Activities

Dirtmeister's Science Lab on Matter

Grades: PreK–K, 1–2, 3–5

Project Description
By participating in Dirtmeister's Science Labs, kids have the opportunity to experience science firsthand. The steps in completing the challenge follow the same methodology used by scientists in solving problems. After reading the question, students are encouraged to formulate hypotheses. With science expert Steve Tomecek (the "Dirtmeister") serving as facilitator, students complete the hands-on investigation and check their results against their predictions.

Background Information on Matter
This month, we explore physical changes in matter by mixing up a unique compound called a colloidal suspension. Known as "goop," "glop," or "ooblek," this material is special because it can change its state with a simple touch or a squeeze. When it sits in the bowl, the matter is clearly in a liquid state. It can pour, take the shape of the container it's in, and flow from one place to another. The second you put this material under pressure, however, it changes state to become a rigid solid. In this particular
case, the energy to cause the change is mechanical instead of heat. When the pressure is released, it
going back to a liquid state.
Colloidal suspensions belong to a special class of liquids called "non-Newtonian." A Newtonian fluid is
like water. It flows easily from one place to another. When you subject it to pressure, it simply flows
out of the way. In a non-Newtonian fluid, the exact opposite happens. When you "shock" it, it suddenly
turns solid. The reason for this strange behavior is that it's really two states of matter in one! When
you mix the corn starch with the water, the corn starch does not dissolve. Instead, the little particles of
starch get suspended in the water and float-making it a very thick liquid. When you put sudden
pressure on the suspension, most of the water runs out from between the grains leaving the solid corn
starch particles to lock up tight. As soon as the pressure is released, the water flows back between
the grains, making the mass fluid again.
Colloidal suspensions don't just happen in a lab. You can find them in your kitchen in a ketchup bottle.
When people don't want to wait for the ketchup to come out, they usually try hitting the bottom of the
bottle. This is the wrong approach because shocking the bottle makes the ketchup turn solid. Instead,
simply turn the bottle over and stick a knife inside. The knife blade will give the ketchup a surface to
flow along. As long as you don't shake it too hard, it will stay a liquid!

**Note:** When you are done experimenting with the mystery matter, don't dump it in the sink! Let it dry
to a solid and then put it in the garbage.

**Materials:** (Scholarship Inc. Webpage)
Dirtmeister's Science Lab Home Page
What Is Matter? (Attachment)
Science Lab On Matter (Attachment)

**Grades K-2**
- While younger students should have no problem working with the matter, things may get a little too
  messy. In this case, you might want to have one big bowl of mystery matter that you can bring around
  the room and have each student touch and observe.
• Read a copy of *Bartholomew and the Ooblek* by Dr. Suess. Then compare Bartholomew's problem with the mystery matter in the bowls. You might want to add some green food coloring to the mystery matter to make it match the material in the story!

**Grades 3-5**

• Have the class make a list of all the different substances that they can think of that behave like the mystery matter. Ketchup, quicksand, and even chocolate milk are all suspensions. See how some of these others compare with the mystery matter in different test situations.

• One of the biggest problems with volcanoes is the sudden mudslides that occur after a prolonged rain. Volcanic ash mixed with water is a colloidal suspension, just like "mystery matter." Have the students use the mystery matter mixture to make a model landscape and have them try to engineer a way to keep a landslide from happening. Ask them to test their ideas by building different types of structures with Popsicle sticks, blocks, or Legos.

**Related Web Sites**

General Science Sites

- [Science and Technology for Children Curriculum](#)
- [The Natural History Museum (London)](#)
- [Edison National Historic Site](#)
- [Endangered Species Program](#)
- [National Inventors Hall of Fame](#)
- [Understanding Our Planet Through Chemistry](#)

**Maps and References**

- Subjects: Science, Chemistry, Physics, Research Skills, Observation, Writing
Matter, matter everywhere.
There's matter in your hair.
Matter in the air.
There's even matter in a pear!
There's liquid matter, solid matter, and matter that's a gas.
Even you are matter, because you have volume and mass!
Okay, so maybe I'm not a poet, but that's how I describe the "stuff" we call matter. In trying to make sense of the universe, scientists have classified everything that exists into two broad categories: matter and energy. Simply stated, matter can be thought of as "stuff" and energy is "the stuff that moves stuff."
Now, if you take all the "stuff" in the world, you know that there are many different types. To further simplify things, matter has been broken down into three basic types, or "states of matter": solids, liquids, and gas. (Actually there are more than three, but we're going to concentrate on the main forms here.)

Matter can change from one state to another, which we call a "physical change." Physical changes usually occur when heat (energy) is either added or taken away. A good example of a physical change is when an ice cube melts. It starts as a solid but when you add heat, it turns into a liquid. The cool thing about a physical change is that it can be reversed. If you take the liquid water from the melted ice and cool it down again (remove the heat), it turns back into a solid!

It turns out that heat isn't the only type of energy that can cause a physical change in matter. In my Science Lab, you'll see what happens when mechanical energy meets some wild and wacky "mystery matter"!
Here's what you'll need:
• a big mixing bowl or a disposable aluminum baking dish
• one 16-oz container of corn starch
• a measuring cup
• water
• scissors
• lots and lots of paper towels and a wet sponge for cleaning up!

Here's what to do:

1. Pour the dry cornstarch into the bowl.
2. Add about 1 1/2 cups of water.
3. Using your hands, mix the two together until it forms a thick paste. (You may have to add a little water — the mixture should have the consistency of tapioca pudding!)
4. Clear off the table around you and prepare to get a little messy!
5. Take some of the mystery matter in your hand and let it rest in your hand. (Make sure you hold it over the bowl!)
6. Next, grab a handful and give it a squeeze.
7. Let a handful rest in your hand. As some falls between your fingers, try cutting it with scissors.
8. Leave the mystery matter in the bowl and try poking it with your finger.

How can you force a physical change in matter? What happened to the state of the mystery matter when you took it out of the bowl and held it in your hand? What happened when you squeezed the mystery matter? What kind of energy was causing this change?

Before you try this Science Lab, predict what state of matter (solid, liquid or gas) your mystery matter is when it is sitting in the bowl.

When you've finished the Science Lab, share your results with the rest of your class. Based on your observations, what conclusions can you make about the state of your mystery matter? See what other tests you can come up with to prove your ideas.