# Chemical Changes

## Goals

- Observe and record chemical changes.
- Design and carry out experiments to identify chemicals in consumer products.
- Use proper small-scale techniques to produce reproducible results.

## Introduction

A chemical change involves the reaction of starting materials (reactants) to form new materials (products). Chemical changes are often visible to the naked eye in the form of color changes, a solid forming out of solution (precipitation) or gas formation. When two chemicals are mixed in the same proportions under the exact same conditions they will react in exactly the same way every time! By recording what you see when two solutions are mixed you document the chemical change. This information can be used to identify unknowns or to describe changes on a submicroscopic level.

### *Descriptions of liquids*

Liquids and solutions have a number of properties that allow them to be distinguished from one another. Proper description of a liquid should include both the color and clarity. Water for instance is described as clear and colorless. It is clear because there are no particulates floating in the liquid and light is transmitted through it. Water is lacking in a color so it is colorless. Milk on the other hand is opaque and white.

### *Descriptions of precipitates*

A precipitate is a solid material that results from the chemical reaction of two liquids or solutions. Precipitates are described on the basis of color, consistency and distribution. Precipitates greatly vary in appearance. Some precipitates may look like crystalline solids sitting at the bottom of a solution while others may look like muddy water (solid in suspension). To accurately describe solids we note their color followed by an appropriate adjective or two. Examples of appropriate adjectives are: milky, cloudy, sticky, clumpy, grainy, granular, free-flowing …… the list goes on.

In today's lab you will practice combining prepared solutions in a reproducible manner to observe whether a change occurs. You will study some of the chemicals in common consumer products. Based on all of your experience in mixing, you will try to make conclusions about the content of these consumer products.

## Safety

Act in accordance with the laboratory safety rules of Cabrillo College.
Wear safety glasses at all times.
Avoid contact* with all chemical reagents and dispose of reactions using appropriate waste container.

*Contact with silver nitrate ($AgNO_3$) will stain the skin.

## Materials

Reagent Central chemicals include microburets filled with the following solutions:

sodium hydrogen carbonate ($NaHCO_3$)
sodium hydrogen sulfate ($NaHSO_4$)
phenolphthalein (phen)
starch
ammonia ($NH_3$)
sodium hypochlorite (NaOCl)
lead (II) nitrate ($Pb(NO_3)_2$)
copper (II) sulfate ($CuSO_4$)
hydrochloric acid (HCl)
FD&C No. 1 (blue dye)
potassium iodide (KI)
calcium chloride ($CaCl_2$)
sodium carbonate ($Na_2CO_3$)

This will damage your clothing!
silver nitrate ($AgNO_3$)
sodium hydroxide (NaOH)

Equipment: Empty pipet for stirring Lab top reaction surface

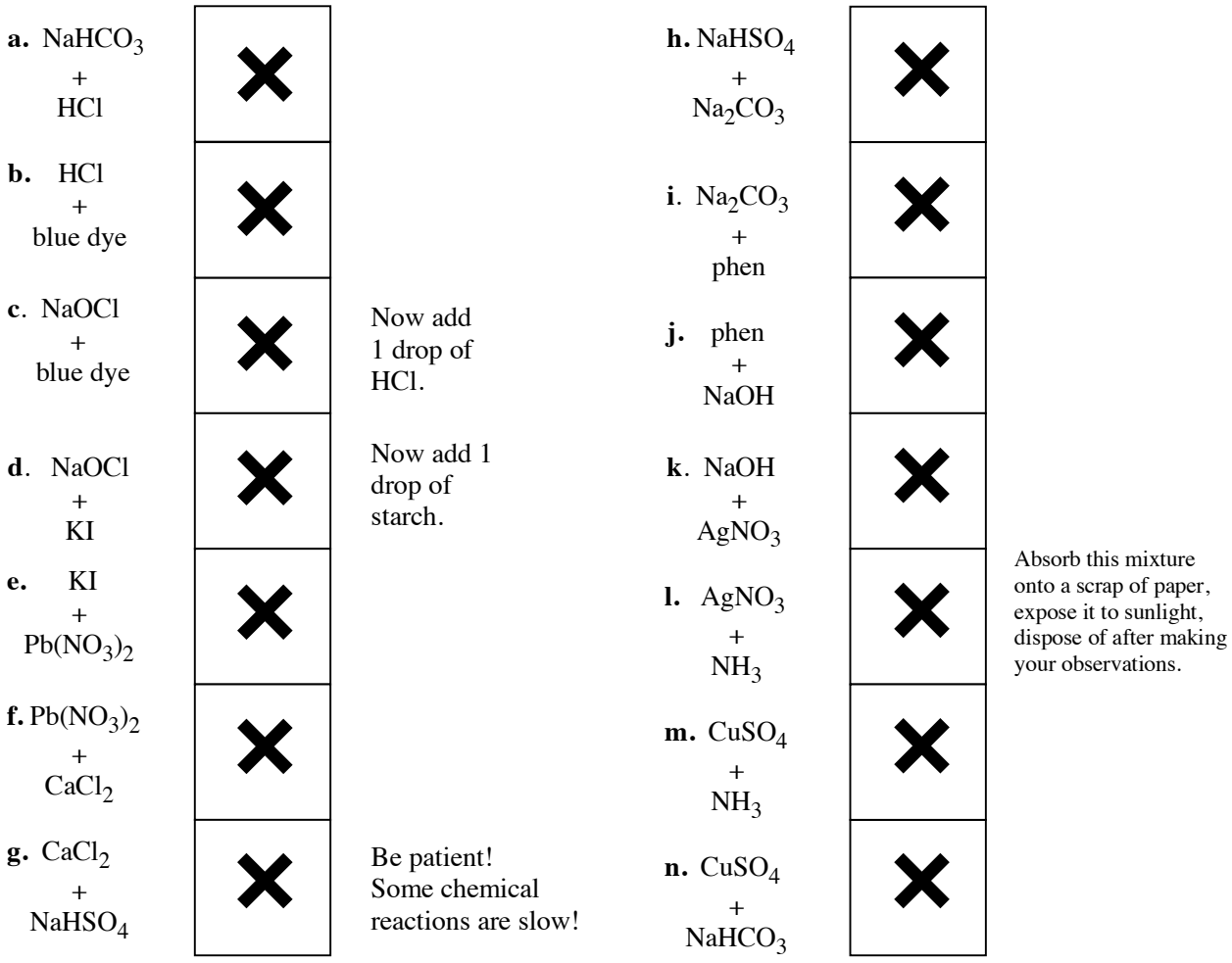
## Experimental Procedure

1. Use small-scale microburets to put 2 drops of each chemical on the ×'s in the indicated spaces below. For background contrast, view the drops on black and white backgrounds provided by the ×'s. Stir each mixture by blowing air through an empty pipet (see p. 14). Record what you see in your lab notebook (see the Data Organization Suggestions section for further details). Do not clean your surface yet.

2. Test several foods for the presence of starch. If you don't know how to do this, answer the questions in the Data Analysis section. If you still don't know how to test for starch, ask your instructor.

3. Avoid contamination by cleaning up in a way that protects you and your environment. Carefully clean the small-scale reaction surface by absorbing the contents onto a small square of tissue paper or paper towel. Dispose of the paper in the appropriate waste bin. Wipe the surface with a damp towel and then dry it. Wash your hands with soap and water before leaving the lab.

**Reaction Guide:** Insert this page into the labtop. Mix one drop of each, using a long stem pipet to blow air past the droplet to complete the mixing.



## Data Organization Suggestions

Data is most useful when it is recorded neatly in tabular form (don't crowed your work). This section is meant to be a guide only. You may use whatever format you like for recording data. However, the data in the laboratory notebook should be clearly organized so that anyone *knowledgeable* in chemistry can understand your observations.

Because we are looking at chemical changes it is beneficial to have initial observations and final observations so that the *change* is apparent. Try using the following format:

| | Initial Observations Reactants | | | | Final Observations Product |
|---|---|---|---|---|---|
| a. | $NaHCO_3$ | + | HCl | → | Product |
| | clear & colorless solution | | clear & colorless solution | | clear & colorless solution with gas formation |
| b. | HCl | + | blue dye | → | Product |
| | clear & colorless solution | | clear & blue solution | | clear & green solution |

For those reactions that involve three steps you can break them down as follows:

| | | | | | |
|---|---|---|---|---|---|
| c. | blue dye | + | NaOCl | → | Product |
| | clear & blue solution | | clear & colorless solution | | clear & blue solution |
| | NaOCl/blue dye product | + | HCl | → | Product |
| | clear & blue solution | | clear & colorless solution | | clear & yellow solution |

When testing foods for the presence of starch you must include a detailed description of your procedure along with the acquired data. Your procedure should be detailed enough so that any member of our class could reproduce your results exactly! Follow a similar data table as above to organize your observations.

## Data Analysis

Answer the following questions in your laboratory notebook using complete sentences.

1. Sodium hydrogen carbonate, $NaHCO_3$, is also known as sodium bicarbonate or more commonly as baking soda. When HCl is added to sodium bicarbonate, bubbles of carbon dioxide form. Write the formula for carbon dioxide. What common consumer products contain this gas?

2. Which of the other combinations form bubbles?

3. The body uses hydrochloric acid, HCl, to help digest food. Where in the body do you think HCl is found? What color does blue food dye turn when HCl is added?

4. Sodium hypochlorite, NaOCl, is a common ingredient in household bleaches and cleansers. What happened to the color of blue dye when both HCl and NaOCl are added?

5. Potassium iodide, KI, is the source of iodine in iodized salt. What color is the KI + NaOCl mixture? What color does starch change to in the presence of KI and NaOCl?

6. A precipitate is a solid that separates upon mixing solutions. Which reaction produced a very bright yellow precipitate?

7. Which other mixings produced precipitates? Describe their colors and textures appropriately.

8. Which mixture produced a precipitate that was very slow to form?

9. Which solutions produced a distinctive brown precipitate? Describe that color.

10. Look at the scrap of paper you used to absorb the silver nitrate and ammonia mixture. What evidence do you see that indicates that silver compounds are light sensitive? Can you think of any way that this chemical change could be used for some application or useful purpose?

11. What were three observations that indicated the formation of a new substance?

12. Which foods contained starch? Is this consistent with what you would have predicted from your personal knowledge of food science? Explain.