POLYMERS & NON-NEWTONIAN FLUIDS

OOBLECK – YOU'RE GONNA MAKE A MESS!!!

YOU WILL NEED:
1 cup of cornstarch
½ cup of water

OTHER MATERIALS REQ'D:
Lots of paper towels or newspaper
Mixing bowl

INTENDED FOR:
Grades 2-6

SCIENCE GOALS:
- Science as inquiry
- Observation of physical properties
- Observation of changing physical properties

DIFFICULTY RATING: EASY **STEM CATEGORY: SCIENCE**

WHAT THIS ACTIVITY IS ABOUT

In this activity, you will investigate the properties of a polymer called "Oobleck" (from the Dr. Seuss story *Bartholomew and the Oobleck)* . When cornstarch is mixed with water, a remarkable physical change takes place.

A POLYMER is a very long-chain molecule made from a MONOMER...a single molecule. MONOMERS link up to create POLYMERS.

POLYMERS are all around us, in products we use everyday, and even in the foods we eat...Ketchup is a POLYMER!

If you want to know the science behind this activity, skip to "WHAT'S GOING ON" for a sneak-peak and some clues.

Also, see the LINKS section for more online information.

WHERE AND WHY THIS IS USEFUL

Polymers are found everywhere, in just about every product we use. Their importance in our society is phenomenal. Although the polymer in this activity is more fun than functional, an understanding of polymers is a very useful goal.

VOCABULARY - WORDS USED IN THIS ACTIVITY

Viscosity - describes a fluid's resistance to flow: the thicker a fluid, the higher its viscosity.
Colloid – microscope particles suspended in a fluid.
Monomer – an atom or small molecule that may bind to other monomers to form a polymer.
Polymer - a large molecule composed of repeating molecules.
Non-Newtonian Fluid - a fluid that acts differently depending on the type of force placed upon it.
ml - milliliter, a measure of volume. 1000 ml = 1 liter

1 REVIEW KIT CONTENTS

This activity is provided free of charge. You will need to supply:

- 1 cup (237 ml, 8 ozs) cornstarch
- Approx. ½ cup (118ml, 4 ozs.) water
- Mixing bowl

Paper towels or newspaper to cover the working surface.

OBSERVE AND DESCRIBE THE NATURE OF THE CORNSTARCH BEFORE MIXING WITH WATER (color, texture, etc.).

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_____

2 ACTIVITY SETUP

It is suggested that you review all of the steps in this activity before you begin.

NOTE: OOBLECK IS VERY MESSY. TO CLEAN UP, WASH WITH PLENTY OF WATER. IF IT GETS ON THE FLOOR OR COUNTERTOP, LET IT DRY TO A POWDER AND THEN VACUUM IT UP.

WHEN FINISHED, DO NOT POUR OOBLECK DOWN THE DRAIN. INSTEAD, THROW IT INTO THE TRASH, THEN RINSE THE BOWL WITH PLENTY OF WATER.

This activity can get messy (but that's the whole point), so make sure to perform it on a surface that can be easily cleaned. It is suggested that the surface be covered with newspaper or paper towels.

Pour the cornstarch into a mixing bowl. Add 118 ml of water. Mix thoroughly (this might take a while). Add more water, **one tablespoon at a time**, until you get a gooey, very thick material: not too dry (and crumbly) and not too wet (not runny like water). If too dry or wet, you will not be able to experience the weirdness of a non-Newtonian fluid.

3 EXPERIMENTS AND OBSERVATIONS

This is a VERY messy activity, so you may want to dictate your answers and observations to an "assistant"...

PART 1: OBSERVE WHAT HAPPENS....

A. HOW HAS THE CORNSTACH CHANGED WHEN THE WATER WAS ADDED?

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_____

FAST POKE: Try to push your finger into the Oobleck very quickly.

SLOW POKE: Now try to gently and slowly push a finger into the Oobleck.

B. DID YOU NOTICE A DIFFERENCE BETWEEN A QUICK-POKE AND A SLOW POKE? IF SO, DESCRIBE THE DIFFERENCE.

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_____

_____

Again, gently and slowly push a finger into the Oobleck. Try to pull it out quickly, then try to pull it out slowly.

C. DID YOU NOTICE A DIFFERENCE BETWEEN A QUICK-PULL AND A SLOW-PULL?

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_____

continued on back.....

NOTE TO PARENTS

Although all items in these activity kits are safe for normal use, you should be aware of the following: Items should not be ingested. These experiments are designed to be performed with adult supervision. Do not throw materials down the sink when finished: instead, dispose of in trash as appropriate. Recommended for ages 6 and up. May contain small parts that may be a choking hazard. It is suggested that eye protection be worn.

WARNING:
CHOKING HAZARD
This activity may contain small parts. Not for use by children under 3 years of age.

The mission of **THE GEEK LAB** is to create excitement about learning science and to make science fun and promote creativity and a passion for exploring. These activity kits will help kids learn about the scientific method and to gain confidence in the field of science, and to experience the mystery and excitement of scientific endeavor.

Please visit us at www.TheGeekLab.com for free online activities and to purchase more activity kits.

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3 EXPERIMENTS AND OBSERVATIONS.....Continued

PART 2: ROLL, ROLL, ROLL...

Grab a handful of the Oobleck. Very quickly, using both hands, make a ball of Oobleck between your palms by rolling it with a circular motion. Keep rolling it.

Now.....STOP! Let the ball sit in the palm of one hand.

Then try rolling it again.

A. WHAT HAPPENED WHEN YOU STOPPED ROLLING THE OOBLECK BETWEEN YOUR PALMS?

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_____

_____

B. DID YOU OBSERVE TWO STATES OF THE OOBLEK? WHAT WERE THEY?

_____

_____

See if you can come up with other experiments to test the properties of the Oobleck.

You can keep your Oobleck. Put it into a zip-lock bag and store it in the refrigerator

LINKS TO MORE INFORMATION:

OOBLECK
http://en.wikipedia.org/wiki/Oobleck
NON-NEWTONIAN FLUIDS
http://en.wikipedia.org/wiki/Non-Newtonian_fluid
POLYMERS
http://pslc.ws/

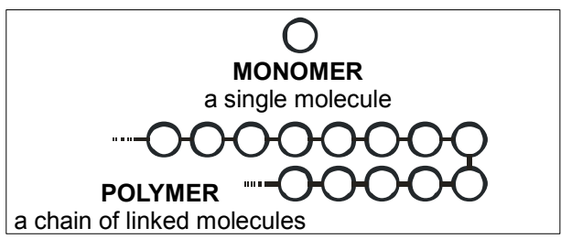
4 WHAT'S GOING ON?

When you mix cornstarch with water, you have created a colloid solution. This solution behaves differently then you would expect. When you treat it "slowly" it behaves like a liquid. When you are "fast" with it, it behaves more like a solid. These are the characteristics of a non-Newtonian fluid: you observe different behavior depending on the type of force applied.

With a "slow" force, the molecules slide over each other very easily. But with the application of a "fast" force, the molecules resist this sliding motion.

Cornstarch and water also create a POLYMER. A polymer is a long molecular chain of MOMOMERS, or single molecules.

This is a representation of what a POLYMER looks like: it is the result of many MONOMERS linking together to make a very long and strong chain.



Some other questions to consider:

COMPARE WATER TO OOBLECK. DOES WATER ACT THE SAME AS OOBLECK?_____

DO YOU THINK THAT WATER IS A NON-NEWTONIAN FLUID?_____

See LINKS for more information.