

## Experiment Guide

### Explore Organic Matter

#### Objective

For this activity, students will create small composting containers to see how different items decompose in soil. The properties of organic versus inorganic matter will also be explored.

#### Introduction to Kids' Lab

Welcome to the BASF Kids' Lab. BASF is the world's largest chemical company and runs Kids' Lab programs like this all around the world. Can anyone think why? BASF wants children all over the world to understand and enjoy experimenting with chemistry!

Has anyone heard that word before: Chemistry? What do you think it means?

**Chemistry is the science of matter.** Have you heard the word "matter" before? What is matter? Matter is anything that takes up space and has a weight here on earth. So basically, matter is a scientific word for stuff.

Chemistry is a science that explores the composition of substances and their properties and reactions. In other words, Chemistry is a science that explores how different stuff behaves.

Matter comes in a few different forms or states: Solids, Liquids and Gases are the most common.

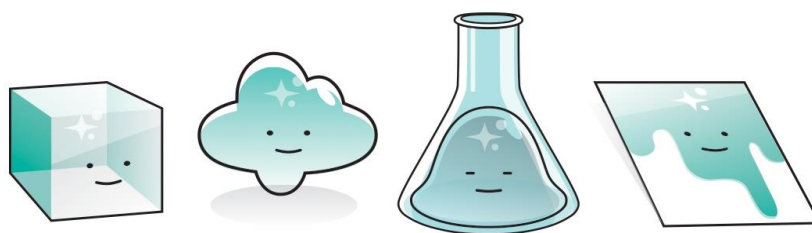
Chemistry is all around us. For example:

Who takes a vitamin? How do vitamins help you? (Grow big and strong, boost immunity) BASF makes chemicals that go into vitamins.

Raise your hand if you play a sport or ride a bike. What should you do to be safe? (Wear a helmet, pads, etc.) What materials make up the helmets that you wear? (Plastics and foam) BASF makes chemicals that go into the plastics and foams in helmets and padding.

Besides helping you grow strong and keeping you safe when you are playing your favorite sport, BASF chemistry keeps farmers' crops safe, cleans water for those in need and keeps babies clean and dry.

Let me introduce you to morpH, the face of Kids' Lab. morpH can move through the three states of matter with ease. Is there a substance that you know of, like morpH that can easily shift from solid to liquid to gas (and back again)? Water! That's right! You know that water is usually liquid but what happens when you freeze water? Water becomes a solid ice cube. When you boil water, it becomes a gas. Water is one of the most important substances on earth. Not only does water make life possible, but it can be used to create interesting substances. We will be exploring some strange matter today!



Water is essential for all living things including microorganisms like bacteria and fungus.  
**morpH and I would like you to explore the properties of organic and inorganic matter.**

### Experiment Introduction

What is Organic matter? Organic matter is anything that is derived from a living organism. An organism is any living thing that has cells such as animals, plants, fungus and bacteria. Anything derived from living things is organic matter- like orange juice, leaves, paper, animal waste, tree stumps, flowers, etc.

Are you organic matter? Yes. You are made up of many cells and complex carbon based molecules such as proteins, carbohydrates, lipids and nucleic acids.

Organic matter is an extremely important component of soil. It is the part of the soil that contains all the nutrients needed by plants like nitrogen, phosphorus and potassium. Soil is also a habitat for numerous microorganisms that help break down organic matter and recycle the nutrients. For example, what happens to all those leaves that fall out of the trees in the fall? Did you notice they were all gone by the following fall? That is because **decomposers** like insects, fungus and bacteria in the soil have inhibited or eaten these leaves and broken them down into to smaller and smaller pieces until the leaves do not look like leaves anymore. These decomposers consume and break down all the remaining nutrients in these leaves, which releases the nutrients back into the soil for other plants to use. Can you imagine how deep the leaves would be if these decomposers did not play this vital role?

Organic matter is easily broken down by decomposers. What about things that are not organic matter? Rocks, metals, glass, plastics and other similar items are not considered organic and are not easily broken down by decomposition. Inorganic matter is only changed by applying extreme conditions like very high heat or pressure.

For this activity, you will set up an experiment and observe how different items decompose in soil. Make sure you are familiar with the following terms:

**Compost:** a mixture of different decaying organic substances, including dead leaves or manure, used to fertilize soil.

**Composting** is nature's process of recycling decomposed organic materials into a rich soil known as compost. Compost allows nutrients in organic material to return to the soil and enrich it for plant growth in the future. (Source: <http://www.recycleworks.org/compost/>)

**Decomposition:** a process where organic matter is broken down into simpler forms. Bacteria, fungi, and insects have an important role as *decomposers*.

**Organic Material:** also known as organic matter; composed of organic compounds that come from the remains of different organisms, such as plants, animals and their respective waste products found in the environment.

### Additional Background Information

In nature, organic matter like plants, animals and animal waste products naturally decompose over time with the help of decomposers like insects, fungi and bacteria. Composting essentially does the same thing but in a more concerted manner. To compost, you simply collect organic waste and provide the proper conditions to facilitate the process. Nearly all organic matter can be composted which is a great way to reduce solid waste and is relatively easy and inexpensive. Did you know that about 25% of the contents in your trashcan can be composted? Composting is basically a way to recycle organic matter.

You can compost all kinds of things! Tea bags, newspapers, grass clippings, coffee grounds, egg shells, fruits and vegetable peeling and even laundry lint can be composted. As long as it is made from a living thing, it is compostable. In case you forget, just remember that the best things to compost are usually green and brown. For a small backyard or school composting operations, you want to avoid organic things like meat, bones, eggs, oils and dairy products. These do not break down readily and may attract animals.

In a commercial composting facility, compost material is shredded to reduce particle size and then mixed thoroughly. Depending on the climate, water may also be added to facilitate microbial activity. Because the microbes need oxygen and the decomposition process releases heat, piles of compost are routinely mixed or turned to aerate the mixture and minimize heat build-up. Excessive heat and reduced oxygen slows the decomposition process. It can take up to a year for compost to be ready. You know that it is ready when it is soft and crumbly and does not have any recognizable components.

Compost that you make at home or you buy from a commercial composter can be used as a soil amendment to increase organic matter in the soil. This is very useful because plants need nutrients from organic matter in order to thrive. Adding compost to sandy or clay soils improves the soil fertility by adding nutrients and improving the soil texture and structure.

For this experiment, the fruit slice will decompose faster than the newspaper and bottle cap because fruits are made up of all kinds of sugars that attract microbes like fungi and bacteria that will easily infest the tissue and break down the cellular components. Newspaper will decompose in about six weeks as long as there is no decrease in sunlight, oxygen and microbes. The bottle cap will not decompose because it is made of plastic. Most plastics are made from petroleum based polymers which form strong carbon-carbon bonds. Because these polymer molecules are held together by strong bonds, microorganisms cannot break down the molecular components. However, plastic containers can be recycled and used to make other plastic items.

### Safety Guidelines

**Lab safety is a must!** In order to safely explore Chemistry, we need to follow proper lab safety. How do you think we are going to do this? Microbiologists follow very strict procedures to protect themselves and they include:

- Gloves
- Safety glasses
- Lab aprons or lab coats

### **Before we get started:**

- Be sure everyone including instructors and helpers are wearing safety glasses. An apron or lab coat and gloves are also recommended for this activity.
- Point out any safety features in the classroom (ie. Eyewash or emergency shower; emergency exits).
- Mention housekeeping rules – NO EATING OR DRINKING.
- Mention location of bathrooms.

### **The Experiment: Making Compost Jars**

Each student or team of students should have three clear containers to begin the experiment. An adult should cut the fruit into pieces beforehand. Observations can be made for several weeks after the experiment is set up.

#### **Materials**

- Three clear jars or similar clear containers (16oz or larger) with lids
- Potting soil
- Measuring tool for cups (1 per instructor)
- Tape for labeling the jars
- Permanent marker
- A peach, apple or orange slice
- A piece of newspaper
- A plastic lid from a water bottle
- Water

#### **Step 1: Add potting soil to each jar**

Add about one and a half cups of potting soil to each jar so that it is about three quarters full.

#### **Step 2: Add an item to compost**

In one jar, place a piece of fruit on top of the soil. In a second jar, place a piece of newspaper and in a third, place a plastic bottle cap on top of the soil. Be sure to place each item close to the edge of the jar so you can watch and document the decomposition process thoroughly. Label each jar with the material inside and the date you have started your experiment.

#### **Step 3: Cover the jars and set in sunny location**

Add about  $\frac{1}{4}$  cup of water to each of the jars and cover them with a lid or a piece of plastic wrap and a rubber band. Poke a few holes in the lid or plastic wrap so that air can pass through. Place the jars in a sunny location like a windowsill and add another  $\frac{1}{4}$  cup of water every couple of days to keep the soil moist but not wet.

#### **Step 4: What is your Hypothesis?**

What do you think will happen to these three items? Which do you think will decompose the quickest? Which do you think will take the longest time? Write down what you think will happen to these three items as they decompose.

#### **Step 5: Observations**

Look at the contents of the jars each day and record the appearance of each item. Has it changed colors? Does it look like something else, like a fungus or bacteria is growing on the item? What color is the item after several days? Is the original item still recognizable?

**Step 6: Clean up and disposal**

Observations can be made for any length of time. Eventually, you may ask the class which of these items may be composted? Which can be recycled? The organic matter- the soil and what is left of the fruit and newspaper can be discarded as compost if available. The inorganic matter such as the glassware and plastic bottle cap can be recycled or discarded. The plastic wrap and rubber bands should be discarded.

**Summary:**

Organic matter includes things like plants, animals, trees, flowers, paper, wood and soil. Organic matter contains all kinds of nutrients that can be used and/or transformed microorganisms. Particular organisms known as decomposers play a vital role in the break down or decomposition of organic matter. Composting is an organized way of accumulating organic waste and recycling organic matter so that the nutrients can be re-used by other organisms. Composting can also reduce the amount of waste that goes to landfills.

Inorganic matter like glass, plastic, rocks, minerals and sand do not decompose easily without adding extreme heat or pressure. The atoms and molecules in inorganic matter are held together very strong bonds which are not easily separated.