

Investigating the Chemical Properties of Four Liquids

In Experiment 3D, you measured the densities of four liquids to determine whether the liquids were the same or different. You probably found that densities of all four liquids were the same within experimental uncertainty. This means that density alone cannot be used to distinguish among these liquids.

Modern analysis of liquids can involve very sophisticated instrumentation. The gas chromatograph, along with the mass spectrometer, is used to analyze urine samples of athletes to determine whether illegal drugs have been taken.

OBJECTIVES

1. to recognize macroscopic changes
2. to compare some chemical properties of four liquids in order to determine whether the liquids are the same or different

MATERIALS

Apparatus

4 test tubes
(13 mm × 100 mm)
test-tube stand
or rack
safety goggles
medicine dropper
lab apron
wash bottle containing
distilled water

Reagents

blue litmus paper
red litmus paper
cobalt(II) chloride
paper
zinc
manganese(IV) oxide
aluminum
liquids A, B, C, and D
in dropper bottles

PROCEDURE

1. Put on your lab apron and safety goggles.
2. Label four test tubes A, B, C, and D, or arrange them in a test-tube rack from left to right so you know which test tube contains A, etc.
3. Add two droppersful of each liquid (A, B, C, or D) to the appropriate test tube.
4. Tear a piece of red litmus paper into four pieces and put one piece in each test tube. Record your observations in your copy of Table 1.
5. Pour the liquids into the sink, put the test paper in the wastebasket, rinse the test tubes three times with tap water and three times with distilled water. The test tubes need not be dried.
6. Repeat Step 3 with the cleaned test tubes.
7. Tear a piece of blue litmus paper into four pieces and put one piece in each of the test tubes. Record your observations in Table 1.
8. Repeat Step 5.
9. Repeat Step 3.



CAUTION: Remember A, B, C, and D are unknowns; whether they are hazardous or not, it is always a good practice to minimize your contact with unknown chemicals. Some of these chemicals are corrosive to skin, eyes, or clothing. Wear safety goggles and gloves when handling the chemicals. Wash spills and splashes off with plenty of water. Call your teacher.

10. Tear a piece of cobalt(II) chloride paper into four pieces and put one piece in each of the test tubes. Record your observations in Table 1.
11. Repeat Step 5.
12. Repeat Step 3.
13. Add one piece of zinc, Zn, to each test tube, wait at least two minutes, and record your observations in Table 1.
14. Pour the liquids into the sink, put the remaining zinc in the used zinc container, and clean the test tubes as in Step 5.
15. Repeat Step 3.
16. Add a piece of aluminum, Al, to each test tube, wait at least two minutes, and record your observations in Table 1.
17. Pour the liquids into the sink, put the remaining aluminum in the used aluminum container, and clean the test tubes as in Step 5.
18. Repeat Steps 2 and 3.
19. Add a small scoop of manganese(IV) oxide (equivalent to a grain of rice) to each test tube, wait at least two minutes, and record your observations in Table 1.
20. Pour the liquids and manganese(IV) oxide into the sink and clean the test tubes as in Step 5.
21. Before you leave the laboratory, wash your hands thoroughly with soap and water; use a fingernail brush to clean under your fingernails.



CAUTION: Keep the test paper pieces out of your mouth; they are poisonous.



CAUTION: Manganese(IV) oxide is poisonous. Do not get it in your mouth; do not swallow any.

REAGENT DISPOSAL

Rinse all solutions down the sink with copious amounts of water. Place all solids in the designated waste containers.

POST LAB DISCUSSION

Use the observations you made on the properties of the four liquids to determine whether the liquids are the same or different.

DATA AND OBSERVATIONS

Table 1

	LIQUID A	LIQUID B	LIQUID C	LIQUID D
Red litmus paper				
Blue litmus paper				
Cobalt(II) chloride paper				
Zinc				
Aluminum				
Manganese(IV) oxide				

QUESTIONS

1. Do liquids *A* and *B* have any properties alike? If so, name them.
2. Do liquids *A* and *B* have any properties that are different? If so, name them.
3. Could *A* and *B* be the same liquid? Why or why not?
4. Could any two of the liquids be the same?

FOLLOW-UP QUESTIONS

1. If any two of the liquids could be the same, explain why.

CONCLUSION

State the results of Objective 2.