

TABLE 23.1

Materials list

Item	Quantity
Consumables	
Sodium chloride (NaCl)	5 g per group
1 M sodium hydroxide (NaOH) solution (in a dropper bottle)	2–3 ml per group
1 M copper(II) nitrate [Cu(NO ₃) ₂] solution (in a dropper bottle)	2–3 ml per group
1 M hydrochloric acid (HCl) (in a dropper bottle)	2–3 ml per group
Sodium bicarbonate (NaHCO ₃)	2–3 g per group
Paraffin wax, in a test tube (or similar)	1 per group
Magnesium ribbon	2 cm per group
pH paper	As needed
Distilled water (in squirt bottles)	As needed
Equipment and other materials	
Spot (reaction) plate	1 per group
Graduated cylinder, 50 ml	1 per group
Beaker, 150 ml	1 per group
Beaker, 500 ml	1 per group
Hot plate	1 per group
Bunsen burner	1 per group
Ring stand with metal ring	1 per group
Clay triangle	1 per group
Wire gauze square	1 per group
Crucible with lid	1 per group
Crucible tongs	1 per group
Test tube tongs	1 per group
Spatula	1 per group
Thermometer	1 per group
Electronic or triple beam balance	1 per group
Whiteboard, 2' x 3' *	1 per group
Lab handout	1 per student
Peer-review guide and instructor scoring rubric	1 per student

* As an alternative, students can use computer and presentation software such as Microsoft PowerPoint or Apple Keynote to create their arguments.

Lab Handout

Lab 23. Classification of Changes in Matter: Which Changes Are Examples of a Chemical Change, and Which Are Examples of a Physical Change?

Introduction

Matter, the “stuff” of which the universe is composed, has two characteristics: it has mass and it occupies space. Physical properties of matter, such as density, odor, color, melting point, boiling point, state at room temperature (liquid, gas or solid), and magnetism, are often useful for identifying different substances. Matter, however, can also go through changes in both its physical and chemical properties. During *physical changes* the composition of matter does not change; for example, freezing a sample of water results in a change of state (i.e., going from liquid to solid), but the substance is still water (H_2O)—its chemical composition did not change. During *chemical changes* the chemical composition of a substance does change; for example, burning a piece of wood in a fireplace is a chemical change. In this example, the original wood is transformed into ashes and smoke, which both have different chemical properties than the original piece of wood.

Your Task

Create and observe the five scenarios listed below. Using your data and observations, determine if a physical or chemical change has occurred when

1. 100 ml of water (H_2O) is mixed with 5 g of table salt (NaCl),
2. a 2 cm magnesium strip is placed in a crucible and heated,
3. 10 drops of sodium hydroxide (NaOH) and 10 drops of copper(II) nitrate [$\text{Cu}(\text{NO}_3)_2$] are mixed,
4. 5 drops of hydrochloric acid (HCl) are added to 2 g of sodium bicarbonate (NaHCO_3), and
5. paraffin wax is subjected to heat in a hot-water bath.

The guiding question of this investigation is, **Which changes are examples of a chemical change, and which are examples of a physical change?**

LAB 23

Materials

You may use any of the following materials during your investigation:

Consumables	Equipment
<ul style="list-style-type: none">• NaCl• NaOH solution• Cu(NO₃)₂ solution• HCl solution• NaHCO₃• Magnesium strip, 2 cm• Paraffin wax• pH paper• Distilled water (in squirt bottles)	<ul style="list-style-type: none">• Spot (reaction) plate• Graduated cylinder (50 ml)• Beaker (150 ml)• Beaker (500 ml)• Hot plate• Bunsen burner• Ring stand with metal ring• Clay triangle• Wire gauze square• Crucible with lid• Crucible tongs• Test tube tongs• Spatula• Thermometer• Electronic or triple beam balance

Safety Precautions

Follow all normal lab safety rules. Your teacher will explain relevant and important information about working with the chemicals associated with this investigation. In addition, take the following safety precautions:

- Wear indirectly vented chemical-splash goggles and chemical-resistant gloves and apron while in the laboratory.
- Wipe up any water spilled on the floor from water baths.
- When investigating the odor associated with chemicals, never inhale with your nose directly over a tube, beaker or bottle; your instructor will demonstrate wafting the fumes toward your nose with your hand.
- Use caution when working with Bunsen burners. They can burn skin, and combustibles and flammables must be kept away from the open flame. If you have long hair, tie it back behind your head.
- Inspect the crucible for cracks. If it is cracked, exchange it for a new one. Clean the crucible and lid thoroughly before using them.
- Be careful with a crucible after removing it from a flame because it will still be hot.
- Use caution when working with hot plates, hot water, and melted wax because they can burn skin. Hot plates also need to be kept away from water and other liquids.
- Handle test tubes placed in the hot-water bath ONLY with test tube tongs.
- Handle all glassware (including thermometers) with care.
- Wash your hands with soap and water before leaving the laboratory.