

# Corn Field Math and Science

## Objective

Students will use corn to solve math problems. They will also use corn starch to participate in a polymerization experiment.

## Materials

- computers and/or resource materials
- calculators
- graph paper
- rulers
- compasses
- protractors
- corn starch
- zipper bags
- small plastic cups
- water
- ingredients for Popcorn Ball Polymers (See recipe, included with this lesson.)

## Procedures

1. Bring dried corn on the cob to class. Provide one per student or divide the class into groups and provide one per group.
  - Students will estimate how many kernels are on the ear of corn.
  - Students will count the kernels.
  - According to the background, an ear of corn can have more than 600 kernels of corn per ear. Does your ear have more or less kernels than 600?
  - Students will determine what percentage of the ears of corn had more kernels than 600 and what percentage had less.
2. Students will solve this word problem: If the kernels from your ear of corn were all planted and each kernel produced an ear of corn with the same number of kernels as the original ear of corn, how many kernels of corn will your ear of corn produce?
3. Hand out the worksheet for students to complete.
  - Students will work in pairs or groups to solve the math problems.
  - Students will check answers after completing the first two before continuing.
  - In a class discussion, students will agree or disagree with the reasoning of other classmates and explain their positions.
4. Students will make Oobleck to explore corn polymerization.
  - Hand out the “What is Oobleck?” worksheet included in this lesson
  - Students will work in pairs and use the worksheets to list the properties for a liquid, a solid and a gas.
  - Lead a class discussion and list the properties on the board.
5. Provide materials to make Oobleck.
  - Based on the ingredients provided, students will hypothesize if they will be

## Oklahoma Academic Standards

### GRADE 5

Number and Operations: 1.4.  
Geometry & Measurement:  
2.3; 3.3

Physical Science: 1-4

### GRADE 6

Number & Operations:  
1.4; 3.3,4; 4.1,4. Algebra:  
2.1; 3.1,2. Geometry &  
Measurement: 3.1,2  
Physical Science: 1.4

### GRADE 7

Number and Operations:  
2.3,5. Algebra: 2.2,3; 3.3; 4.1  
Physical Science: 1-2

### GRADE 8

Algebra: 4.1,2,3;  
Physical Science: 1-3,5

creating a solid or a liquid. Students will write their hypotheses on the worksheets

—Students will work in pairs to make Oobleck, as described on the Oobleck Instruction Sheet.

6. Students will experiment with the Oobleck before answering the questions on the instruction sheet and recording their answers.

**EXPLAIN:** Oobleck is a non-Newtonian fluid. That is, it acts like a liquid when being poured, but like a solid when a force is acting on it. You can grab it and then it will ooze out of your hands. Make enough Oobleck and you can even walk on it! Other non-Newtonian fluids include molasses, ketchup and toothpaste. Provide an assortment of Newtonian and non-Newtonian fluids and let students work in pairs to decide which is which.

7. Discuss polymerization as explained on the instruction sheet. Use popped popcorn to demonstrate how small molecules (monomers) combine to make polymers. Students will make popcorn balls to represent polymers.
8. Provide students with copies of the vocabulary page. Students will follow the instructions and use context clues to place the correct word in each numbered blank.

# Cornfield Math

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Use your calculator and other mathematical tools to solve the following problems. Compare your methods with a partner.

1. a) An acre of land is 43,560 sq. ft. How long is one side of a square acre?  
b) If the rows are 2.5 ft. apart, how many rows are there?  
c) How many corn plants will be in each row if there are 22,000 plants in a square acre?
2. Each corn plant produces one ear of corn. There are 600 kernels per ear. How many kernels are produced on 1 acre of land?

WAIT: CHECK YOUR ANSWERS TO THE FIRST TWO PROBLEMS BEFORE CONTINUING.

3. There are 135 bushels of corn produced per acre. How many kernels of corn are in a bushel?
4. A farmer has 640 acres planted in corn. How many bushels of corn will this yield if each plant produces two ears?
5. Corn is selling for \$2.40 a bushel. Farmer A's plants produce two ears per plant, while Farmer B's plants produce one. Compare their earnings per acre.
6. The yield has increased by 125% or by a factor of 2.25 since 1950. It is 135 bushels today. What was it in 1950? explain in writing how you completed your answer.
7. The farmer decided to plant his 320 acres in three different varieties of corn. Use graph paper to construct a model of the farmer's land. Label each section, and complete the calculations. Show your work. Discuss your work on this question with a partner or in a cooperative group.
  - a) Variety A produces one ear per plant. the farmer planted  $\frac{1}{3}$  of his 320 acres in Variety A. How many bushels of corn can he expect from Variety A?
  - b) Variety B produces two ears per plant. the farmer planted half of his 320 acres in Variety B. How many bushels of corn can he expect from Variety B?
  - c) Variety C produces 1 ear per plant. The farmer planted the rest of his acreage in Variety C. How many bushels of corn can he expect from Variety c?
  - d) What is the total yield the farmer can expect for the entire 320 acres?
  - e) How much would the farmer receive from the sale of his corn at \$2.40 a bushel?

# Cornfield Math (answers)

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1. An acre of land is 43,560 sq. ft.
2. a) How long is one side of a square acre?  
 $\sqrt{43,560} = 208.71$  ft per side  
b) If the rows are 2.5 ft. apart, how many rows are there?  
 $208.71 \div 2.5 = 83.48$  or  $83.48 + 1 = 84.48$  rows of corn (if you add a row on each side rather than start from the edge, so the side of the field counts as one row.)  
c) How many corn plants will be in each row if there are 22,000 plants in a square acre?  
 $22,000 \div 83.48 = 263.54$  or  $22,000 \div 84.48 = 260.42$
3. Each corn plant produces one ear of corn. There are 600 kernels per ear. How many kernels are produced on 1 acre of land?  
 $22,000 \times 600 = 13,200,000$
4. There are 135 bushels of corn produced per acre. How many kernels of corn are in a bushel?  
 $13,200,000 \div 135 = 97,777.78$
5. A farmer has 640 acres planted in corn. How many bushels of corn will this yield if each plant produces two ears?  
 $640 \times 135 = 86,400 \times 2 = 172,800$  (2 ears per plant)
6. Corn is selling for \$2.40 a bushel. Farmer A's plants produce two ears per plant, while Farmer B's plants produce one. Compare their earnings per acre.  
**Farmer A:  $\$2.40 \times 270 = \$648$  per acre; Farmer B:  $\$2.40 \times 135 = \$324$  per acre**
7. The yield has increased by 125% or by a factor of 2.25 since 1950. It is 135 bushels today. What was it in 1950? Explain in writing how you completed your answer.  
 $x + (125\%)x = 135$ ;  $2.25x = 135$ ;  $135 \div 2.25 = 60$ ;  $x = 60$  bushels
8. The farmer decided to plant his 320 acres in three different varieties of corn. Use graph paper to construct a model of the farmer's land. Label each section, and complete the calculations. Show your work. Discuss your work on this question with a partner or in a cooperative group.
  - a) Variety A produces one ear per plant. the farmer planted  $\frac{1}{3}$  of his 320 acres in Variety A. How many bushels of corn can he expect from Variety A?  
 $\frac{1}{3} \times 320 = 106.66$  acres  $\times 135$  bushels = **14,399.1 bushels**
  - b) Variety B produces two ears per plant. the farmer planted half of his 320 acres in Variety B. How many bushels of corn can he expect from Variety B?  
 $\frac{1}{2} \times 320 = 160$  acres  $\times 270$  bushels = **43,200 bushels**
  - c) Variety C produces 1 ear per plant. The farmer planted the rest of his acreage in Variety C. How many bushels of corn can he expect from Variety c?  
 $(1 - \frac{1}{3} - \frac{1}{2}) \times 320 = 53.33$  acres  $\times (135 \times 1.5) =$  **10,799.325 bushels**
  - d) What is the total yield the farmer can expect for the entire 320 acres?  
 **$14,399.1 + 43,200 + 10,799.325 = 68,398.425$  bushels**
  - e) How much would the farmer receive from the sale of his corn at \$2.40 a bushel?  
 **$68,398.425 \times \$2.40 = \$164,156.22$**

Name \_\_\_\_\_

# Corn Science: What is Oobleck?

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## Problem

A liquid and a solid are mixed together in a plastic bag. Using your senses (except taste), determine if the substance is a liquid, a solid or a gas.

## Research

List three properties of solids, liquids and gases.

Solid

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Liquid

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Gas

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## Hypothesis

I think the substance will be a \_\_\_\_\_

Name \_\_\_\_\_

# Oobleck Instruction Sheet

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## OUBLECK

Oobleck gets its name from the Dr. Seuss book *Bartholomew and the Oobleck*. In the story, a gooey green substance, Oobleck, falls from the sky and wreaks havoc in the kingdom. Work with a partner to make Oobleck. (Oobleck will keep in a baggy for 3-4 days. When finished throw it away. DO NOT pour it in a sink.)

Ingredients Needed(for each pair of students):

1/2 cup corn starch	small plastic cup	water
Zip-closing plastic bag	plate	stop watch

1. Dump ½ cup corn starch into a zipper bag.
2. Fill a small plastic cup with water.
3. Slowly mix the water into the corn starch a little at a time until you get a gooey mixture. Don't add too much water. If the mixture is too runny add more cornstarch to thicken. If it is too thick or crumbly, add a few drops of water to thin.
4. Design their own experiments. Record your results and share them with the class.

### Questions

- What happens when you push the Oobleck away from you slowly? Quickly?
- Can you roll the Oobleck into a ball? If so, use a timer to see how long it takes to spread out when you set the ball on a plate.
- Will the ball bounce on the table? (DO NOT bounce on the floor.)
- What happens to the Oobleck when you hold it above the plate and let it hang?
- What happens if you push an object, such as your finger or a spoon, slowly into the Oobleck?
- What happens if you push the same object with more pressure?
- What happens if you try to stir the Oobleck slowly? Quickly?
- What happens to the Oobleck if you pour it into various shaped containers? Does it keep its own shape or take on the shape of the container?
- Is Oobleck a liquid or a solid? Support your answer with information you gathered during your experiment.

A polymer is a chemical compound or mixture of compounds that is formed by combination of smaller molecules and consists basically of repeating structural units. Polymers play an important in our everyday lives. They range from familiar synthetic plastics such as styrofoam to natural biopolymers such as DNA and proteins that are fundamental to biological structure and function. Corn starch is a natural polymer made from corn.

Polymers, both natural and synthetic, are created by polymerization. Polymerization is the name of the process that takes place when the smaller molecules are combined.

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# Popcorn Ball Polymers

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A polymer is formed when several small molecules (monomers) combine. It consists of repeating structural units. Students will create their own models of polymers by making popcorn balls.

(makes 12 popcorn balls)

1/2 cup corn syrup

1 cup sugar

1/4 cup butter

1/2 teaspoon salt

1 teaspoon vanilla

1/2 teaspoon baking soda

3 quarts (12 cups) warm popped corn

1. Combine sugar, corn syrup, butter and salt in a heavy 2-quart saucepan.
2. Grease a large mixing bowl and put in popped popcorn. Grease a mixing spoon. Set aside.
3. Combine molasses and sugar in a saucepan. Stirring constantly, bring to a boil over medium heat. Continue stirring and boil 2 minutes.
4. Remove syrup mixture from heat; stir in vanilla and baking soda.
5. Pour syrup over popcorn, stirring to coat well.
6. Let the mixture cool a little while students wash their hands.
7. Students will work quickly to press the popcorn into balls to make “popcorn polymers.”
8. Cool completely before eating.

Name\_\_\_\_\_

# Vocabulary Page

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Read the following passage. Use the Word Bank below to fill in the blanks with one of the three words provided for each numbered blank. Use the word that makes the most sense. Remember to use context clues that come before and after the blanks.

Matter can be described and identified by physical and chemical properties. Physical (1)\_\_\_\_\_ have to do with appearance. You can observe many physical properties with your senses and by measuring the length, (2)\_\_\_\_\_, height, mass and density of a substance. (3)\_\_\_\_\_ properties include color, shape, smell, texture, taste and size. The state of matter (whether it's a solid, (4)\_\_\_\_\_, or gas) and the (5)\_\_\_\_\_ at which the substance boils, melts or freezes are also physical properties. Magnetic properties are physical properties as well.

(6)\_\_\_\_\_ properties, on the other hand, have more to do with the atomic or molecular composition of matter. Chemical properties deal with how substances react with other (7)\_\_\_\_\_ such as water, air or fire.

A physical change has occurred when a substance changes color, size, shape, temperature or state. A (8)\_\_\_\_\_ change has occurred when a substance has changed into something new or (9)\_\_\_\_\_ so that the original substance is gone. Digestions, combustion, and radioactive decay are examples of chemical changes. A chemical change takes place in a (10)\_\_\_\_\_ to produce electricity when you turn on a flashlight.

## Word Bank

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|-----|-------------|-------------|------------|------------|
| 1.  | chemicals   | properties  | substances | textures   |
| 2.  | width       | density     | height     | property   |
| 3.  | chemical    | matter      | described  | physical   |
| 4.  | water       | molecule    | liquid     | atom       |
| 5.  | time        | temperature | design     | cylinder   |
| 6.  | chemical    | physical    | substance  | gaseous    |
| 7.  | properties  | physicals   | degrees    | substances |
| 8.  | temperature | physical    | chemical   | color      |
| 9.  | similar     | different   | familiar   | original   |
| 10. | battery     | bulb        | change     | switch     |