

Corn...America's Golden Harvest

Objective: The student will know the history of corn, the parts of a corn seed, and the by-products of corn.

Grade Level: 1-3 4-6

TEKS:

S- 1.2A; 1.6B; 2.2A, C; 3.4A
LA- 1.10B; 2.10B; 3.9B

S- 4.3C, D; 4.11C
SS- 4.13 A-B

TAKS:

GRADE

OBJECTIVES

Reading	3, 4, 5, 6	1, 3, 4
Writing	4	1, 2, 3, 4, 5, 6
Science	5	1, 2, 3, 4
Math	3, 4, 5, 6	1, 2, 4, 5, 6

Assessment Summary:

Materials: Corn is Maize by Alike, Texas Corn, Popcorn

A variety of corn seeds (they can be obtained from your local feed supply company), popping corn, paper, pencils, handouts

"Corny Things at My House"

"How Do You Like Your Corn?"

"Popcorn Poppin' Trivia"

"Word Scramble"

"Follow the Corn Trail" and "Corny Question Quiz"

"A Bushel of Corn Adds Up" and "Math Challenge"

"Become an Environmental Scientist" Science Activity

Equipment: Magnifying glasses, microscopes

Assessment: Grade appropriate teacher assessment

Quizzes

Activity sheets

Research and writing projects

Background Information

The corn plant is a North American native. It was first grown in Mexico 7,000 years ago. The native Indians first taught the pilgrims to use corn. The United States grows more corn than any other country. The average ear of corn has more than 600 kernels in 16 rows and weighs 3/4 of a pound. By-products of corn are corn starch, syrup, dextrose, and oil. Corn is known as "maize" in many parts of the world. Several varieties of sweet corn and popping corn are grown for human use. Popcorn has also been growing in the Americas since 1492. A gift of popped popcorn was brought to the first Thanksgiving feast. Popcorn was found by archaeologists in West Central New Mexico 5,600 years ago. Other artifacts validate popcorn's link to the past-pottery popcorn poppers dating back to pre-Inca cultures in Peru. The major corn producing states in the United States are Iowa, Nebraska, Minnesota, and Illinois.

Corn is in touch with us daily - often without our ever knowing it! Americans would find it difficult to live without corn. It is our country's number one crop. Many people are familiar with sweet corn and enjoy it as a part of their diets. However, most corn is field corn which is fed to livestock and poultry, and processed into a variety of products.

For example, corn syrup sweetens our soft drinks, cornstarch strengthens fibers in cotton shirts, and toothpaste contains sorbitol processed from corn to make the paste tasty. Many other non-edible products contain corn including glue, fireworks, crayons, chalk, ink, paper, paint and cosmetics. The more obvious corn products are the edible variety such as corn meal, corn chips and cereals.

The next time you go shopping for groceries, become a corn detective. Just how many items can you identify that contain corn or a corn by-product? The number will amaze you! Corn is used in a variety of food and non-food products that are a part of our daily lives.

Nearly 60% of all the corn grown in the United States is fed to livestock. Corn provides a safe and nutritious feed that helps produce quality meat, dairy, and egg products for human use.

Did you know that the main ingredient in most dry pet food is corn? Corn helps keep our dogs and cats healthy and active.

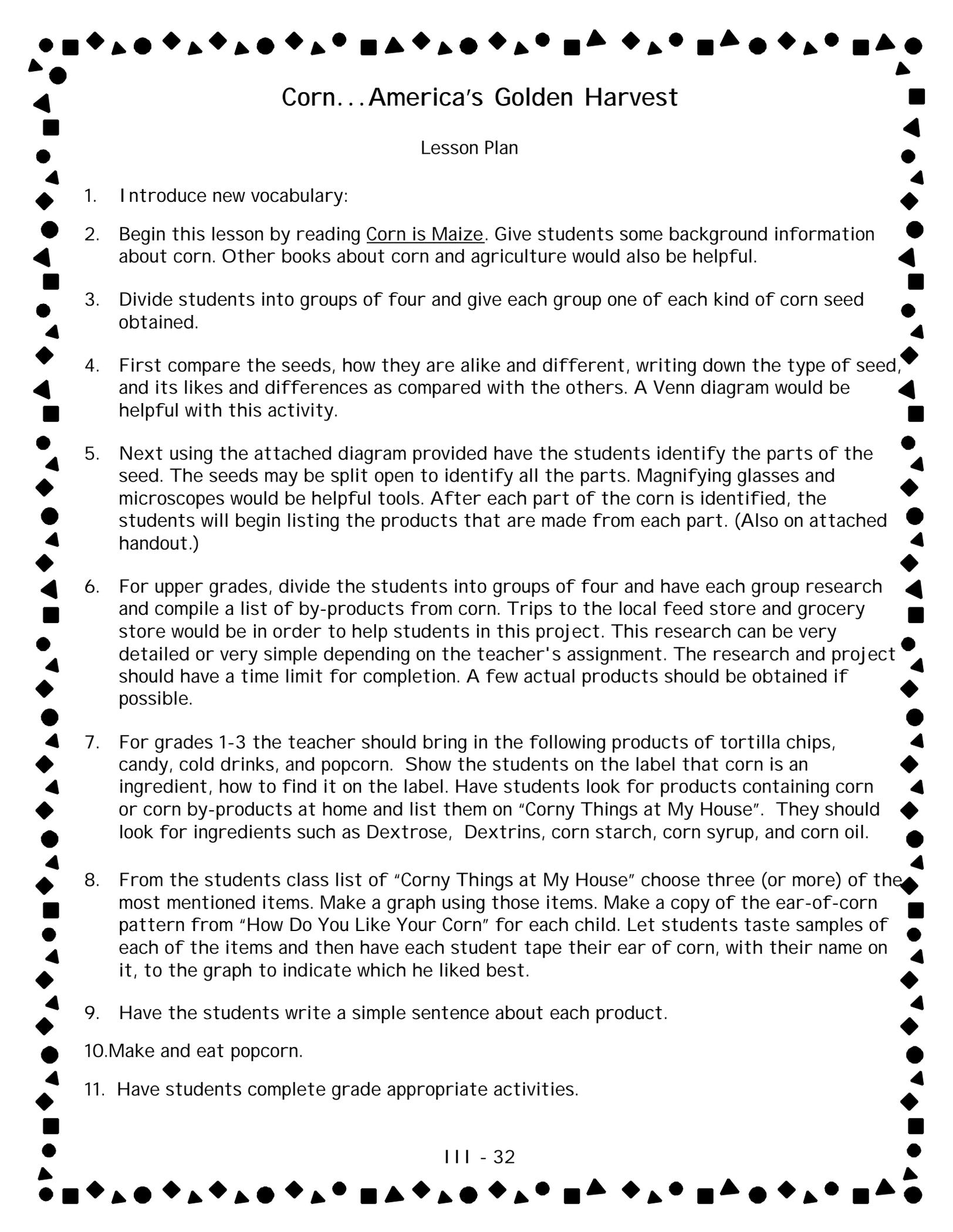
Corn has long been recognized as a good source of nutrition for humans. Corn provides protein and fiber that are both essential elements in our diet.

That little kernel of corn can be used in so many ways. Oil from the germ of the kernel is low in saturated fat. This low fat product is ideal for health conscious Americans.

Starch from our little friend provides carbohydrates to our diet. This provides needed energy for growth and activities. Fructose, from cornstarch, is a sweetener that is one and one half times sweeter than refined sugar. Less fructose is needed to sweeten so the foods contain fewer calories. Fructose also helps the body utilize protein.

Fewer calories, higher fiber, reduced amounts of sugar and less fat are all parts of a desirable diet. Corn in the human food chain helps provide all of these.

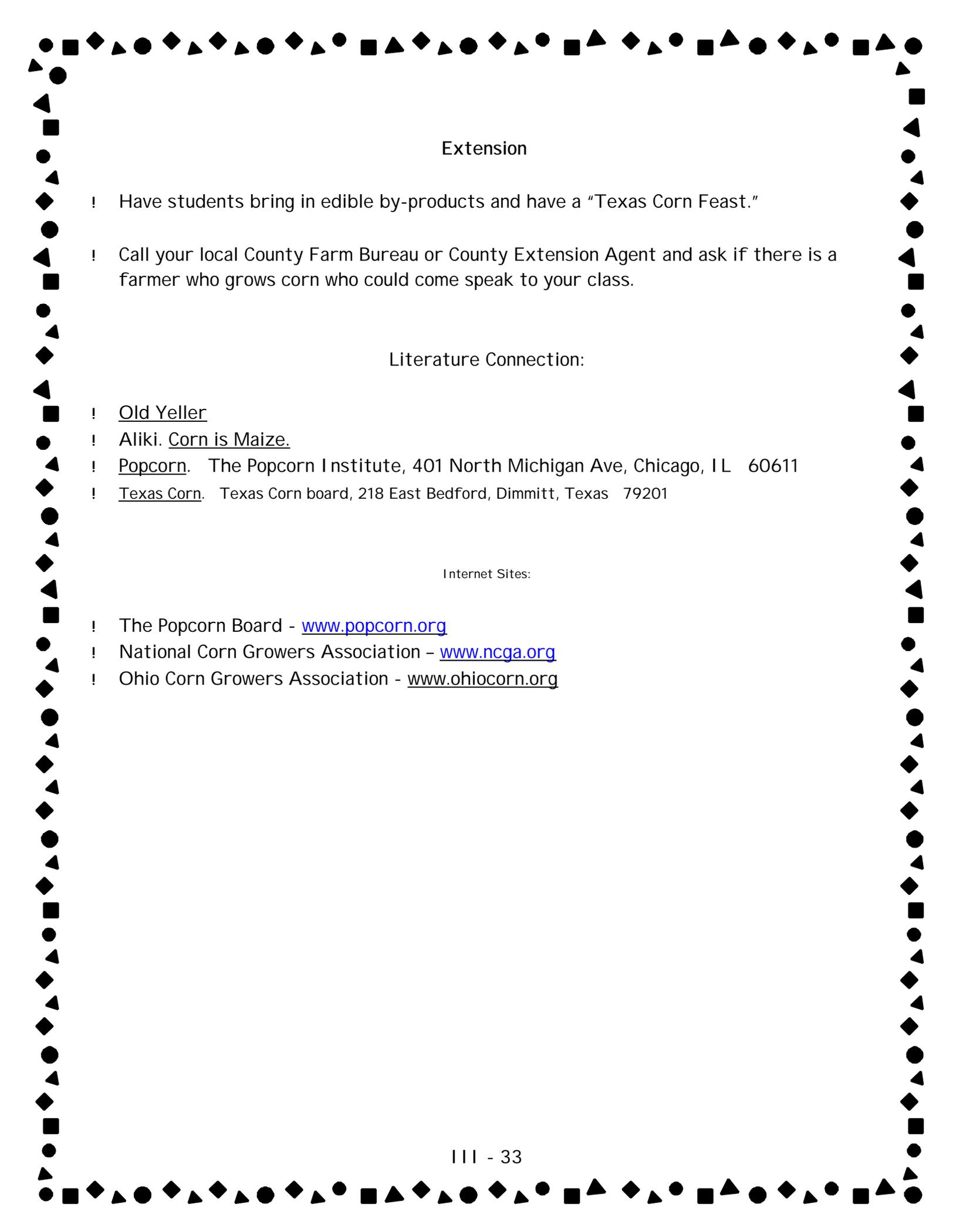
National Corn Growers Association - www.ncga.org

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Corn...America's Golden Harvest

Lesson Plan

1. Introduce new vocabulary:
2. Begin this lesson by reading Corn is Maize. Give students some background information about corn. Other books about corn and agriculture would also be helpful.
3. Divide students into groups of four and give each group one of each kind of corn seed obtained.
4. First compare the seeds, how they are alike and different, writing down the type of seed, and its likes and differences as compared with the others. A Venn diagram would be helpful with this activity.
5. Next using the attached diagram provided have the students identify the parts of the seed. The seeds may be split open to identify all the parts. Magnifying glasses and microscopes would be helpful tools. After each part of the corn is identified, the students will begin listing the products that are made from each part. (Also on attached handout.)
6. For upper grades, divide the students into groups of four and have each group research and compile a list of by-products from corn. Trips to the local feed store and grocery store would be in order to help students in this project. This research can be very detailed or very simple depending on the teacher's assignment. The research and project should have a time limit for completion. A few actual products should be obtained if possible.
7. For grades 1-3 the teacher should bring in the following products of tortilla chips, candy, cold drinks, and popcorn. Show the students on the label that corn is an ingredient, how to find it on the label. Have students look for products containing corn or corn by-products at home and list them on "Corny Things at My House". They should look for ingredients such as Dextrose, Dextrins, corn starch, corn syrup, and corn oil.
8. From the students class list of "Corny Things at My House" choose three (or more) of the most mentioned items. Make a graph using those items. Make a copy of the ear-of-corn pattern from "How Do You Like Your Corn" for each child. Let students taste samples of each of the items and then have each student tape their ear of corn, with their name on it, to the graph to indicate which he liked best.
9. Have the students write a simple sentence about each product.
10. Make and eat popcorn.
11. Have students complete grade appropriate activities.

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Extension

- ! Have students bring in edible by-products and have a "Texas Corn Feast."
- ! Call your local County Farm Bureau or County Extension Agent and ask if there is a farmer who grows corn who could come speak to your class.

Literature Connection:

- ! Old Yeller
- ! Alike. Corn is Maize.
- ! Popcorn. The Popcorn Institute, 401 North Michigan Ave, Chicago, IL 60611
- ! Texas Corn. Texas Corn board, 218 East Bedford, Dimmitt, Texas 79201

Internet Sites:

- ! The Popcorn Board - www.popcorn.org
- ! National Corn Growers Association - www.ncga.org
- ! Ohio Corn Growers Association - www.ohiocorn.org

Corny Things at My House

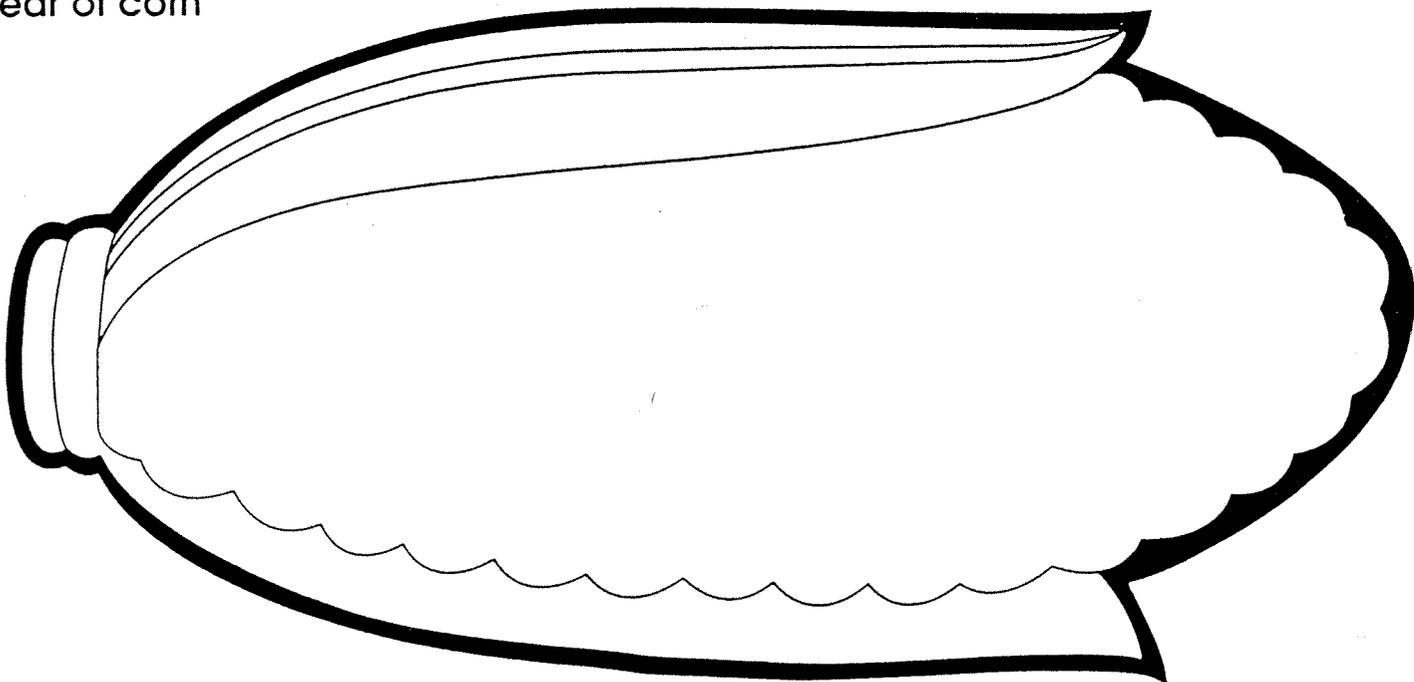


How Do You Like Your Corn?

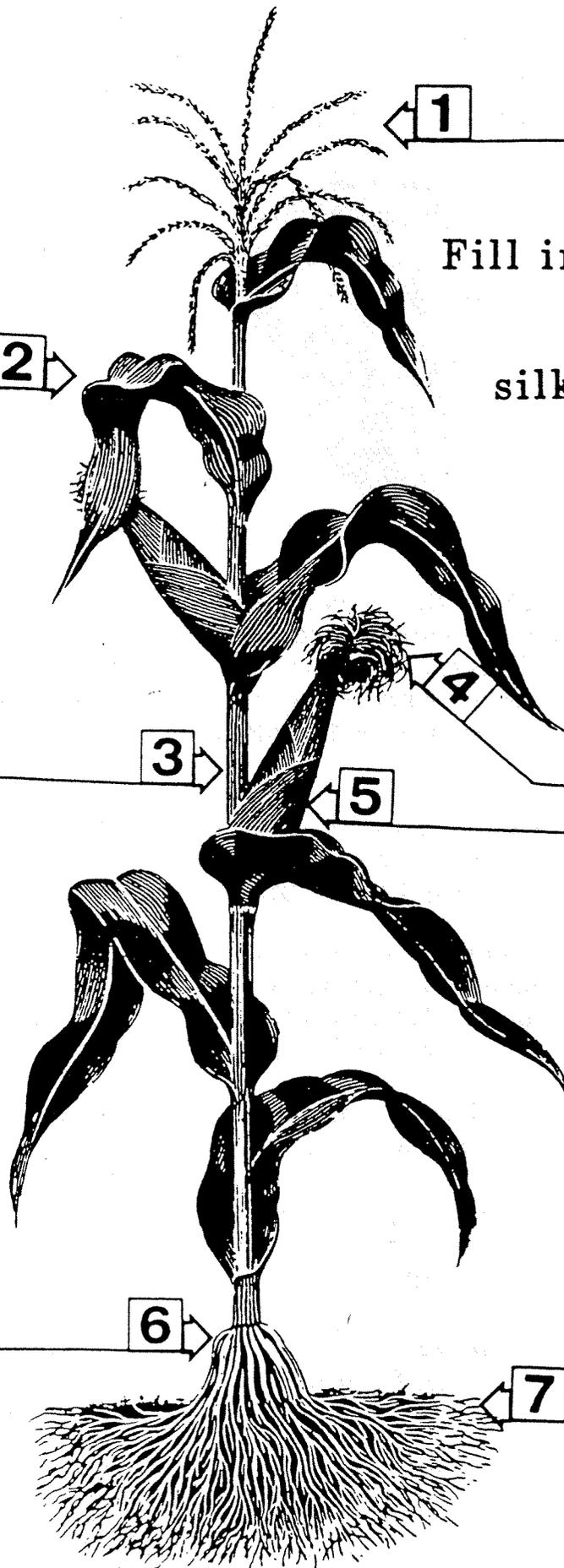
Make a graph like this on the chalk board using the most listed corn products from students' lists. Photocopy the ear of corn for each student and have them tape their ear of corn on the board under their favorite food made from corn. Or have make their own grap. individually.

Popcorn	Corn on the Cob	Corn Bread

ear of corn



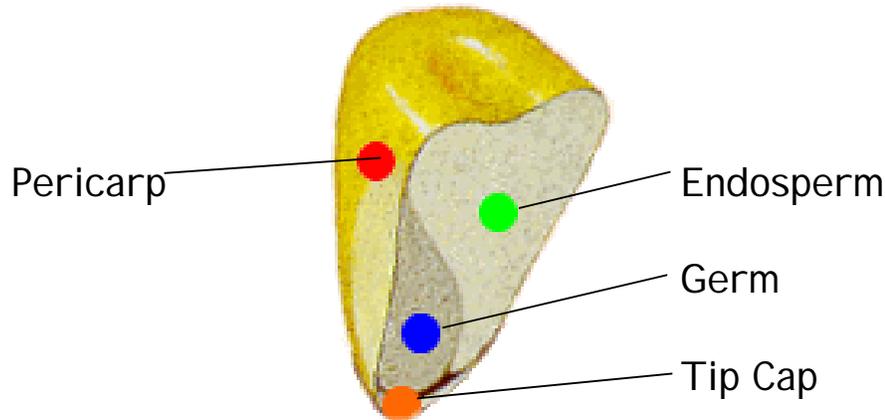
All About Corn



Fill in the blanks with:
stalk, leaf, tassel,
silks, ear, prop roots,
and roots.

WHAT'S IN A KERNEL OF CORN?

PARTS OF A CORN KERNEL



The Endosperm is about 82% of the kernel's dry weight and is the source of energy and protein (starch) for the germinating seed. There are two types of endosperm, soft and hard. In the hard endosperm, starch is packed tightly together; in the soft endosperm, the starch is loose. When corn dries in the field before harvest, the moisture loss causes the soft endosperm to collapse and form a dent in the top of the kernel.

The Pericarp, also called the hull, is the outer covering of the kernel that protects it from deterioration. It is water- and water vapor-resistant and is undesirable to insects and micro-organisms. We get corn gluten feed and meal from the pericarp.

The Germ is the only living part of the corn kernel. It contains the essential genetic information, enzymes, vitamins and minerals for the kernel to grow into a corn plant. About 25% of the germ is corn oil. Corn oil is the most valuable part of the corn kernel because of its amount of linoleic acid (polyunsaturated fat) and its bland taste.

The Tip Cap is the only area of the kernel not covered but the pericarp. It was the attachment point of the kernel to the cob. It is the major entry path into the kernel.

Corn Kernel By-Products

Pericarp (hull)
Corn Gluten Meal
Livestock Feed

Germ
Cooking Oil
Mayonnaise
Salad Dressing

Endosperm
Paper
Textiles
Sweeteners
Ethanol

www.ohiocorn.org

Corn Facts

- In 1950 average corn yield was 37 bushels per acre. In 1966 the average yield was 74 bushels per acre. By 1994 farmers produced an average yield of 138 bushels per acre!
- A single kernel of seed corn may produce a plant that yields 800 kernels of corn per ear. Each plant produces an average of two ears. An estimated 22,000 to 35,000 individual plants can be grown on an acre of farm land.
- All ears of corn produce an even number of rows, with an average of 16 rows.
- In the United States, corn is grown on more acres of farm land than any other crop. In one year the U. S. harvests more than 80 million acres of corn.

From One Bushel of Corn...

32 pounds of STARCH

Adhesives, Batteries, Detergents,
Crayons, Degradable Plastics, Dyes,
Plywood, Antibiotics, Chewing Gum,

Soups

OR

33 pounds of SWEETENER

Shoe Polish, Paper, Soft Drinks and
Juices, Licorice, Peanut Butter, Pickles,
Catsup, Marshmallows, Cereal,

11.4 pounds of 21% of PROTEIN

GLUTEN FEED

Livestock and Poultry Feed, Pet Food

1.6 pounds of CORN OIL

Cooking Oil, Margarine, Mayonnaise,
Salad Dressing, Shortening, Printing
Ink, Soap, Leather Tanning

OR

2.5 Gallons of

ETHANOL/ALCOHOL

Motor Fuel Additive, Alcoholic
Beverages, Industrial Alcohol,

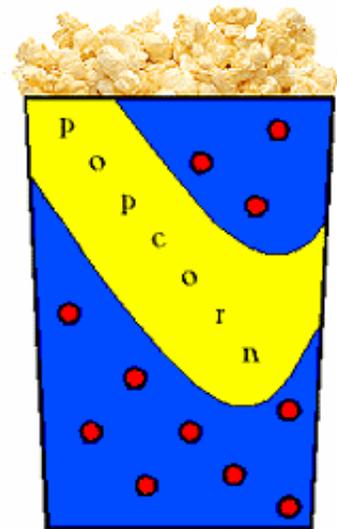
3 pounds of 60% GLUTEN

MEAL,

Amino Acids, Fur Cleaning

Fun Popcorn Facts

- How does popcorn pop?
Water is stored in a small circle of soft starch in each kernel. As the kernel is heated, the water heats, the droplet of moisture turns to steam and the steam builds up pressure until the kernel finally explodes to many times its original volume.
- Popcorn was at the first Thanksgiving!
The English colonists were introduced to popcorn at the first Thanksgiving feast when Quadequina, brother of the Wampanoag chief Massasoit, brought a deerskin bag of popped popcorn to dinner as a gift.
- Popcorn for breakfast? Of course!
The first breakfast cereal was made by adding sugar and milk to popped popcorn.
- How is popcorn different from other kinds of corn?
There are five different types of corn, and of these varieties (popcorn, sweet, dent, flint, and pod) popcorn is the only corn that pops.
- Popcorn.....a vegetable or a grain?
Popcorn's nutritious value comes from the fact that, like other cereal grains, its primary function is to provide the body with heat and energy. Its carbohydrate content spares protein allowing the body to store much needed body fuel.
- Popcorn comes in all the colors of the rainbow
Kernels range in color from off-white to light gold, red, black and many colors in between.
- Is microwave popcorn the same as the popcorn I pop on the stove?
Microwave popcorn is the same as other popcorn except the kernels are usually larger and the packaging is designed for maximum popability.



The Popcorn Board-www.popcorn.org

Popcorn Poppin' Trivia Answers

- C -- Americans will consume nearly 16 billion quarts of popped popcorn this year or 59 quarts of per man, woman and child.
- B -- Water is stored in a small circle of soft starch in each kernel. As the kernel is heated, the water heats, the droplet of moisture turns to steam and the steam builds up pressure until the kernel finally explodes to many times its original volume.
- C -- The best popping temperature is between 400° /-460° / Fahrenheit.
- B -- According to the USDA Nutrient Database for Standard Reference, 1 cup of popcorn, oil-popped, contains 55 calories.
- A -- Popcorn was used by the Native Americans as a staple in their diet and for decoration. Headdresses, necklaces and corsages included popcorn.
- B -- Old maid is a term used for kernels that fail to pop and are often found at the bottom of the popcorn bowl.
- C -- Store popcorn in an airtight container in a cool, dry place. Do not store it in the refrigerator or freezer, as the low humidity may dry out the popcorn and effect popability.
- B -- Popcorn is a very economical. On average, two tablespoons of unpopped kernels produce a quart of popcorn for about six cents.
- B -- Vegetable oils are low in saturated fat. Do not use butter, as it will burn.
- C -- According to the Guinness Book of World Records, the world's largest popcorn ball measured 12 feet in diameter and weighed 2,000.

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Be a Corn Detective

Word Scramble

Unscramble the following list of food items that contain corn.



nroc sekalf c _ _ _ f _ a _ _ _

cei earcm _ c _ _ _ _ m

oads s _ _ _

nuteap ttreub _ e _ _ u _ _ _ u _ _ e _

upchket k _ _ _ h _ _

alads ingsserds _ l _ _ d _ e _ _ _ _ g

ylelj _ e _ _ _

mallmarowssh _ a _ s _ _ _ _ l _ _ s

meanringa m _ _ g _ _ _ _ _

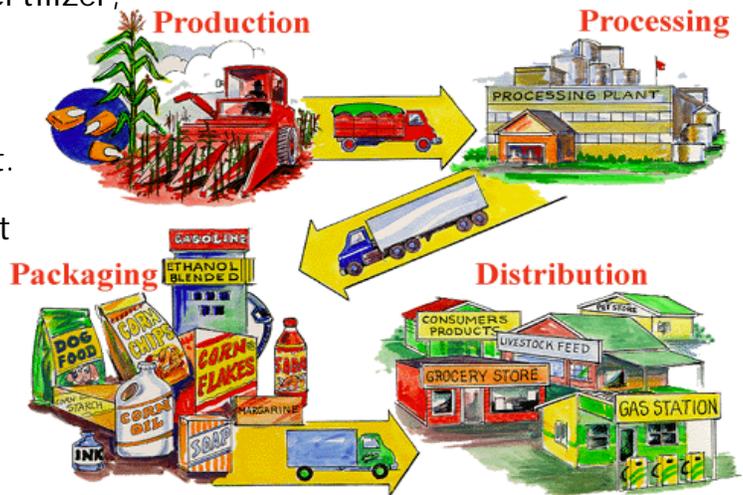
tcoa hipcs _ a _ o _ _ i _ _

Follow the Corn Trail

Production

Corn seeds are planted in late February and March. The planter places the seed in rows about 25 inches apart. A good stand of corn might number 25,000 plants per acre. The plants grow all spring and summer. Fertilizer, weed control, and insect control are provided by the farmer. All of these steps help ensure a larger crop.

By fall, most corn is ready to harvest. Corn used to be harvested by hand. Most farmers now use a combine that removes the cobs from the stalks and the kernels from the cobs. The kernels of corn go into a wagon or truck to be transported. It is then dried and stored either on the farm or in a grain elevator. Much of the corn grown in the United States and Texas never leaves the farm. A large portion of Texas corn crop is fed to livestock.



Processing

A bushel of corn weighs 56 pounds and can be processed in a variety of ways. It can be soaked, pressed, ground, cooked, and flaked. 72,800 kernels of corn can produce.

- 1.6 pounds of corn oil
- 2.6 pounds of gluten meal
- 10.9 pounds of protein
- 31.5 pounds of starch OR 33 pounds of sweetener OR 2.5 gallons of ethanol fuel

Packaging

After these corn products have been processed, they are packaged. Corn comes to us in all shapes, sizes, and forms: from corn flakes to corn chips, from margarine to corn oil, from puddings to soda, from soap to ethanol.

Distribution

These corn products are distributed to you and me, the consumer, through groceries, gas stations, animal feed dealers, and every kind of store imaginable. You can find more than 3,000 items in your grocery that contain corn.

Corny Question Quiz

After reading the passage "Follow the Corn Trail" circle the correct answer.

1. How many plants of corn will there be in a 100 acre field?

- A. 2,500,000
- B. 25,000
- C. 2,500

2. 60% of the corn grown in Texas is used in the production of which agricultural product?

- A. corn flakes
- B. livestock
- C. corn oil

3. One bushel of corn can make _____ pounds of sweetener.

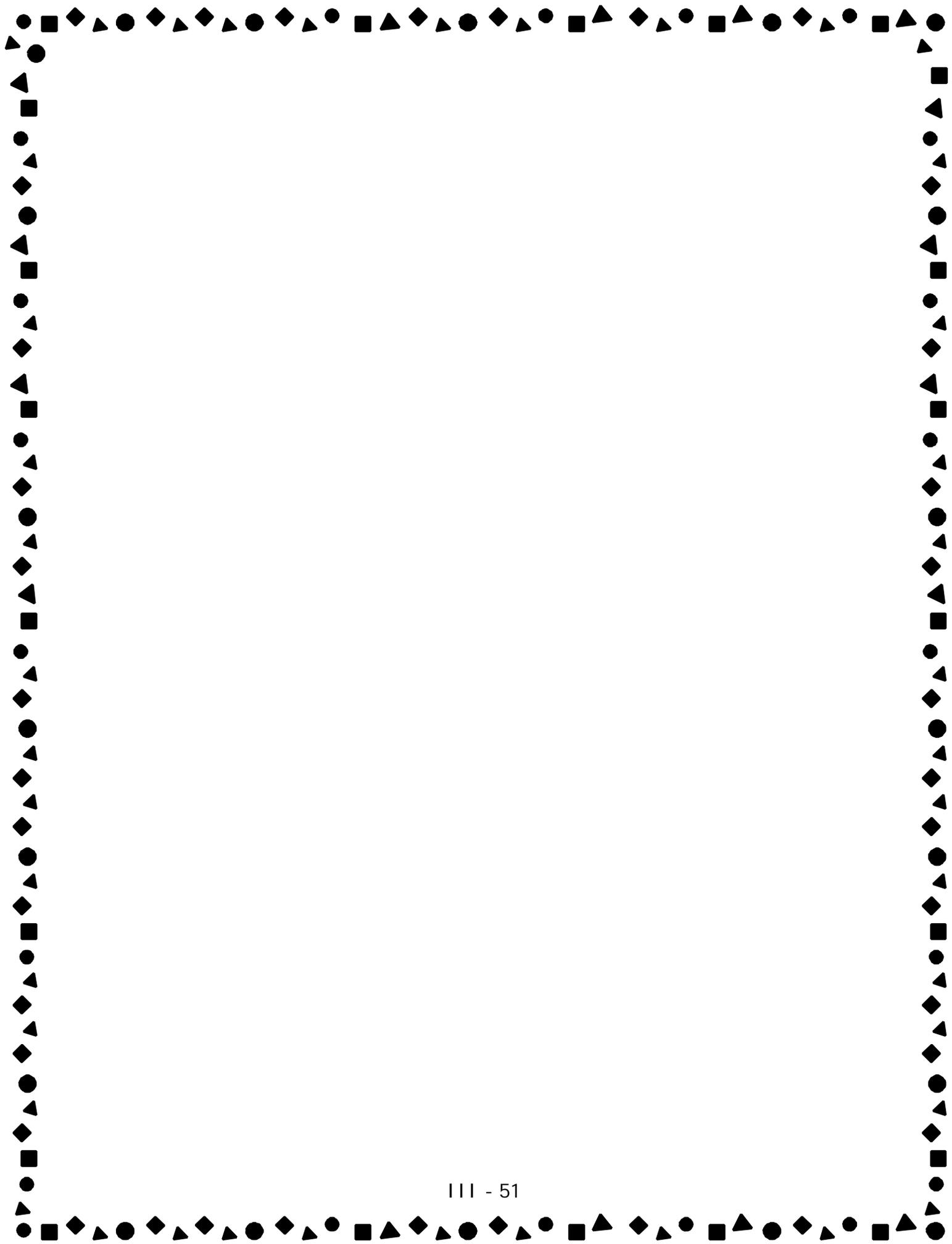
- A. 10
- B. 33
- C. 5

4. Corn can be processed by soaking, pressing, grinding, cooking, or _____.

- A. popping
- B. snacking
- C. flaking

5. How many gallons of environmentally, friendly ethanol fuel could be made from 10 bushels of corn?

- A. 25
- B. 0.5
- C. 7



Answer Key

All About Corn

- 1.tassel
- 2.Leaf
- 3.Stalk
- 4.Silks
- 5.Ear
- 6.Roots
- 7.Roots

Follow the Corn Trail

- 1.A
- 2.B
- 3.B
- 4.C
- 5.A

Word Scramble

nroc sekalf	corn flakes
cei earcm	ice cream
oads	soda
nuteap ttreub	peanut butter
upchket	ketchup
alads ingsserd	salad dressing
ylelj	jelly
mallmarowssh	marshmallows
meanringa	margarine
tcoa hipcs	taco chips

Gas Up with Corn

- 1.25
- 2.35
- 3.86
- 4.232
- 5.279
- 6.349
- 7.460

A Bushel of Corn Adds Up

- 1.A
- 2.B
- 3.C
- 4.B
- 5.C

Become An Environmental Scientist

- 1.B
- 2.A
- 3.A

Gas Up ... By Pumping Corn

Scientists are working to find ways to use less gasoline and reduce air pollution. One answer is growing in America's cornfields!

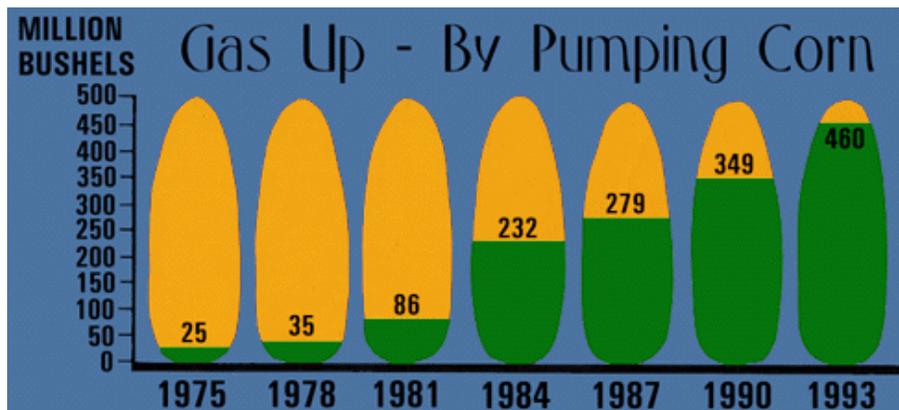
Ethanol - from agriculture - is the fuel for the future. It can be used alone or added to gasoline to make supplies go farther. It reduces air pollution. In Texas and throughout the United States most ethanol is made from our country's #1 renewable resource ... CORN. Many gas stations already sell gasoline that is 10 percent ethanol.

Ethanol is an environmentally friendly fuel:

- It burns cleaner than gasoline. That cuts air pollution.
- It is a renewable resource. When we need more fuel, we grow more corn!
- It stretches the supply of gasoline. That means we don't use as much crude oil to make gasoline.

There's more good news. When we make ethanol-blended gasoline, we don't have to use as much oil from other countries. This means that: 1. We don't have to depend on other governments half way around the world. 2. We don't have to use the energy to transport the oil (ocean tankers).

Americans are using more and more ethanol every year. The chart below demonstrates the increased use of corn in the production of ethanol since 1975.



HOW MANY BUSHELS OF CORN WERE USED TO PRODUCE ETHANOL IN ...

- | | | | | | |
|------------|-------|-------|------------|-------|-------|
| 1. 1975 -- | 9 25 | 9 50 | 5. 1987 -- | 9 279 | 9 320 |
| 2. 1978 -- | 9 60 | 9 35 | 6. 1990 -- | 9 349 | 9 295 |
| 3. 1981 -- | 9 86 | 9 45 | 7. 1993 -- | 9 405 | 9 460 |
| 4. 1984 -- | 9 232 | 9 176 | | | |

Ohio Corn Growers Association—www.ohiocorn.org

A Bushel of Corn Adds Up



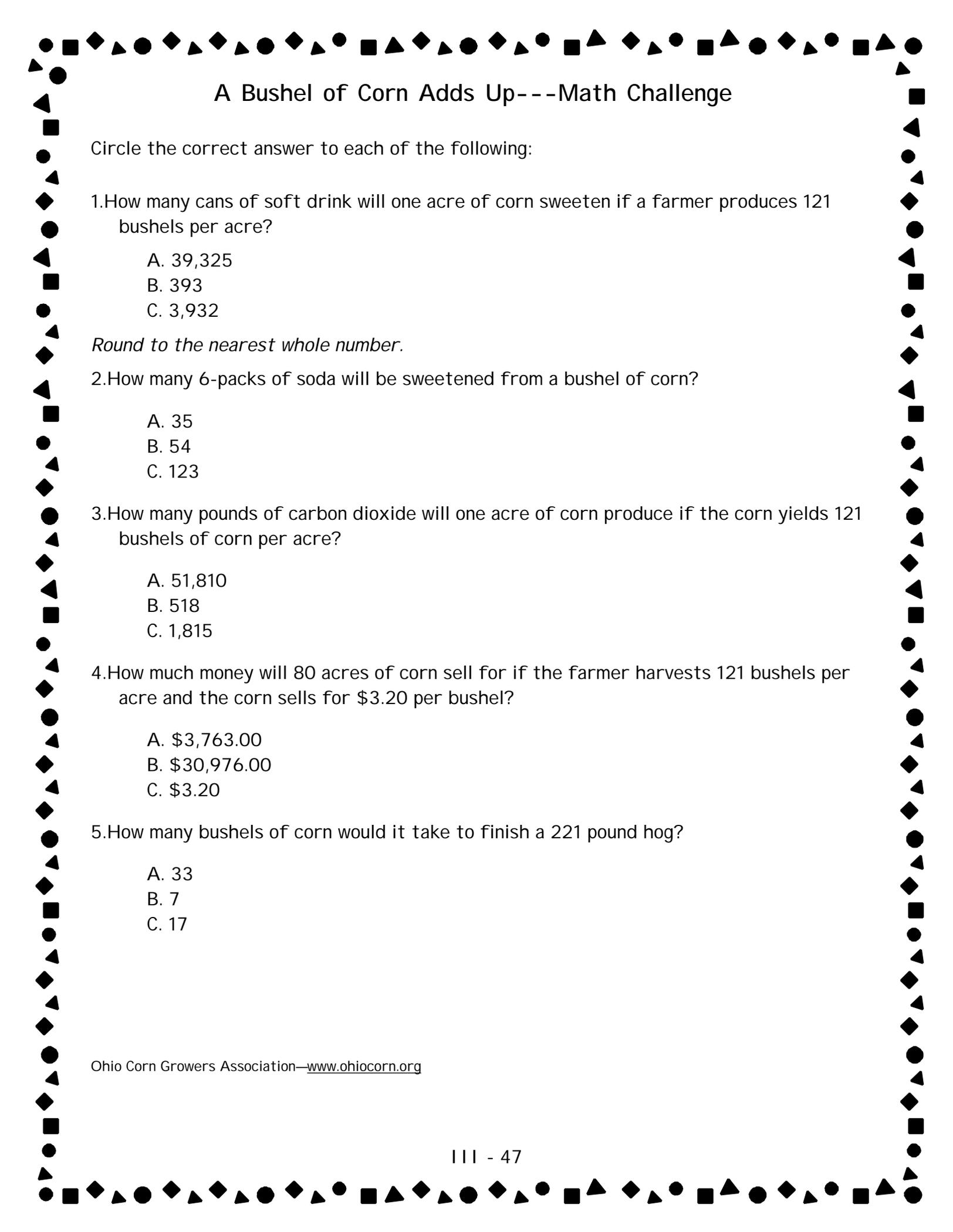
Let's look at the facts:

- One bushel of corn weighs 56 pounds
- One bushel of corn contains about 72,800 kernels

What can we get from a bushel of corn?

- Sweetener for 325 cans of soda water
- Oil for 2 pounds of margarine
- Enough starch for a ton of paper
- 15 pounds of carbon dioxide "fizz" in soft drinks
- When fed to livestock, one bushel of corn produces about:
 - 5 1/2 pounds of beef
 - 13 pounds of pork
 - 19 1/2 pounds of chicken

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A Bushel of Corn Adds Up---Math Challenge

Circle the correct answer to each of the following:

1. How many cans of soft drink will one acre of corn sweeten if a farmer produces 121 bushels per acre?

- A. 39,325
- B. 393
- C. 3,932

Round to the nearest whole number.

2. How many 6-packs of soda will be sweetened from a bushel of corn?

- A. 35
- B. 54
- C. 123

3. How many pounds of carbon dioxide will one acre of corn produce if the corn yields 121 bushels of corn per acre?

- A. 51,810
- B. 518
- C. 1,815

4. How much money will 80 acres of corn sell for if the farmer harvests 121 bushels per acre and the corn sells for \$3.20 per bushel?

- A. \$3,763.00
- B. \$30,976.00
- C. \$3.20

5. How many bushels of corn would it take to finish a 221 pound hog?

- A. 33
- B. 7
- C. 17

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Become an Environmental Scientist

Explanation

The development of new products using safe ingredients like corn is usually done in a laboratory. This experiment allows you to create your own biodegradable plastic. Remember to use the scientific process: follow the procedures and record your observations.

Materials and Equipment

- cornstarch
- water
- tablespoon
- microwave oven
- corn oil
- paper cup
- stirrer
- food coloring



Procedure

1. Place a tablespoon of cornstarch in a paper cup.
2. Add two drops of corn oil to the cornstarch.
3. Add a tablespoon of water to the corn oil and cornstarch.
4. Stir the mixture.
5. Add two drops of your favorite food coloring to the mixture and stir well.
6. Microwave for 25 seconds on high. [MAY BE HOT!]
7. When it is cool enough to handle, CAREFULLY remove the material from the cup.
8. Roll the material into a ball.

Answer the following questions about your experiment

1. How did the oil and water change the cornstarch?
2. What happened to the mixture after microwaving?
3. Describe the ball of material.

How Do You Like Your Corn?

Make a graph like this on the chalk board using the most listed corn products from students' lists. Photocopy the ear of corn for each student and have them tape their ear of corn on the board under their favorite food made from corn. Or have make their own graph individually.

Popcorn	Corn on the Cob	Corn Bread



All About Corn

Answer Key

All About Corn