

Activity 3.2

Developing tests to distinguish between similar-looking liquids

How can you identify an unknown liquid based on the way it behaves on different paper surfaces?

In *Activity 3.1* students tested water, salt water, rubbing alcohol, and detergent solution on a brown paper towel. In this activity they will be presented with an unknown, which is one of the four known liquids as well as a variety of paper surfaces. Students will help develop a testing method using these surfaces to identify the unknown. They will realize that by using a combination of results from two or more tests, they can successfully identify the unknown.

Materials needed for each group

Tap water in cup	1 Additional small cup	Notebook paper,
Isopropyl rubbing alcohol (70%) in cup	5 Droppers (4 labeled droppers from the previous activity + 1 additional)	copy paper, or newspaper
Detergent solution in cup	Construction paper	Brown paper towel
Salt water in cup		Wax paper
		Pencil

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.
- Use the solutions and droppers from *Activity 3.1*.
- Use regular tap water as the unknown solution.
- Use common inexpensive construction paper. Art-quality or coated construction papers will not work well in this activity.
- To prevent spills, tape cups to the desk or table so that the cup and dropper do not fall over.

Preparing materials

- Use a permanent marker to label one small cup **Unknown**. Then place 1 teaspoon of water in this cup.
- Label one dropper **U** for the unknown liquid.
- Cut construction paper into quarters. Any color of construction paper will do.
- Cut the notebook or copy paper into quarters. If using newspaper, select areas of the paper that are either not printed or are consistently printed like the stock quotes. Avoid portions of the paper with pictures. Cut the newspaper into pieces that are about 10 × 15 cm.
- Cut the wax paper and brown paper towel into pieces that are about 10 × 15 cm.

Activity sheet



Copy *Activity sheet 3.2—Developing tests to distinguish between similar-looking liquids*, p. 141, and distribute one per student when specified in the activity.

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”.

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Developing tests to distinguish between similar-looking liquids

Question to investigate

How can you identify an unknown liquid based on the way it behaves on different paper surfaces?

1. Present the unknown liquid and the other testing surfaces.



Distribute *Activity sheet 3.2—Developing tests to distinguish between similar-looking liquids*. Tell students that the unknown liquid you are giving them is either water, salt water, isopropyl alcohol, or detergent solution. Remind them that these liquids acted differently on brown paper towel, so it is possible that there will be differences on other paper surfaces like wax paper, newsprint, and construction paper.

2. Have students, in groups, develop a method for testing the liquids on the surfaces.

As you listen and talk with groups about their plans, make sure that they plan to test one surface at a time. Also be sure they are planning how they will control variables such as: using the same amount of each liquid, applied to the same surface, in the same way, from the same height, and at the same time. Once groups have had enough time to make initial plans, discuss some of these as a whole class.



Note: Students may want to place one drop of a particular liquid on each of the different testing surfaces and observe how the liquid absorbs into each. But by using the same liquid on different surfaces, it is the *surfaces* that are being compared and not the *liquids*. To compare the *liquids*, all five liquids must be placed on the *same* surface at the same time. This way each surface serves as its own test with all variables controlled. Any observed differences must be the result of the different characteristics of the liquids. By considering the results of all of these tests, students can identify the unknown.

3. Have students conduct their tests and record their observations.

Remind students to use a different dropper for each liquid. Students should be sure that they do not mix up the droppers.

Procedure

1. Use a pencil to label five areas on a piece of brown paper towel.
2. Pick up a small amount of each liquid in its dropper.
3. At exactly the same time and from the same height, squeeze 1 drop of each liquid into its labeled area. Watch the liquids absorb for about 1 minute.
4. Record any observations that give you information about the possible identity of the unknown.
5. Repeat Steps 1–4 for wax paper, newspaper, and construction paper.



Let students know that they should repeat tests, if necessary, to give them enough information so that they are sure of the identity of the unknown.

After recording their observations, students may notice that the rubbing alcohol has evaporated from the brown paper towel. Students may be interested to see that each liquid has its own characteristic rate of evaporation.

4. Discuss student observations and have them identify the unknown.

Expected results:

The water and salt water will bead up on wax paper, while the detergent and alcohol will spread out and flatten. The drops behave similarly on the other three paper surfaces. The water absorbs into the papers faster than the salt water does, which stays beaded up longer than the water. This difference is most distinct on the construction paper. After the water and salt water begin to absorb into brown paper towel, newsprint, or construction paper, the water seems to wet a larger area. The detergent and alcohol leave smaller marks, but the alcohol mark has a smooth edge and the detergent has a more irregular edge. Also, the detergent mark appears darker.

If allowed to evaporate, the rubbing alcohol evaporates first. Although the water and salt water are similar, the water evaporates before the salt water. The detergent solution evaporates the slowest.

Ask students what they think is the identity of the unknown and have them explain what evidence led them to that conclusion.

Note: Some students may have difficulty deciding if the unknown is water or salt water. However, if they focus on testing the unknown along with water and salt water, students will see differences. Water absorbs into brown paper towel, newsprint, and especially construction paper somewhat faster than salt water does. The salt water stays beaded up longer. In an evaporation test, water will evaporate a little bit more quickly than salt water.