

Experiment Guide

Mighty Termites

Objective

Termites are both a structural pests and beneficial to our ecosystem. Find out how with some hands-on activities.

Introduction to Kids' Lab

Welcome to the BASF Kids' Lab. BASF is the world's largest chemical company and run 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.

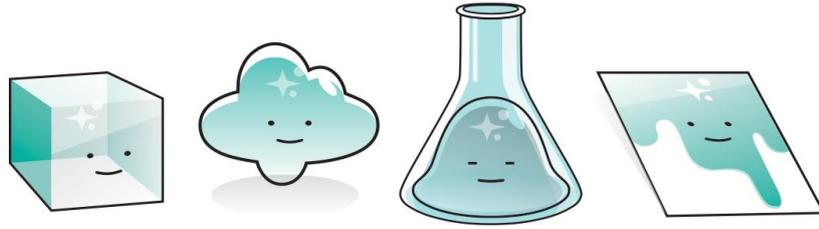
Chemistry is all around us. For example:

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 and essential for all living things, including insects.



Water is essential for all living things including insects like termites.

morpH and I would like you to explore an interesting insect, the mighty termite.

Experiment Introduction

Termites are some of the oldest insects on earth and can be found all over the world. They thrive in hot and wet climates and are known for building big colonies, often called mounds. In some parts of the world, these mounds can be as large as a truck, although most of the colony's inhabitants actually live near or below ground level. Subterranean colonies of termites could have up to a million individual termites.

Termites have specific jobs within their colonies. There is always a **king** and a **queen** that keep the colony populated. There are also **workers**, who take care of the nest and care for the young immatures, and **soldiers**, who protect the colony from attack.

Termites can be a pest if they are found inside a home. You wouldn't want them over for dinner because instead of eating your food, they would rather eat the table and chairs! Termites love to eat wood, but this can be a problem because they can damage the wood in your home. BASF has special solutions that make sure termites will not damage your house.

Even though termites are not good inside your house, they are extremely important insects outside! They are important **decomposers** because they chew up and break down the organic matter from old trees and plant debris. They are even known to help pollinate flowers!

Scientists who study termites and other insects are called **Entomologists**.

Make sure you are familiar with the following terms:

Termite: a small, clear and eusocial insect that lives in colonies and has a distinct caste system; feeds on wood and can chew through trees and timber.

Nymph: an immature form of an insect that does not change as it grows; looks like a smaller version of an adult of the same species.

Worker: a type of termite that supplies all termites in the colony with nourishment, carries eggs to a safe place once eggs are laid, feeds the immatures, grooms the queen and organizes the nest.

Soldier: a type of termite that defends the colony from attack and fixes any damages by "plugging" any broken walls or tunnels.

King: adult male termite who mates with the queen in order to populate the colony.

Queen: adult female termite in the colony who lays eggs and is tended to by worker termites.

Decomposer: an organism that decomposes organic material. Termites are important decomposers.

Mound: a structure often built by termite colonies that can reach 17 feet high and 550 pounds; made up of a complex system of tunnels that creates a ventilation system.

Communication: the exchange of information from one organism to another organism that elicits a response. In a termite colony, the king and queen communicate with **pheromones**, which are excreted chemicals that control the behavior or physiology of the members of the colony.

Reproductive adults: also known as “alates.” An adult termite that has wings and leaves the termite colony to mate and start a new colony; the only kind of termite that is winged.

Insect: an arthropod that has six legs and one or two pairs of wings.

Eusocial: a species that has an advanced level of social organization. A single female produces all of the offspring within a colony and there is a cooperative division of colony maintenance tasks such as gathering food and caring for developing offspring. Ants, termites and some bees are eusocial insects.

Additional Background Information

The life cycle of termites is characterized by **incomplete metamorphosis** which has three stages: egg, nymph, winged adult. Termites start off as eggs and when they hatch they are called nymphs. These nymphs will grow and molt several times and then become soldiers or workers. The nymphs and adults look very similar in insects with incomplete metamorphosis, the only difference is an increase in size. Even the body shape of the winged reproductive adults looks very similar to the other stages.

All termite species are **eusocial**. As with most eusocial insects, the queen and/or king of the colony produces **pheromones** that inhibits reproduction of others within the colony. In a termite colony, these pheromones also regulate the number of males and females and the number of workers and soldiers. If there is no queen, a king will produce pheromones that facilitates the development of a new queen from the developing nymphs. The queen and king are the only reproductive adults in the colony and the parents to all of the inhabitants. All other termites within the colony cannot reproduce and may never molt into reproductive adults or alates. In an established colony, many winged alates will emerge from the colony and swarm to find a mate. Newly paired couples from this annual mating swarm will become the queen and king of a new colony.

A termite queen can lay up to 30,000 eggs per day! That’s 10,950,00 a year! A queen can live about 15 years, so if you add it all up, that’s about 164,250,000 for an entire lifetime! Because her only job is to keep populating the colony, she does this all day and night. She is attended by worker termites.

Termite workers and soldiers are usually blind. Because termites can communicate through sounds or scents, especially specific scents known as pheromones, it doesn’t matter that most termites are blind! Because termites cannot see and cannot talk, they have to find other ways to communicate. Termite soldiers have big horns on their heads that they bang on the wall to alert other termites of an attack or predator. The vibration caused by these soldiers banging their heads alerts the colony that a threat is present.

As termites chew through wood, they are eating cellulose. Wood and the cell walls of plants are made of cellulose. Cellulose is very tough and provides structure to cell walls and plants. Cellulose from trees is used to make paper. Cellulose from cotton plants is used to make clothes so termites will eat paper and clothes too!

Termites are expert chewers but they don't actually digest the wood they eat. Termites can digest cellulose because of microorganisms in their gut. These microorganisms produce the enzymes that break down the cellulose from wood and plant material. Nutrients extracted by this process benefit the termite. Termites and these microbes have a symbiotic relationship, meaning that the two different organisms live together and both benefit from the interaction. In this case, the termite chews the cellulose into small pieces and the microbes break this matter down further into separate molecules like nutrients that can sustain the life of the termite. Termites are not born with these microbes. They must get them from other termites by consuming the waste of other termites. This process is scientifically known as trophallaxis, but in simple terms, it just means that they eat each other's waste.

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? Biologists 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.
- 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.

Termite Activities

Termite Basics:

Discuss the characteristics of the queen, king, workers and soldiers and what each of these members do within a termite colony.

Review the worksheet "What makes a Termite, a Termite" and discuss the differences and similarities between termites and cockroaches and ants. All insects have six legs, a head, thorax and abdomen.

The "What makes a Termite, a Termite" worksheet can be used as a guide to complete the "Termite Life Cycle Matching Game."

Answers: 1=E, 2=C, 3=A, 4=G, 5=D, 6=H, 7=F, and 8=B.

Pheromone Video:

As you know, most termites are blind so they rely on each other in a social colony. One of the ways they communicate is by scent where they can detect pheromones that are secreted by other termites. When a termite finds a good place to eat, it will leave a trail of pheromones along a path so that other termites can follow the path to the food. Watch the video of the

termites following the line of a pen. Why do you think they are following this line? The pen ink contains a chemical that mimic the pheromones left by termites, so these termites are simply following the scent of the chemical in the pen.

Detriments and benefits of termites:

Discuss how termites are both architectural pests but also beneficial decomposers. Ask the students to circle all of the places you might find termites in and around your home on the “Where Would Termites Be If They Got Into Your House?” Since termites consume wood and wood products like paper, they can be found anywhere in your home. BASF makes products that help protect homes from termites. Next, complete the termite maze worksheet.

If available, pass around a piece of wood or object that termites have damaged. Notice that the termites create tunnels in the wood as they chew their way through it. Termite mounds have similar tunneling systems.

Discuss that termites are also beneficial because they have the ability to break down cellulose. The cell walls and fibers in plants are made of cellulose and few animals have the capacity to digest this plant matter. Termites are very efficient decomposers of cellulose and fulfill an ecological niche by breaking down dead wood and other plant matter.

If time permits, complete the Termite Word Search worksheet.

Summary:

If you see a termite in your house, there is a good chance that many more are present and are making tunnels to get to more of your house. Unfortunately, termites cause billions of dollars’ worth of damage to homes and businesses every year and must be prevented from colonizing these buildings. Termites are more active in warm climates and can cause damage year round in warm regions of the world.

If you are outside and you see termites chewing through a tree that has died, they are doing their job as decomposers and helping break down this organic matter. Can you imagine what it would look like if these trees and other plants were not digested by termites and other decomposers? Termites have a very important ecological role as decomposers.



<http://www.russellsastronomy.com/gallery/NT/NT2013/termite-mounds.jpg>