

Become a Metal Detective

In this investigation, you will become a metal detector, or, if you prefer, a metal detective (Figure 1). First, you will perform a series of tests on the collection of chemical elements in your custody. You will make keen observations with your sharp senses. In your detective notebook, you will record and analyze your results for any patterns. Finally, you will confirm the identity of each element as a metal or a non-metal and note its location on the periodic table of elements for future reference.

SKILLS MENU

- | | |
|-------------------------|-----------------|
| ● Questioning | ● Performing |
| ● Hypothesizing | ● Observing |
| ● Predicting | ● Analyzing |
| ● Planning | ● Evaluating |
| ● Controlling Variables | ● Communicating |



Figure 1 A metal detective

Testable Question

How can you distinguish metals from non-metals?

Hypothesis/Prediction

Predict which of the elements can be classified as metals, and which as non-metals. Give reasons for your prediction.

Experimental Design

In this investigation, you will perform various tests to determine whether selected elements are metals or non-metals. You will note the colour and lustre of each sample. You will also test each sample for malleability, density, magnetism, and electrical conductivity.

Equipment and Materials

- eye protection
- lab apron
- well tray
- magnet
- balance
- low-voltage conductivity apparatus (Figure 2 on the next page)
- fine steel wool
- samples of available elements (for example, Mg, Cr, Fe, Ni, Cu, Ag, Au, Zn, Al, C, Si, Sn, S)

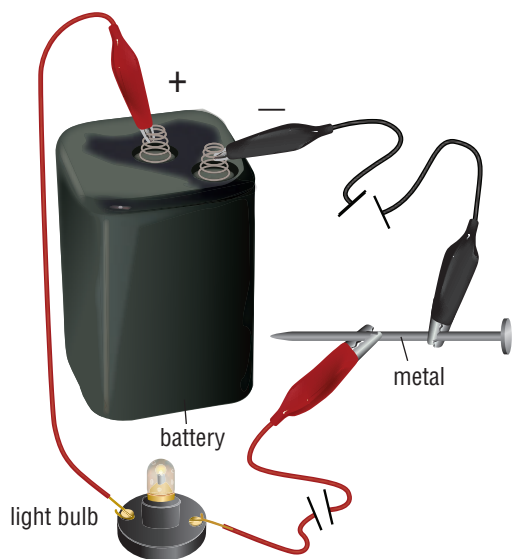


Figure 2 A conductivity apparatus

Procedure



1. Copy Table 1 into your notebook.

Table 1 Observations and Analysis

Element	Properties					
	Colour	Lustre	Malleability	Density	Magnetism	Electrical conductivity
?						
?						

2. Put on your lab apron and eye protection.
3. Obtain a well tray and trace its outline in your notebook.
4. Obtain a sample of each element. Place each element in a separate well in the well tray. Record the name of each element in the corresponding location on the traced outline.
5. Examine each element. Note its colour and lustre. Follow your teacher's instructions for scrubbing a sample with steel wool to expose its surface. Record your observations.
6. Test each element for malleability or brittleness by trying to bend or break it. Record your observations.
7. Estimate the density of each element by comparing its mass with another element sample of similar size. Record your observations.

8. Test each element with a magnet to determine if it is magnetic or non-magnetic. Record your observations.
9. Test each element with the conductivity apparatus to see whether it conducts electricity. If the light bulb lights up, it is a conductor. If not, it is an insulator. Record your observations.
10. When all elements have been tested, follow your teacher's instructions for returning or disposing of all materials and equipment.
11. Wash your hands thoroughly with soap and water.

Analyze and Evaluate

- (a) What patterns of behaviour do you observe that allow you to group the elements according to their properties? **T/I**
- (b) Did the evidence you obtained in this investigation support your prediction? Explain why or why not. **T/I**
- (c) Write a report summarizing your findings in this investigation. Follow your teacher's instructions for content and format of your report. **C**
- (d) Which tests, if any, presented problems in making or interpreting the observations? Explain. **T/I**
- (e) Suggest improvements to the procedure that may increase your confidence in the results of the tests. **T/I**

Apply and Extend

- (f) Refer to the elements that you have classified as metals. Use your observations to organize them into subgroups with similar properties. **T/I**
- (g) Explain how the properties of each of the following elements make them suitable for their use in these products: **A**
 - (i) electrical wires made of copper
 - (ii) aluminum in drink cans
 - (iii) iron needles in compasses
 - (iv) silicon in computer chips
 - (v) gold foil on paintings and sculptures