

1.1 Activity

Identifying a Mystery Powder

Forensic science is the application of science to criminal investigations. Forensic scientists collect, analyze, and evaluate evidence from a crime scene.

The evidence is then used in law enforcement.

Qualitative analysis (that is, identifying a sample of matter from its physical and chemical properties) is an integral part of forensic science.

In this activity, imagine that you are a forensic scientist. You suspect that a death was caused by the ingestion of a mysterious white powder. Traces of the powder were found near the victim. The victim's partner claims that a severe heart attack was the cause of death. It is your responsibility to identify the mystery powder.

Question

What is the identity of the mystery powder?

Materials

eye protection

lab apron

6 different white powders, labelled 1 to 6, obtained from your teacher

unidentified white powder, obtained from your teacher

microtray

5 eyedroppers

scoopula

toothpicks

distilled water

universal indicator

dilute hydrochloric acid, $\text{HCl}_{(\text{aq})}$

dilute iron(III) (ferric) nitrate solution, $\text{Fe}(\text{NO}_3)_3_{(\text{aq})}$

iodine solution, $\text{I}_{2(\text{aq})}$

LEARNING TIP

State Subscripts

The following subscripts are used to indicate the physical state of a substance:

(s) solid

(l) liquid

(g) gas

(aq) dissolved in water

Procedure

1. Label the microtray using a grease pencil, as shown in **Figure 1**.

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | ○ | ○ | ○ | ○ | ○ | ○ |
| 2 | ○ | ○ | ○ | ○ | ○ | ○ |
| 3 | ○ | ○ | ○ | ○ | ○ | ○ |
| 4 | ○ | ○ | ○ | ○ | ○ | ○ |

Figure 1

The distribution of the six powders in a microtray

2. Using a scoopula, add a small sample of the first white powder to four wells in column A of the microtray (**Figure 1**). Place samples of the other five powders in columns B, C, D, E, and F, respectively. Record the identity and appearance of each powder.
3. Using an eyedropper, add five drops of water to each of the six samples in the *first row* of the microtray. Mix the contents of each well using a different toothpick. Record your observations in a table.



Wear eye protection and a lab apron. Hydrochloric acid, iron(III) nitrate, iodine solution, and universal indicator are corrosive if they contact the skin or eyes.

4. Using an eyedropper, add one drop of universal indicator to each well containing a sample and water in the *first row* of the microtray. Mix the contents of each well with a different toothpick. Record your observations.
5. Using an eyedropper, add five drops of dilute hydrochloric acid to each sample in the *second row* of the microtray. Mix the contents of each well with a different toothpick. Record your observations.
6. Using an eyedropper, add five drops of dilute iron(III) nitrate solution to each of the six samples in the *third row* of the microtray. Mix the contents of each well with a different toothpick. Record your observations.

7. Using an eyedropper, add five drops of iodine solution to each of the six samples in the *fourth* row of the microtray. Mix the contents of each well with a different toothpick. Record your observations.
8. Obtain an unidentified labelled powder from your teacher. This powder is one of the six substances you have just tested. Repeat steps 2 to 7 with the mystery powder. Record your observations.

Analysis

- (a) Analyze your observations, and then answer the Question.
- (b) List the physical properties of the six samples that helped you identify the mystery powder.
- (c) List the chemical properties of the six samples that helped you identify the mystery powder.
- (d) Why was it important to test the six samples before identifying the mystery powder?
- (e) What kind of analysis did you perform in this activity? Justify your answer.

Evaluation

- (f) How confident are you in your answer to the Question? Justify your level of confidence using evidence from this activity.
- (g) Describe additional tests that you could perform to increase your level of confidence in your answer.
- (h) Suggest sources of error and changes to the Procedure that would help to reduce these sources of error.
- (i) In your own words, explain why the qualitative analysis of matter plays an important role in forensic science.