfur (S)
lab burner	(CaCO <sub>3</sub> ), finely ground
file	saturated Ca(OH) <sub>2</sub> solution (limewater)
new penny	6M HCl
250-mL flask	0.5M Na <sub>2</sub> CO <sub>3</sub>
ice	0.5M CuCl <sub>2</sub>
tongs	
100-mL graduated cylinder	
ring stand	

## PROCEDURE

1. Read and complete the lab safety form.
2. For each of the following reactions, record in the data table all changes that you observe.

### Synthesis Reaction

1. Place 50 mL of 0.1M CuSO<sub>4</sub> in a 125-mL flask.
2. Place 1.6 g granular copper and 0.8 g powdered sulfur on a watch glass and mix together thoroughly with a spatula.
3. Heat the flask on a hot plate set at high until the solution begins to boil.
4. Stir the Cu/S mixture into the boiling CuSO<sub>4</sub> solution.
5. Continue boiling until a black solid forms.

### Decomposition Reaction

1. Place 100 mL of saturated Ca(OH)<sub>2</sub> solution (limewater) in the 250-mL flask.
2. Add finely ground CaCO<sub>3</sub> to a large test tube until it is one-fourth full. Stopper the tube with the stopper/glass tube/rubber tubing assembly, and clamp the tube to the ring stand.
3. Light a laboratory burner, and begin to heat the test tube. Submerge the end of the rubber tubing into the limewater so that any gas produced in the tube will bubble through the limewater.
4. Continue heating the CaCO<sub>3</sub> until you observe a change in the limewater. The presence of CO<sub>2</sub> causes limewater to become cloudy.

## SAFETY PRECAUTIONS



**WARNING:** Use care when handling hot objects. Dispose of the reaction mixture and products as instructed by your teacher.

**Single-Displacement Reaction**

1. Place 30 mL 6M HCl in a 125-mL flask.
2. Using a file, cut six 0.2-cm notches evenly spaced around the perimeter of a new penny.
3. Place the penny in the flask of acid and leave it in a fume hood overnight.

**Double-Displacement Reaction**

1. Add 25 mL 0.5M  $\text{Na}_2\text{CO}_3$  and 25 mL 0.5M  $\text{CuCl}_2$  to a 125-mL flask.
2. Swirl the flask gently until you observe the formation of a precipitate.

**Combustion Reaction**

1. Light a laboratory burner and adjust the air and gas supplies until the flame is blue. Observe what happens.
2. Using tongs, hold a flask or beaker with ice in it about 10 cm over the flame for approximately one minute. Move the flask away from the flame and observe the bottom of the flask.

**ANALYZE AND CONCLUDE**

1. **Infer** Which observations noted during each of the reactions indicated that a reaction had occurred?

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2. **Compare and Contrast** What did all of the reactions have in common?

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3. **Determine** Write the name and formula of the  
a) black solid formed in the synthesis reaction.

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- b) gaseous product of the decomposition reaction.

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- c) solid product of the decomposition reaction.

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- d) pale blue precipitate in the double-displacement reaction.

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- e) liquid product of the combustion reaction.

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4. **Explain** how the penny changed during the single-displacement reaction. What would happen if a pre-1983 penny, which is solid copper, were used?

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5. **Recognize** Is energy a reactant or product of the combustion reaction?

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**CHEMLAB****6****APPLY AND ASSESS**

- 1. Error Analysis** Were there any physical changes that often occur during a reaction that you did not observe while doing this ChemLab? If so, what were they?

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- 2. Apply** Write balanced chemical equations for all of the reactions carried out.

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**INQUIRY EXTENSION**

**Analyze and Explain** During the single-displacement reaction, did all of the pennies tested by your class react in the same way? Explain why some pennies might react differently than others.

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**DATA AND OBSERVATIONS**

Data Table	
Reaction	Observations
Synthesis	
Decomposition	
Single displacement	
Double displacement	
Combustion	