# IDENTIFYING UNKNOWN SUBSTANCES

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## Goal

Identify unknown substances with the help of different tests.

- **1.** What is the independent variable in this lab?
- 2. What is the dependent variable in this lab?

# **Hypothesis**

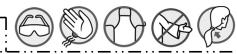
I think that			
because			

## **Materials**

- 4 samples of unknown substances (solid insoluble in water, solid soluble in water, liquid and gas)
- balance (accurate to 0.01 g)
- · small rubber stopper
- 100-mL graduated cylinder
- · wash bottle of distilled water
- · electrical conductivity detector
- · test-tube rack
- 3 test tubes (18 mm × 150 mm) and stoppers (No. 1)
- · 10-mL graduated cylinder
- spatula
- · wire loop

- · Bunsen burner
- · cobalt chloride paper strips
- 100-mL beaker
- · hot plate
- thermometer clamp or universal clamp and perforated cork stopper
- ring stand
- thermometer
- 140-mL syringe with perforated plunger and stopper
- 4-in nail
- · container of limewater
- · wood splints
- · matches or lighter

## **Procedure**



## Solid insoluble in water

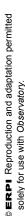
- 1. Note the colour and the odour of the solid.
- 2. Weigh and record the mass of the solid.
- 3. Measure the volume of the solid.
  - a) Place the stopper at the bottom of the 100-mL graduated cylinder.
  - b) Pour 25 mL of distilled water into the graduated cylinder. Record the volume.
  - c) Add solid to the graduated cylinder so it is submerged completely in water.
  - d) Measure and record the volume.
- 4. Calculate the density of the solid.
- 5. Test electrical conductivity of the solid.
  - a) Touch the electrodes of the conductivity detector to the solid.
  - b) Observe if the detector lights up. Note the result.
- 6. Clean up.

### Solid soluble in water

- 1. Note the colour and the odour of the solid.
- 2. Determine the solubility of the solid in water.
- a) Weigh the empty test tube and the stopper. Record the mass.
  - b) Measure into the 10-mL graduated cylinder exactly 5 mL of distilled water.
  - c) Pour the water into the test tube and close it with the stopper. Weigh and record the mass.
  - d) Calculate the mass of the water.
  - e) Add a small quantity of soluble solid into the test tube.
  - f) Stopper the test tube and shake until dissolution is complete.
  - g) Repeat steps e) and f) until solute does not dissolve.
  - h) Weigh the empty graduated cylinder. Record the mass.
  - i) Decant the solution into the graduated cylinder. Measure and record the volume.
  - j) Measure and record the mass of the graduated cylinder and the solution.
  - k) Calculate the mass of the dissolved solute.
  - I) Calculate the solubility of the solid.
- 3. Conduct flame test on solid.
  - a) Dip the wire loop into distilled water, then into the solid.
  - b) Pass the wire over the flame of the Bunsen burner. Record the colour of the flame.
- 4. Clean up.

#### Liquid

- 1. Note the colour and the odour of the liquid.
- 2. Determine the density of the liquid.
  - a) Weigh and record the mass of the 10-mL graduated cylinder.
  - b) Pour exactly 10 mL of liquid into the graduated cylinder.
  - c) Weigh the graduated cylinder (with liquid). Record the result.
  - d) Calculate the density of the liquid.



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- 3. Test the liquid with a cobalt chloride paper strip.
  - a) Dip a cobalt chloride paper strip into the liquid.
  - b) Record the colour of the paper.
- **4.** Determine the boiling point of the liquid.
  - a) Pour 20 mL of liquid into the 100-mL beaker.
  - b) Place the beaker on the hot plate.
  - c) Insert the thermometer into the beaker and clamp it so the bulb is submerged completely and not touching the beaker.
  - *d)* Heat the beaker and record the temperature at which bubbles form.
- 5. Clean up.

### Gas

- 1. Note the colour and the odour of gas.
- 2. Determine the density of the gas.
  - a) Stopper the syringe. Set the plunger at the mark of 140 mL and insert the nail into the hole.
  - b) Weigh the syringe (with plunger, stopper and nail). Record the result.
  - c) Remove the stopper and the nail from the syringe.
  - d) Push the plunger down fully into the syringe.
  - e) Connect the rubber tip of the gas cylinder to the tip of the syringe.
  - f) Carefully open the valve of the gas cylinder.
  - g) Quickly close the valve of the gas cylinder when the plunger reaches the mark of 140 mL.
  - h) Disconnect and quickly close the syringe.
  - *i)* Insert the nail into the hole of the plunger. Record the volume of gas in the syringe as exactly as possible.
  - *j)* Weigh the syringe (with gas). Record the result.
  - k) Calculate the density of the gas.
- 3. Test the gas with limewater.
  - a) Fill the test the tube with gas and quickly close it with the stopper.
  - b) Remove the stopper and quickly pour limewater into the test tube, then stopper the test tube and shake. Record the result.
- **4.** Test the gas with a flaming wood splint.
  - a) Fill the test tube with gas and quickly close it with the stopper.
  - b) Remove the stopper and quickly insert the flaming wood splint into the test tube. Record the result.
- 5. Test the gas with a hot ember.
  - a) Fill the test tube with gas and quickly close it with the stopper.
  - b) Remove the stopper and quickly insert the hot ember into the test tube. Record the result.
- 6. Clean up and put away materials.



itle:						
Substance	Colour	Odour	Mass (mL)	Volume (mL)	Density (g/mL)	Other observations and results
Solid insoluble in water						
Solid soluble in water						
Liquid						
Gas						
1. What cha	of the res aracteristic pr or a chemica ysical chara	operties hav I characteris	tic propert	y.		one is a physical charateristic
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Conclusion

3. What are the possible sources of error in this lab?

**4.** How could you improve the protocol for this lab?

and compare results obtained with data from

2. Was your hypothesis confirmed or not? Explain your answer.

**1.** Complete the following sentence:

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To identify an unknown substance, it is necessary to determine some of its