

## Activity 3.3

### Using color to see how liquids combine

#### Can you tell a difference between liquids by the way they look when they combine with water?

In this and the following activity, students will use a different method to observe another characteristic property of water, salt water, alcohol, and detergent solution. The liquids will be colored yellow so that students can observe the different ways they combine with water that has been colored blue. After carefully observing the combining liquids in this activity, students will be able to identify these same yellow liquids, labeled **A**, **B**, **C**, and **D**, in *Activity 3.4*.

#### Materials needed for each group

Tap water  
Isopropyl rubbing alcohol (70%)  
Detergent  
Salt  
5 Droppers (4 labeled droppers from the previous activities + 1 additional)  
5 Small cups (4 labeled cups from the previous activities + 1 additional)  
Crayons or colored pencils  
Toothpicks  
Paper towels  
Yellow food coloring  
Blue food coloring

#### Notes about the materials

- **Be sure you and the students wear properly fitting goggles.**
- **When using isopropyl alcohol, read and follow all warnings on the label.**
- Reuse labeled cups and droppers from *Activities 3.1* and *3.2*.
- Only the teacher will need yellow and blue food coloring when preparing the solutions.
- To prevent spills, tape cups to the desk or table so that the cup and dropper do not fall over.

## Preparing materials

- Make new solutions for the class according to the following procedure. These recipes make  $\frac{1}{4}$  cup of each solution, which is enough for 8 groups to conduct the activity.
  - **Water**—Use  $\frac{1}{4}$  cup regular tap water.
  - **Salt water**—Add 1 tablespoon salt to  $\frac{1}{4}$  cup tap water.
  - **Alcohol**—Use  $\frac{1}{4}$  cup 70% isopropyl alcohol. This is a common household strength.
  - **Detergent**—Add 1 teaspoon clear, colorless, liquid hand soap or detergent to  $\frac{1}{4}$  cup tap water. Stir gently.
- Add 2 drops of yellow food coloring to each solution
- Place about 1 teaspoon of each solution into its labeled cup. These solutions will be reused in *Activity 3.4* along with another set of solutions (p. 149). Cover the solutions to store them between activities.
- Add 4 drops of blue food coloring to  $\frac{1}{2}$  cup of tap water.
- Label one small cup **water** for each group.
- Label one dropper **W** for the blue water.
- Then place about 2 teaspoons of this blue water into the newly labeled cups.

## Testing sheet

Make 3 or 4 copies of *Testing sheet 3.3—Using color to see how liquids combine*, p. 146. (This page contains two testing sheets, and each group will need only one.) Cut along the dotted lines and laminate each testing sheet. If you do not have access to a laminating machine, place each chart in a sandwich-sized zip-closing plastic bag, seal it, and have student groups tape each bag to the desk or table. These testing sheets can be reused.

## Activity sheet



Copy *Activity sheet 3.3—Using color to see how liquids combine*, p. 147, and distribute one per student when specified in the activity.

Students will refer to this completed activity sheet as they attempt to identify the unknown liquids in *Activity 3.4*.

## Assessment

An assessment rubric for evaluating student progress during this activity is on pp. 153–154. For this formative assessment, check a box beside each aspect of the activity to indicate the level of student progress. Evaluate overall progress for the activity by circling either “Good”, “Satisfactory”, or “Needs Improvement”.

## Activity 3.3

### Using color to see how liquids combine

#### Question to investigate

## Can you tell a difference between liquids by the way they look when they combine with water?

### 1. Have students combine a small amount of each of the yellow liquids with blue water.

As you explain the following procedure, discuss with students the importance of using each dropper for one liquid only so that liquids are not accidentally mixed in the cups. Students should also use a clean toothpick as they combine each pair of liquids. Point out that the test would be most fair if they pulled the blue liquid to the yellow liquid each time.



Distribute *Activity sheet 3.3—Using color to see how liquids combine* along with one laminated *Testing sheet 3.3—Using color to see how liquids combine* for each group. Students should use yellow, blue, and green pencils to record their observations on the activity sheet as each pair of liquids combines. Students should also write a descriptive caption for each drawing that gives information not shown in their drawings, like “the ends stayed yellow and blue for awhile with a green area in the middle and eventually all turned green.” The completed activity sheet will be used in *Activity 3.4* as students attempt to identify the four unknown yellow liquids.

#### Procedure

The procedure below is not provided for students in the activity sheet. Explain to students what they will do by showing them. Demonstrate how to hold the toothpick horizontally to pull one large drop of blue water toward one of the yellow drops. You may use the overhead to show this. Once groups are working, check to see that students add enough liquid to *completely fill* each circle on the chart. Also be sure that students use the toothpick only to move the blue drop of water toward the yellow drop. They should not use the toothpick to stir the liquids.

1. Add drops of each liquid to its labeled circle to completely fill each circle on the chart. Depending on your dropper, you may need to add about 5 drops or more.
2. Then, use a toothpick to pull the blue water toward the yellow water. It may take a few tries to get them to join. Instead of holding the toothpick straight up and down, it is helpful to hold it more horizontally so more of the toothpick touches the blue water. As soon as the two drops meet, lift the toothpick away and discard it. Watch the two drops combine on their own. *Do not stir.*
3. Record your observations.



4. When the drawings and captions are complete for the first pair of liquids, combine the second pair and record your observations.
5. Continue testing the remaining pairs in this manner.

## **2. Have students discuss their observations.**

Ask students to describe what happened as each pair of liquids combined.









### ***Expected results:***

- **Water + Water**  
Colors do not combine completely. A region turns green in the middle, while the ends of the merged liquids remain the original yellow and blue.
- **Water + Salt water**  
Colors combine almost immediately as evidenced by the quick change to green throughout.
- **Water + Alcohol**  
The yellow and blue liquids appear to “shake” for a time as they combine.
- **Water + Detergent**  
Colors combine at a medium rate and result in a more spread-out area of light green.

Ask students whether they think they could use this test to identify the four yellow liquids even if they were unknown.









### Testing sheet 3.3

## Using color to see how liquids combine

1	2	3	4
Blue	Blue	Blue	Blue
<b>Water</b>	<b>Water</b>	<b>Water</b>	<b>Water</b>
			
<hr/>	<hr/>	<hr/>	<hr/>
			
<b>Water</b>	<b>Salt water</b>	<b>Alcohol</b>	<b>Detergent solution</b>
Yellow	Yellow	Yellow	Yellow

### Testing sheet 3.3

## Using color to see how liquids combine

1	2	3	4
Blue	Blue	Blue	Blue
<b>Water</b>	<b>Water</b>	<b>Water</b>	<b>Water</b>
			
<hr/>	<hr/>	<hr/>	<hr/>
			
<b>Water</b>	<b>Salt water</b>	<b>Alcohol</b>	<b>Detergent solution</b>
Yellow	Yellow	Yellow	Yellow