experiment 18

Analysis and Identification of Household Chemicals by Qualitative Analysis

OBJECTIVES

- To develop a flowchart to identify twelve household chemicals.
- To identify the twelve household chemicals as unknowns.
- To write a procedure to identify the unknowns.

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ANALYSIS AND IDENTIFICATION OF HOUSEHOLD CHEMICALS BY QUALITATIVE ANALYSIS

IN THE LAB

- Students will work in pairs.
- You do not need to write a full report for this experiment.
- Students will submit **three** things for this experiment: a completed flowchart (with formulas given, **NOT** A2, D3, etc.), a list identifying the unknowns, and the full procedure (procedure must be typed).

WASTE

- Reagents may be washed down the drain with excess water.

SAFETY

- Wear gloves. Although these chemicals can be found in the grocery store, we should still use appropriate safety measures when handling them.

Ever have a surprise dinner made from food in unlabeled cans? Imagine you have twelve unlabeled boxes and need to identify their contents. You know which twelve they are from the things you purchased at the grocery, and you're able to get samples of each of the twelve for comparison.

- Write a procedure before coming to lab. The procedure should be detailed enough so that someone could have only your procedure and the twelve unknowns and determine their identity.
- With the exception of the pH tests, all tests should be done on fresh samples of the solid.
- This is a **qualitative** assessment, so it is *not* necessary to measure the exact amounts used.
- **HINT:** The flowchart branches to identify each of the twelve substances. By looking at the number of branches, you can determine how many substances were in the previous box.

The following tests will be used in completing this experiment. The knowns are provided so that you can see what each of them looks like for each step, so you will be able to identify your unknowns.

Solubility Test: Add a small amount of the solid using the tip of your spatula (about the size of a small pea) to a test tube and add approximately 3 mL of water. The semi-micro test tubes hold approximately 4 mL. While wearing gloves, shake and repeatedly invert the test tube to help in the dissolution of the substance. Some crystals may remain, but the solution itself will be clear. You will see a distinct difference in the solutions for insoluble substances. Be careful not to contaminate your other solutions with the spatula or any reagent remaining on your gloves.

Iodine Test: Add two drops of the iodine solution and wash down into the test tube with a 0.5–1 mL of water. The iodine will react with starch to produce a deep blue color.

Vinegar Test: Add 10–20 drops of vinegar directly to the solid to see if CO_2 forms, as evidenced by the presence of bubbles and indicates the presence of a carbonate or bicarbonate.

HCl Test: Slowly add approximately 2 mL of 6 M HCl to the solid sample and see if the substance dissolves. Do not get more than 10 mL at a time out of the stock container.

pH: Use a **clean** stir rod to dot a sample of the substance on a piece of the pH paper. The pH strip can be used 2 or 3 times as long as you have a clean, dry area on the strip.

NaOH Test: Add 5–10 drops of 2 M NaOH and check for the formation of a white precipitate, which is the formation of an insoluble hydroxide. Do not get more than 5 mL out of the stock container.

Flame Test: Prepare a new test tube as you did for the solubility test, and place one of the wood splints into the test tube. Once your flowchart has been completed, you will have three solutions that you cannot identify based on the other tests. Test each of the three solutions by holding the splint in the flame for 1–2 seconds. If you leave it in a long time, you will burn the splint, which will interfere with the flame test. Re-wet the splint and put it back into the flame to confirm your results; it may take a few tries to see the color differences, since they will only appear briefly. The TA will set up the Bunsen burners in the hood for your use.

The following table lists the compounds you will be testing in this experiment. The samples will be provided to you in a well plate, and the location of each substance in the well plate is indicated to the left of its name. Unknowns are provided in rows C and D. Include the identification information (i.e., D3) when reporting your unknowns.

Table 18.1. Household chemicals and properties.[1]

Location	Name	Formula	Use	Solubility (g/100 mL water)	
				Room Temp	Hot (Temp in °C)
A1	boric acid	H_3BO_3	antifungal agent	6	27 (100)
A2	calcium carbonate	$CaCO_3$	chalk, antacids	0.001	0.002 (75)
A3	calcium sulfate	$CaSO_4$	plaster of Paris	0.2	
A4	cornstarch	glucose polymer	thickener	insoluble	
A5	magnesium sulfate	$MgSO_4 \cdot 7\ H_2O$	Epsom salt	71	91 (40)
A6	potassium bitartrate	$KHC_4H_4O_6$	cream of tartar	0.5	6 (100)
B1	sodium bicarbonate	$NaHCO_3$	baking soda	10	16.5 (60)
B2	sodium borate	$Na_2B_4O_7 \cdot 10\ H_2O$	Borax laundry booster	6	130 (100)
B3	sodium carbonate	Na_2CO_3	washing soda	28	45 (100)
B4	sodium chloride	NaCl	table salt	36	39 (100)
B5	sodium hydroxide	NaOH	drain cleaner	110	347 (100)
B6	sucrose	$C_{12}H_{22}O_{12}$	table sugar	200	500 (100)

[1] Oliver-Hoyo, M.; Allen, D.; Solomon, S.; Brook, B.; Ciraolo, J.; Daly, S.; Jackson, L. *J. Chem. Educ.* , *78*, 1475.

EXPERIMENT

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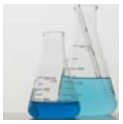
DATA & ANALYSIS





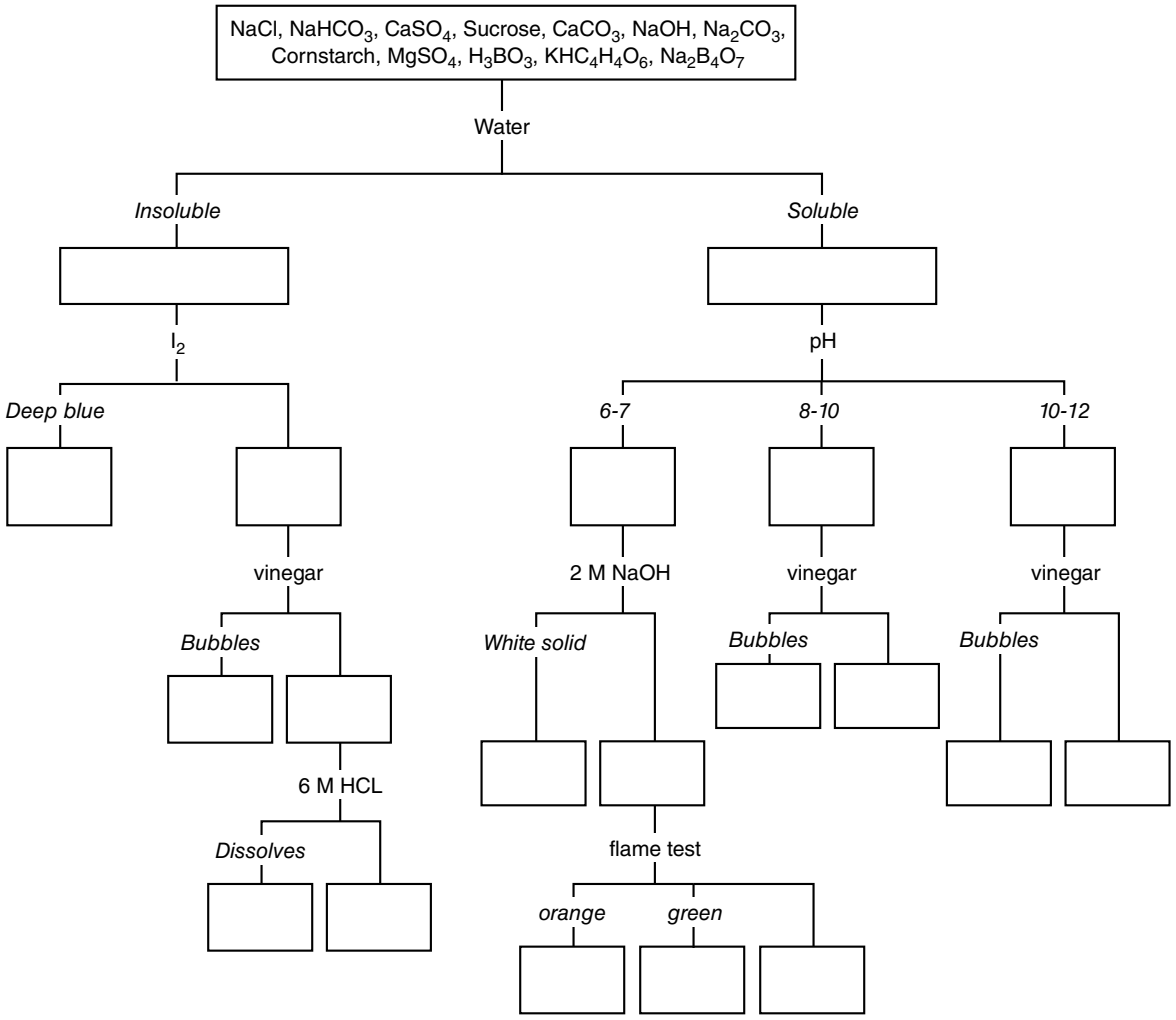
ANALYSIS AND IDENTIFICATION OF HOUSEHOLD CHEMICALS BY QUALITATIVE ANALYSIS

Name

Date (of lab meeting) Section

TA

Partner's Name (if applicable) List



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