



Give It Your Best Shot

Grades: 6-8 and 5

Science Standards: Content Standard A: Science as Inquiry; Content Standard B: Physical Science; Content Standard G: History and Nature of Science; Assessment Standards A,C and D and Integration with Language Arts and Mathematics

Concept: Latex comes from the liquid juice of the Hevea tree. Ammonia is added as a preservative to keep it from coagulating or clumping before it is used. There is an ammonia odor when the latex is poured. The vinegar neutralizes the ammonia and this is what makes the latex coagulate.

In this activity, students will make their own latex ball. They will then design and construct a catapult to propel their latex ball at various targets. The catapult segment integrates with science units on simple machines and will incorporate math, language arts, and social studies curriculum on the Middle Ages.

Materials:

TO MAKE A LATEX BALL

2 plastic cups - 3 oz size
20 mL vinegar
pH paper
20 mL latex
spoon
25 ml graduated cylinder
markers
paper towels
goggles and a pan or sink with water

TO MAKE CATAPULT - *per group*

Base block 3/4" x 8" x 4"
Lever board 1/4" x 6" x 1"
Plastic spoon
2 tongue depressors
6 nails
6 elastic bands

ADDITIONAL SUPPLIES:

Hammers
Small eye screws
Rubber bands
Meter sticks or measuring tapes

Note: It is important to get a variety of nails that are small and have sharp points to hammer into tongue depressor and onto the base board without splintering the wood. Small eye screws seem to work well also but be sure they are size to fit through both the tongue depressor and into the baseboard.

Safety: Liquid latex is packaged in ammonia which acts as a preservative,. Latex may be purchased from Flinn Scientific (800-452-1261) with catalog # L0004 for 500 mL. The ammonia has irritating fumes. Latex is not considered hazardous. People with a latex allergy

should NOT do this laboratory. Caution students in the use of hammers and scissors when making the catapults.

Procedure:

MAKING A LATEX BALL:

1. Put on your goggles. Measure 20 mL of tap water using the graduated cylinder. Pour it into the plastic cup. With a marker, make a line of the side of the cup indicating the volume of 20 mL. Pour the water out of the cup
2. Pour the latex into the marked cup so that you have 20 mL of latex in the cup
3. In the other cup, add 20 mL of vinegar. Test the pH of the vinegar by placing a pH indicator paper into the cup to see if it is an acid or a base.
4. Pour the vinegar into the latex and stir with a spoon.
5. Carefully take the mixture out of the cup and roll it into a ball with your hands.
6. Rinse the ball in a pan or sink of water and squeeze out any bubbles.
7. Pat the ball dry with paper towels.

DESIGNING - CONSTRUCTING A CATAPULT

Research ancient uses of the catapult. Pictures of various catapults used throughout history may be used to stimulate ideas for your own design. The construction of a catapult uses the materials found in the material list.

Teacher Notes:

A catapult is a machine that works like a slingshot or a bow and arrow. In the Middle Ages, they were used to hurl heavy rocks and pieces of metal across the moats and over the castle walls. Some of the catapults had a range of 1/4 mile and could throw a stone weighing 60 pounds. The power came from how the catapults were constructed. The twists were made of sinew (animal tendons), horsetails or human hair. Inserted into this was a lever made of wood and bound with leather. At the end of the arm or lever, was a sling. To shoot the stones, the arm (lever) was brought down and released shooting the missile from the sling. When the Romans fought Carthage in 140 BC, the Carthaginian women cut off their hair for the twists of the catapults. In World War I, the soldiers made catapults that flung grenades and poison-gas bombs. Sometimes the bombs were put in tin cans filled with gunpowder or dynamite. In naval warfare, a catapult is used to launch planes from the decks of the aircraft carriers.

MATHEMATICS APPLICATIONS:

While doing this activity, students might research or make up math facts about the catapult such as the following:

1. The cords of the catapults were often made of rope, horsehair, sinew (tendons) of animals or human hair. If they twisted the pieces to be 12'6" long and needed to cut 20" lengths for each section, how many sections could be made?
2. Each Roman legion got 10 catapults and 60 ballistae (crossbows). What is the ratio of artillery to infantrymen if there were 7,000 Romans in each legion? What do you think were the jobs of the rest of the people who weren't with a weapon?
3. Catapults were said to have been invented by the Jewish people in 800 BC. How long ago was that?

4. In 146 BC, the Romans attacked Carthage. All the Carthaginian women cut their hair to make end twists for the catapults. If one woman on the average could supply 7 "twists" for the end pieces and it took 30 twists on each side of the catapult, how many women did it take for each catapult?
5. The estimated range and power of the catapults was 1/4 mile and stones could be up to 60 pounds. Make a story problem based on this information and what you know about ancient battles.

PROCEDURE FOR DESIGNING - BUILDING CATAPULTS

1. Students should work in a group of 2-3 to design and construct the catapult.
2. Each group should be given a bag of catapult building materials. They should be told that they only get one bag of supplies and they should first design their plan on paper before beginning to build it.
3. Additional building supplies such as hammers, elastic pieces and nails - screws should be provided at a designated area.
4. Students should draw their plans on paper first before starting to build.
5. When their initial design is drawn, they may begin to build their catapult.
6. When they have completed their catapult, they may attempt to hurl their ball at a target.

VOCABULARY FOR CATAPULT TARGETS:

Trajectory - curved path of the object that's being thrown

Projectile - an object that can be thrown, hurled or shot

Range - distance between the catapult and the target

TARGET SCENARIOS: Use sources of pictures from coloring books and large picture books for the targets.

ASSESSMENT ACTIVITIES:

- It is the Middle Ages. You have just been ordered to scale the walls of a castle to rescue the princess. You must distract the medieval warriors and be able to get over the walls. Plan your ascent. Using the energy of the catapult, propel yourself over the castle wall. The target could be a picture of a castle.
- You have been training for several years to play basketball. It is now the last seconds of the game, the score is tied and you are at the line to shoot a free throw. Plan your technique to get the ball in the basket. The target could be a basketball goal.
- You have been hired by Robert Ballard to work as an underwater explorer to find a sunken ship in the Aegean Sea. Being the technological expert you are, it is up to you to locate the exact coordinates of the old ship. Use your catapult as a tracking device to locate objects under water. The target could be a sunken ship.
- It is summer and you are going to the county fair. You go to the booth with large figures on a board. The object is to propel the ball at the target to win a prize. You know you can do it. Aim, fire, hit the target. The target could be bull's eye target.

MUSIC - VIDEOS

1. "RUBBER BALL" by Bobby Vee, compact disc by EMI - lyrics go well when students are making flubber balls, measuring splat balls, constructing and hurling balls on catapults. Results in controlling noise.
2. "Flubber" video by Disney, starring Robin Williams, PG rating, has section 1/3 into video where flubber is being produced and has a good graphic.
3. "Fascination of Rubber" video produced by Deutsches Institute Fur Kautschuktechnologie E. V., Norman Gebhardt - shows how latex is obtained from the rubber trees and process whereby latex is being made into rubber

LANGUAGE ARTS

1. BALLOONS, BY Bernie Zubrowski, Morrow Jr. Books, NY, 1990
2. SECRET LIFE OF SCHOOL SUPPLIES, Vicki Cobb, J.B. Lippincott, NY, 1981
3. BALLS - THE BOOK WITH BOUNCE, Bill Haduch , editors of Planet Dextor, AddisonWesley Pub. Co. 1996
4. ICKY POO BOOK, editors of Klutz Press, Palo Alto,CA, 1990
5. OOBLECK, WHAT DO SCIENTISTS DO? GEMS, Univ. CA at Berkley, 1996
6. THE BOOK OF SLIME, By Ellen Jackson, Millbrook Press, Brookfield, Conn.,1997
7. BROCCOLI-FLAVORED BUBBLE GUM, Justin McGivern, Raintree Steck-Vaughn Pub., Austin, TX,1996
8. SCIENCE IN SECONDS WITH TOYS, BY JEAN POTTER, John Wiley and Sons, NY, 1998
9. ICKY-SQUISHY SCIENCE by Sandra Markle, Hyperion Pub., NY, 1996
10. CHEMISTRY FOR EVERY KID By Janice VanCleave, John Wiley and Sons Inc., NY 1989
11. ANTONIO'S RAIN FOREST, BY Anna Lewington, Carolrhoda Books, Inc. Minneapolis, 1993
12. FLAT STANLEY, BY Jeff Brown, Harper Collins Pub., Inc. 1996
13. MAKE YOUR OWN SUPERBALL, BY Ray Miller, Scholastic Co., 1998
14. PLAY AND FIND OUT ABOUT SCIENCE, Janice VanCleave, John Wiley and Sons, Inc., 1990
15. 101 THINGS EVERY KID SHOULD KNOW ABOUT SMOOTH RIRES, Lowell House, LA, 1976
16. FATAL FORCES, By Nick Armid, Scholastic, Inc. 1997
17. LEGO INVENTION BOOK, By Don Rathjan, Klutz Pub., Palto Alto., CA 1998
18. BALLOON BEASTS, by Ray Miller, Scholastic Inc. 1998
19. CASTLES, by Philip Sterle, Kingfisher Pub. Inc. NY 1995
20. WONDER WHY CASTLES HAD MOATS and other questions about medieval times, Philip Stuelin, Kingfisher Pub., NY, 1994
21. CASTLES AT WAR, by Andrew Langly, DK Publishers, 1998

WRITING ACTIVITIES

Writing Prompts:

1. What would happen if you woke up one day and your feet were made of the same polymer as the 'splat' ball?
2. What are some of the things you would be able to do if you physically

- changed like "Flat Stanley"?
4. Design a pair of shoes that would have the properties of the superball you made. What sports would you play and how would it affect the game?
 5. If you could be any type of sports ball, what type would you like to be and describe the reasons.
 6. Describe your day from morning to nighttime as one of the balls you made. What would you look like, feel like, who would own you and what would you do?
 7. With a partner, list as many types of balls as you can. Don't forget objects that are "shaped like a ball" such as the earth.
 8. Make a list of as many famous people whose last names are "Ball". (i.e. George Washington's mother's name was Mary Ball).

Written by Sue Hall, Wisconsin Polymer Ambassador

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