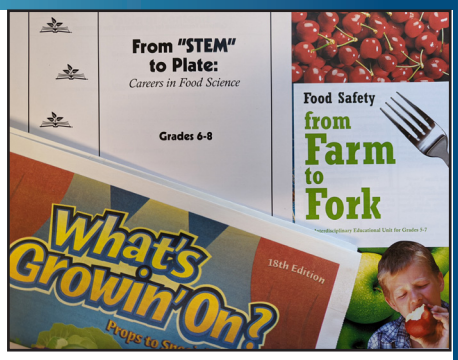
Taste and Teach

Additional Resources



We've included more agriculturally-related teaching resources!

These materials can help you incorporate agriculture into your regular lessons throughout the school year..

Five **Fun Facts** About California Agriculture!

- California has been the nation's top agricultural state for more than 50 years. California agriculture received $49.1 billion in 2020, more than any other state.
- 95% of California farms are family farms or partnerships.
- California grows more than 400 agricultural commodities.
- Milk is California's most valuable commodity. Milk production generated $7.5 billion in 2020.
- Nearly 40% of US vegetables and 56% of US fruits and nuts are produced in California.

Check out these **Fun Resources!**

- ***What's Growin' On?:*** The 16-page student newspaper provides reading and activities, geared for grades 3-8. One copy of our recent editions is included in the back pocket. Request class sets while supplies last at **LearnAboutAg.org/resources/wgo**.
- **Fact and Activity Sheets:** We offer more than 30 fact sheets, covering a wide range of agricultural topics. Download or request print copies at **LearnAboutAg.org/resources/fact**.
- **Invasive Species:** *The Invaders* introduces six invasive species threatening California agriculture. Explore more in-depth resources at **LearnAboutAg.org/resources/fact_invasion**.
- **Plant Nutrients:** Fact and activity sheets explain the essential plant nutrients (NPK)! Explore plant science resources for all ages at **LearnAboutAg.org/resources/fact**.
- ***Food Safety from Farm to Fork:*** This interdisciplinary educational unit is all about food safety. Explore more units and lesson plans at **LearnAboutAg.org/resources/lesson**.
- **Ag-Bites and WE Gardens:** These one-page resources promote hands-on learning. See the full sets at **LearnAboutAg.org/resources/bites** and **LearnAboutAg.org/resources/gardens.**
- ***Farming is Everywhere*:** This educational coloring book is fun for younger students! The coloring book is available for download at **LearnAboutAg.org/resources/grab**.
- **Other Resources:** We've included resources from **ChooseMyPlate.gov** and **FruitsAndVeggies.org**. The kiwifruit resource (in the November section) was provided by **HarvestOfTheMonth.com**, a great source for nutrition education resources. The apple lesson (*A is for Apples*) was provided through the National Agricultural Literacy Curriculum Matrix, a collection of materials available at **AgClassroom.org**. For students interested in agricultural career opportunities, check out **AgExplorer.com**.

Questions?

Contact info@LearnAboutAg.org or 916-561-5625

LearnAboutAg®
California Foundation for Agriculture in the Classroom

California

Agricultural Fact and Activity Sheets

Information compiled by California Foundation for Agriculture in the Classroom

These California-specific fact sheets include information about natural resources or commodity production, history, nutrition, top producing counties, and economic values. The activity sheets provide specific lesson ideas and fun facts for each topic. The lesson plan is aligned to current California Education Standards.

- Agricultural Water
- Alfalfa
- Almonds
- Apples
- Artichokes
- Asparagus
- Avocados
- Beef
- Bees
- Bell Peppers
- Blueberries
- Cantaloupe
- Cherries
- Citrus Fruits
- Cling Peaches
- Corn
- Cotton
- Cut Flowers
- Dairy
- Dry Beans
- Eggs
- Forest Resources
- Fresh Carrots
- Green (Snap) Beans
- Herbs
- Invasive Species
- Lettuce
- Mushrooms
- Pears
- Pickling Cucumbers
- Pistachios
- Plant Nutrients - Nitrogen
- Plant Nutrients - Phosphorus
- Plant Nutrients - Potassium
- Pork
- Poultry
- Processing Tomatoes
- Prunes
- Rice
- Spinach
- Strawberries
- Table Grapes
- Table Olives
- Walnuts

Top 10 Ways to Use Agricultural Fact and Activity Sheets

1. **Ag Literacy Events**
   Information and fun activities for young students who are just starting to learn about agriculture.

2. **Bulletin Board Ideas**
   Assign each student a different commodity or natural resource. Students design a weekly bulletin board and engage their peers in a related activity.

3. **World Geography Connection**
   Where did these California commodities originate? Students create a world map, illustrating country of origins.

4. **History Connection**
   Highlight the dates mentioned on each commodity sheet. Create a timeline that goes all around the classroom, using words and images to record these significant moments in agriculture.

5. **Math Connection**
   Students use numbers found within the facts sheets to create an appropriate graph of their choice. For example, create a pie chart representing the%age of clingstone peaches that are used for fruit cocktail, are canned and are eaten fresh.

6. **Agricultural Marketing**
   Students use the information on fact sheets to develop jingles, billboards, and commercials. Discuss the importance of a strong and positive marketing campaign for agriculture.

7. **Agriscience Project Ideas**
   Fact sheets are a wellspring of ideas for researching and experimenting about different agricultural commodities and natural resources.

8. **Language Arts/English Connection**
   Students read the front of the fact sheet and demonstrate their reading comprehension by writing a summary or writing questions and then exchanging with a partner. Students select an agricultural topic and write a research paper using proper grammar and citing of references.

9. **Nutrition Connection**
   Students analyze the nutritional values of various agricultural commodities and explain the human body's use of specific vitamins. Students identify where the commodities fit in the different food groups.

10. **Add some spice to your lessons!** Find a new method for teaching everything from alfalfa to water.

07/20 Learn About Ag

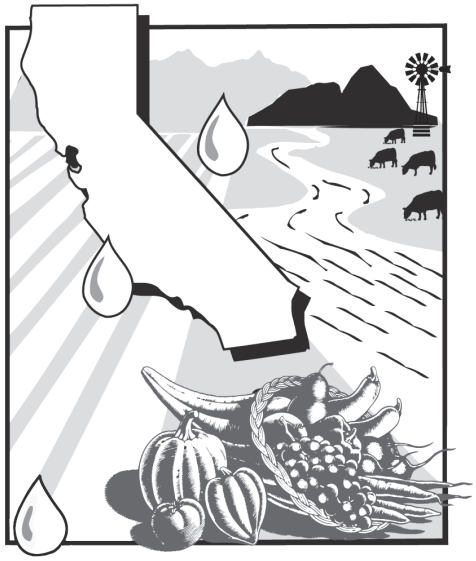
This is one in a series of fact sheets composed by the California Foundation for Agriculture in the Classroom (CFAITC). For additional educational materials: CFAITC, 2600 River Plaza Drive, Suite 220, Sacramento, CA 95833-3293 • (916) 561-5625 • (800) 700-AITC • Fax: (916) 561-5697
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Natural Resource Fact Sheet

Agricultural Water

Information compiled by the California Farm Water Coalition

Sources – California's water supply averages 194.7 million acre-feet per year, statewide. This water comes from rain and snowfall and the Colorado and Klamath rivers. From this supply, the majority is consumed by natural vegetation, leaving 82 million acre-feet available for dedicated use. During an average water-supply year, California farmers and ranchers apply 31.6 million acre-feet of water to grow their crops. Other consumptive uses include the environment at 38.7 million acre-feet and 8.0 million acre-feet for municipal and industrial uses.



The major projects that have been the primary sources of stored water include the Central Valley Project (CVP), State Water Project (SWP), Coachella Canal, All-American Canal, and the Klamath Basin. Construction of the CVP began in 1937 and for the SWP in 1957, with full SWP funding approved in 1960. The delivery of water origininating in northern California from the CVP and SWP has been reduced in recent years due to enviromental regulations that govern the delivery of water through the Sacramento-San Joaquin Delta.

Distribution – Water is available through natural precipitation such as rain and snow. It is then transported throughout the state's numerous waterways, including creeks, streams, lakes, and rivers. Other water is stored underground in porous rock and soil (also called aquifers) and brought to the surface by wells and pumps. Approximately 30 to 50 percent of the water supply for farms, homes and businesses comes from groundwater depending on the water-year type. More groundwater is used during dry years or in times of drought because less surface water is available.

Two-thirds of the demand for water comes from the Southern one-third of the state while two-thirds of the precipitation and water storage are in the Northern one-third, creating significant challenges for water distribution.

History – The history of California agriculture and water development are intertwined. The first California agricultural water delivery system was built at Mission San Diego Acala. With the Gold Rush, the state's demand for food grew with its population. As early as 1865, private companies began constructing canals in the Central Valley to irrigate crops. In 1877, the State Legislature passed the Wright Act, authorizing the formation of public irrigation districts. These agencies, formed by local citizens, are responsible for providing a steady, reliable supply of water for irrigation, flood control, recreation, human consumption, and other uses. In the twentieth century, the California Department of Water Resources and the United States Bureau of Reclamation also began storing water and delivering it to farms and cities. This large-scale development of water has allowed California to become a national and world leader in agriculture.

Irrigation Techniques – Simply stated, the term "irrigation" is the process of putting water into the soil to make plants grow. There are three basic ways to irrigate: surface, micro-irrigation, and sprinkler. Surface irrigation includes methods such as border-strip and furrow where water flows on top of the soil. Micro-irrigation techniques, such as drip, bubbler, spray, and subsurface drip, deliver a measured amount of water through an emitter located near each plant. Micro-irrigation techniques can be located above or below ground. Sprinkler irrigation includes the use of a mechanical device which sprinkles water over the crops and simulates rain.

The method of irrigation used depends on many factors including geographical location, crop type, soil type, climate, and economics. Farmers often use laser-leveling of fields, computers, remote sensors, and GPS to improve the efficient use of their water supplies.

Economic Value – Water is an essential component to life and the economy of California. It is vital to the success of California's $50 billion agricultural industry. California farms grow two-thirds of the fruit, one-third of the vegetables, and one out of every five gallons of milk produced in the United States. Each of the more than 400 commodities grown in California depends upon the availability of water—from the fruits, vegetables and meats people eat to the cotton and wool clothing people wear and the forest and floral products people use and enjoy.

For additional information:
California Farm Water Coalition
(916) 391-5030
Website: www.farmwater.org

California Farm Water Coalition

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This is one in a series of fact sheets composed by the California Foundation for Agriculture in the Classroom (CFAITC). For additional educational materials: CFAITC, 2600 River Plaza Drive, Suite 220, Sacramento, CA 95833-3293 • (916) 561-5625 • (800) 700-AITC • Fax: (916) 561-5697
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Agricultural Water Activity Sheet

History of Agricultural Water Development in California

Late 1700s - California missions began to irrigate crops for their own consumption. Cattle production dominates commercial agriculture.

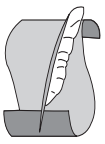
1839 - John Sutter founds New Helvetia (later to become Sacramento) as the first large-scale agricultural operation in the Sacramento Valley.

1848 - James Marshall discovers gold in the American River.

1856 - First commercially developed irrigation project is constructed in Yolo County.

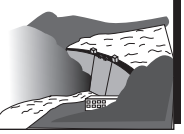
1879 - The California State Supreme Court case Lux vs. Haggin establishes "The California Doctrine" of water rights.

1887 - With the Wright Act, the State Legislature allows the establishment of public irrigation districts. Shortly thereafter, the Turlock, Modesto, and Merced Irrigation Districts are formed.

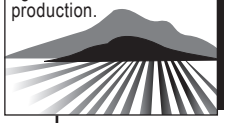


1901 - Colorado River water is first used to irrigate crops in the Imperial Valley.

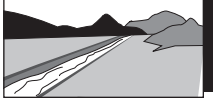
1940s - First deliveries of irrigation water made by the federally funded Central Valley Project.



1946-Present - California leads the nation in agricultural production.



1960s - First deliveries made by the California State Water Project.



2015 - Exports of California farm products to other countries exceed $21 billion in value.

Lesson Ideas

- Examine the affect of watering duration and frequency on plant growth by manipulating one variable. Beginning with the same amount of water, irrigate one plant with more water less often and one plant with less water more often.
- Fill three plastic cups; one with soil, one with gravel, and one with sand. Predict which cup will hold the most water. Pour water into the cups to test your predictions.
- Discuss the water cycle and how evaporation, condensation, transpiration, and precipitation affect agriculture.
- Place a rain gauge outside your classroom and record the precipitation in your area.
- Research the seasonal rainfall averages in your area.
- Locate newspaper articles that cover local, state and federal water issues. Discuss how they affect the students.

Fantastic Facts

1. Most precipitation in California occurs in Northern California.
2. California's agriculture industry is dependent on the availability of water.
3. The average annual rainfall and snowfall in California is 194.7 million acre-feet.
4. Irrigation is the process of putting water in the soil to make plants grow.
5. Rivers, creeks, dams, canals, and pumps are used to store and transport water.
6. The first water delivery system established for California agriculture was the Mission San Diego Acala.
7. Lasers are used to level irrigated fields with precision.

Lesson Plan: Waterways

Introduction: Surface, sprinkler, and micro-irrigation are the three main types of irrigation techniques used in California. In this lesson, students will deliver water from a source (a bucket) to a field (an aluminum pie plate) and apply the water using an irrigation technique.

Objective: Students will learn about sources of water in their community and construct a model of a chosen irrigation technique.

California Standards: CC ELA: SL.3-12.4, SL.4-8.5; NGSS: 3-5-ETS1-1, 3-5-ETS1-2, 5-ESS3-1, MS-ETS1-3, HS-ETS1-1, HS-ESS3-1

Materials: Buckets, aluminum pie plates, straws, duct tape, sponges, old rags, PVC pipe tubing and fittings, writing paper, butcher paper, markers, and other supplies.

Procedure:

1. Divide students into groups. Have them discuss and write down where they think the water for their community comes from. Discuss their thoughts and clarify the information with facts you have gathered from your local water agencies.
2. Explain that once water is available, it must be delivered to cities and farmlands. Show the students the supplies they have to work with—the bucket of water is the source and the straws, sponges, pipe fittings, etc. are the equipment used to deliver the water to the farm or city (the aluminum pie plate placed a reasonable distance from the souce).
3. Once the students have created a way to transport the water, add soil, which represents the farm or garden that needs irrigating, to the pie plate. Have the students devise a way to efficiently irrigate their crop.
4. After completing the experiment, have each group draw a picture of their model on butcher paper and share their successes and challenges with the class. Compare and contrast the various delivery and irrigation techniques.
5. Invite a local water district representative or a farmer to visit your class to discuss how local water is delivered to homes and farms and how the farms are irrigated.

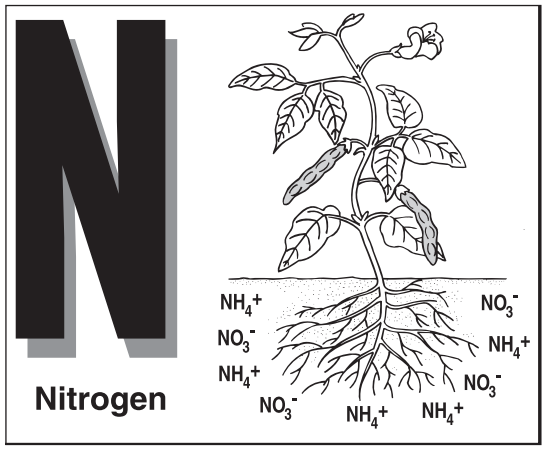
04/20 Learn About Ag This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Natural Resources Fact Sheet

Plant Nutrients–Nitrogen

Information compiled by the Western Plant Health Association

Plant Utilization – Nitrogen is one of the 17 chemical elements required for plant growth and reproduction. Nitrogen is in chlorophyll, a green chemical which allows plants to capture energy from the sun and make food for themselves in a process called photosynthesis. It is also the basic element of plant and animal proteins, including the genetic material DNA and RNA, and is important in all phases of plant growth.



Production – Nitrogen is an abundant element on and around Earth. Approximately 78% of the Earth's atmosphere is nitrogen gas (N_2). As with all plant nutrients, however, nitrogen must be in specific forms to be utilized by plants. Converting N_2 into nitrogen plants can use is called nitrogen fixation. Most often, nitrogen gas is converted into plant available nitrogen by using complex chemical processes or nitrogen-fixing bacteria.

Most manufactured nitrogen fertilizers begin as ammonia. At temperatures of 400ºC - 500ºC and great pressure, nitrogen from the air and hydrogen from natural gas combine to produce ammonia. The ammonia can be used directly or further processed into other nitrogen fertilizers. Legumes, such as beans and alfalfa, grow specialized nodules on their roots. *Rhizobia*, nitrogen-fixing bacteria, live in these root nodules and convert atmospheric nitrogen into nitrogen plants can use. Farmers take advantage of this unique symbiotic relationship by periodically growing legumes in nitrogen-deficient soil to naturally boost nutrient levels.

Forms – In the soil, nitrogen exists in different forms, which interact with one another and with plants, animals and microorganisms. Most crops use nitrogen rapidly, therefore, farmers and home gardeners often supply nitrogen to the plants in a variety of ways, including the application of manufactured fertilizers, applying composts and manures, and growing legumes in rotation with other crops.

Plants absorb nitrogen in the forms of nitrate (NO_3^-) or ammonium (NH_4^+) ions, both of which are water-soluble. Nitrate ions are absorbed quickly by plant roots, but leach easily. Ammonium ions are attracted to soil particles and move slowly through the soil to plant roots. Commercial fertilizers, both dry and liquid, are available with various combinations of nitrate and ammonium ions, enabling farmers to manage their nitrogen application. Crop advisors monitor crops to ensure the crops receive optimum amounts of nitrogen.

History – Americans have fertilized their crops with nitrogen for centuries. Early colonists used animal manure, fish scrap, cottonseed meal, and tobacco stems as nitrogen fertilizer. Later, Americans imported nitrate of soda from Chile, rotated crops with legumes and used ammonium sulfate, a by-product of steel production. Many of these are still used today.

The process of synthesizing ammonia is considered one of the greatest chemical engineering feats. The process was first demonstrated in the laboratory in 1884, but it was not commercially feasible until 1913 in Germany. The first American ammonia plant was built in 1921. Nitrogen fertilizer production was minimal until after World War II, when the demand for food increased with an increase in human population. Improved nitrogen management is the focus of intensive research at both public and private research facilities.

Top Producing Regions – China is the world's largest producer of nitrogen and phosphate fertilizers and Canada produces more potash fertilizer than any other country. Although the U.S. is the third largest producer of nitrogen fertilizers, we still import more nitrogen fertilizer than any other country. Natural gas is a major feedstock for production of ammonia. During this same period 27 U.S. ammonia plants closed. Since 2008, four new ammonia plants have opened but the U.S. remains dependent on nitrogen imports. More than 60% of imported anhydrous ammonia is from Trinidad. Globally, wheat receives the largest share of nitrogen fertilizer at 18.1%, however, in the U.S. nearly half (49%) of all nitrogen fertilizer is applied to corn.

Economic Value – The economic value of the nitrogen industry is difficult to assess. Many people have businesses associated with replenishing agricultural soils with nitrogen, including those whose livelihoods depend on providing compost bins, soil amendments, and tools. Ammonia production adds $4 billion to the United States economy annually.

For additional information:
California Fertilizer Foundation
(916) 574-9744
Website: www.calfertilizer.org

California Fertilizer Foundation

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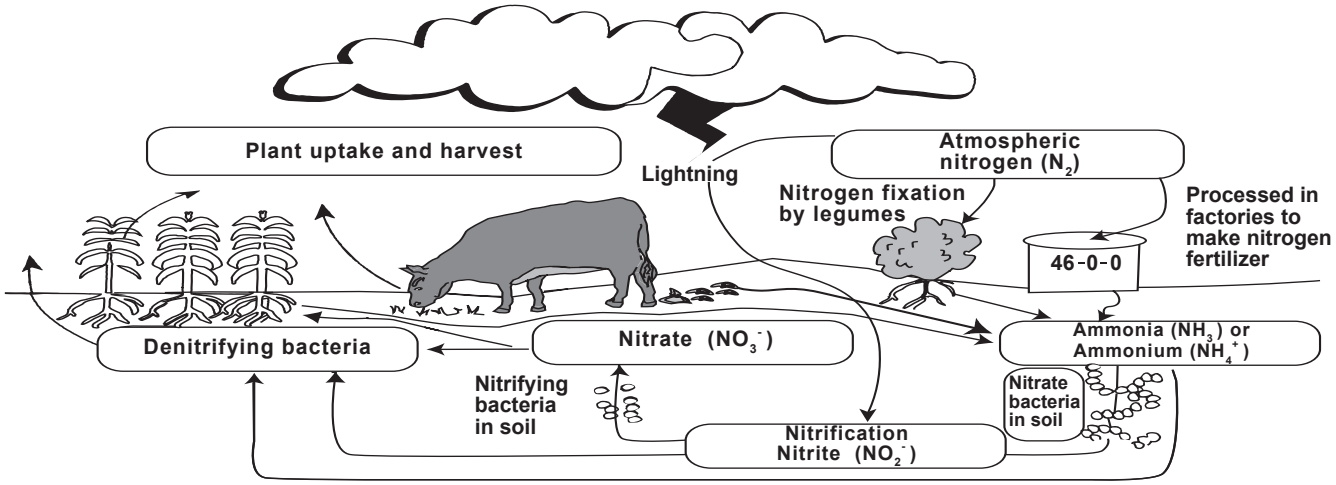
Nitrogen Activity Sheet



Lesson Ideas

- Compare and contrast the nitrogen and water cycles.
- Make a poster of the nitrogen cycle using magazine pictures.
- Chart and compare the growth of plants which are fertilized with varying amounts of nitrogen fertilizer.
- Compare fertilizer labels for nitrogen content.
- Make compost at your school using garden, fruit, and vegetable lunch waste.
- Identify plants which are legumes. Research how these plants make nitrogen available to other plants.
- Draw a picture of a plant and the plant's need for nitrogen.
- Research the procedures and chemical equations used in ammonia fertilizer production.
- Compare and contrast the nitrogen content of various organic fertilizers, including steer manure, chicken manure, and fish emulsion.
- Locate nitrogen on the periodic table of elements. Learn about its physical and chemical properties.

Fantastic Facts

1. Ammonia is the basic chemical ingredient in commercial nitrogen fertilizer production.
2. The color green is associated with plants which contain a sufficient amount of nitrogen.
3. Legumes, such as beans and alfalfa, contain microorganisms in their roots that convert nitrogen into a form other plants can use.
4. NO_3- and NH_4+ are the two forms of nitrogen that plants can absorb through their roots.
5. The United States is the world's top importer of nitrogen.
6. Nitrate (NO_{3-}) is a form of nitrogen that can leach rapidly, depending on environmental factors.

Lesson Plan: Let's Make Manure Tea

Introduction: Substances added to improve the nutrient content of soils are called fertilizers. Fertilizers can be natural or man-made (synthetic). Animal waste is sometimes used as a natural fertilizer.

Objective: Students will make a liquid fertilizer called "manure tea" from steer manure. Students will design and perform an experiment to determine the optimum dilution of this nitrogen-rich fertilizer.

California Standards: NGSS: 3-5-ETS1-3, MS-LS1-5, MS-ETS1-3

Materials: Store-bought steer manure (3 or 4 cups), coffee filter, five-gallon bucket with lid, water, string, index cards cut in half, stapler, tablespoon, corn seedlings and other supplies for student-designed experiment.

Procedure:

1. Write the term "manure tea" on the board. Obtain student ideas for its definition. Also discuss that plants need certain nutrients for successful growth and reproduction.
2. Have each student make a manure tea bag by placing two tablespoons of manure into a coffee filter and stapling it shut. Staple a string to one end and 1/2 of an index card to the other end of the string. Have students create and draw labels for their "brands" of tea on the index cards.
3. Hang the tea bags in a covered five-gallon bucket that is full of water. Let the bags steep overnight. Record observations.
4. Design and perform a class experiment that will determine the optimum manure tea concentration for growing corn. Brainstorm variables to control and potential failure points.
5. At the conclusion of the experiment, compare and identify the most successful design solutions. Discuss how their newly-gained knowledge can relate to large-scale agriculture.

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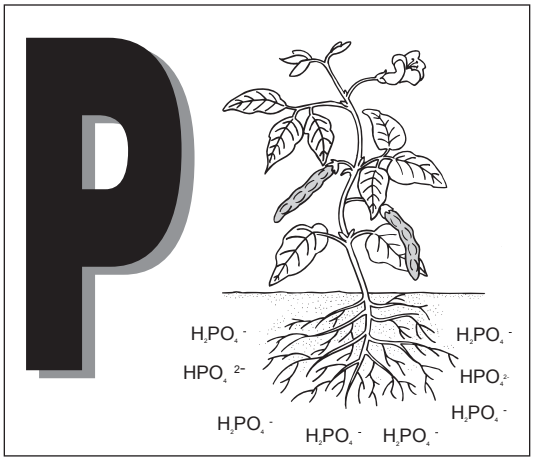
Natural Resources Fact Sheet

Plant Nutrients–Phosphorus

Information compiled by the Western Plant Health Association

Plant Utilization – Phosphorus, one of the 17 chemical elements required for plant growth and reproduction, is often referred to as the "energizer" since it helps store and transfer energy during photosynthesis. It is also part of the genetic material of all cells—DNA and ATP.



All plants require phosphorus during all phases of growth. Most annual plants (plants that grow, reproduce, and die in one year) require large amounts of phosphorus as they begin to grow. Plants grown in cold weather which have limited roots and rapid top growth, such as lettuce, are high phosphorus users. Legumes also require plentiful amounts of phosphorus. Established plants such as trees, shrubs, and vines, especially those grown in warm climates with long summers, require the least amounts of phosphorus fertilizer.

Production – In the soil, phosphorus is often found in chemical forms that cannot immediately be absorbed by plants, so farmers commonly apply phosphorus to the soil. The common source for commercial phosphorus fertilizer is rock phosphate, a calcium phosphate ore found in deposits within the earth. Rock phosphate is usually strip mined and then pulverized. The resulting material is treated with sulfuric, phosphoric, or nitric acid to produce various soluble phosphates that can be used as fertilizers such as monoammonium phosphates, diammonium phosphates, and super-phosphates.

Forms – All plants require phosphorus. Plants most often absorb phosphorus in the form of phosphate ions $H_2PO_4^-$ and sometimes as HPO_4^{2-}. These phosphate ions react readily with the soil and become part of the soil particles in a process called "fixation." Fixation prevents the leaching of phosphorus, but also changes it to a form that plants cannot use. The challenge in agriculture is to provide plants with the proper amount of phosphorus, in the proper form, at a time when the roots will absorb it.

The phosphorus concentration in fertilizer is reported as P_2O_5 and is represented by the middle number of the three numbers listed on the label. Manufactured fertilizers come in liquid and granular forms. Organic fertilizers, such as manure, contain phosphorus in limited quantities. Growers usually apply phosphorus directly near the root zone. This is called banding and makes the phosphorus available for immediate absorption by the roots. Growers often mix phosphorus in soil when planting seedlings or transplanting trees, shrubs, or vines.

History – Early American farmers used ground bones as fertilizers, however, very little of the phosphorus in the bones was available to the plants. In 1808, Sir James Murray of Ireland produced the first effective phosphorus fertilizer. Murray treated bones with sulfuric acid, converting the phosphorus to phosphate, a form of phosphorus plants can absorb. Murray later discovered that rock phosphate could be used in this same process.

Super phosphate production began in the United States in South Carolina in 1849. In 1851, John Jay Mapes of Long Island, New York, built the first phosphate manufacturing plant in the United States. Thus, he earned the title of "Father of the American Fertilizer Industry." By 1889, America produced 90% of the world's phosphate fertilizer and continues to produce 30% of the fertilizer produced today.

Top Producing Regions – In 2008, China led the world in phosphate production with 35 million tons, followed by the U.S. with 31 million tons, and Morocco/Tunisia with 28 million tons. The U.S. remains the leading exporter of phosphate fertilizers. In 2009, China led all countries in annual phosphate fertilizer consumption with 10 million metric tons followed by India which consumed more than five million tons and the U.S. with more than four million tons.

In 2007, Florida and North Carolina accounted for 85% of the total domestic output of phosphate rock. Production also occurs in Idaho and Utah. India and China are the major destinations for United States exports of phosphate fertilizers.

Economic Value – The economic value of the phosphate industry is difficult to assess. The fertilizer value alone is more than $3.5 billion, but the additional value associated with this industry for mining and food production greatly exceeds this value.

For additional information:
California Fertilizer Foundation
(916) 574-9744
Fax: (916) 574-9484
Website: www.calfertilizer.org

California Fertilizer Foundation

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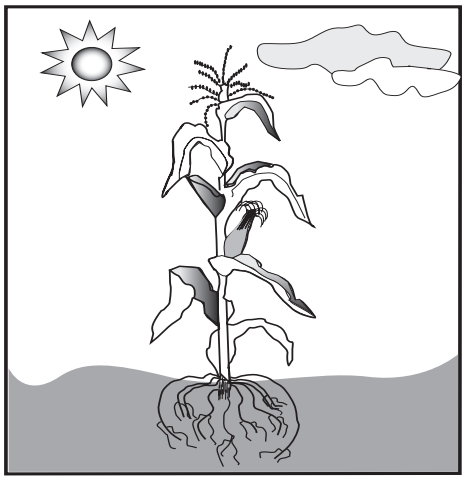
Phosphorus Activity Sheet

How Phosphorus Functions in Plants

- *Stimulates early growth and root formation and growth.*
- *Necessary for cell division and DNA and RNA formation.*
- *Improves the ability of plants to absorb water and other nutrients.*



- *Stimulates flower blooms and seed development.*
- *Improves plant strength and the ability to tolerate unfavorable environmental conditions.*
- *Aids in photosynthesis and food formation.*

Lesson Ideas

- On a United States map, color the states yellow that mine rock phosphate.
- Learn about the physical and chemical properties of phosphorus.
- Research and list foods high in phosphorus and learn how phosphorus is used in the human body.
- Interview a nursery or greenhouse worker and ask when and how phosphorus should be applied to your favorite plants.
- On a world map, color the major phosphorus producers one color and the major phosphorus importers another.
- Research how phosphorus rock is processed into phosphate fertilizer.
- Invite farmers into your class to discuss how plant nutrients are added to their particular crops.
- Create a comic strip whose main character is “Phosphorus—the Energizer.”

Fantastic Facts

1. Plants require the most phosphorus at the beginning of life and during periods of rapid growth.
2. The largest phosphorus producer is China.
3. Plants that have small root systems and significant above ground growth require plentiful amounts of phosphorus fertilizer.
4. Before rock phosphate, ground bones mixed with dilute sulfuric acid provided plants with phosphorus.
5. Florida and North Carolina produce the most rock phosphate in America.
6. P is the symbol for the element phosphorus.
7. The middle number on a fertilizer label represents the amount of phosphorus it contains.

Lesson Plan: Read the Label

Introduction: Fertilizer labels have a standard format which lists three numbers. Each number represents the quantity of a nutrient in the fertilizer. The first number represents the%age of nitrogen (N) in the particular fertilizer. The second number represents the%age of phosphorus (P_2O_5), and the third number represents the%age of potassium (K_2O) in the fertilizer.

Objective: Students will examine fertilizer labels, research the nutrient needs of an agricultural crop, and create a fertilizer label for that crop.

California Standards: CC ELA: SL.3-12.3; NGSS: 5-LS1-1, MS-LS1-5

Materials: Fertilizer labels, white paper, markers, reference books.

Procedure:

1. Distribute sample fertilizer labels. In groups, have students examine the labels. As a class, create a template for a standard fertilizer package. Discuss what the three numbers mean on the front label.
2. Have each student select a crop for which they will find out its nutrient requirements. They may use encyclopedias, the Internet, a local agricultural commissioner’s office, or information from the University of California Cooperative Extension.
3. Have students create fertilizer labels that would meet the nutritional needs for their crop. Students may need to specify the time frame for application, such as “at planting.”
4. As a class, compare the fertilizer labels the students developed. Could one fertilizer be used for more than one commodity? Discuss what other factors might be considered when determining what fertilizer to purchase—price per unit, package size, soil type, climate, availability of composts and manures.
5. Invite an agronomist or fertilizer manufacturing representative to your class to discuss the uses and sales of fertilizers. After the presentation, identify the speaker’s claims, point of view, and reasoning.

07/20 Learn About Ag

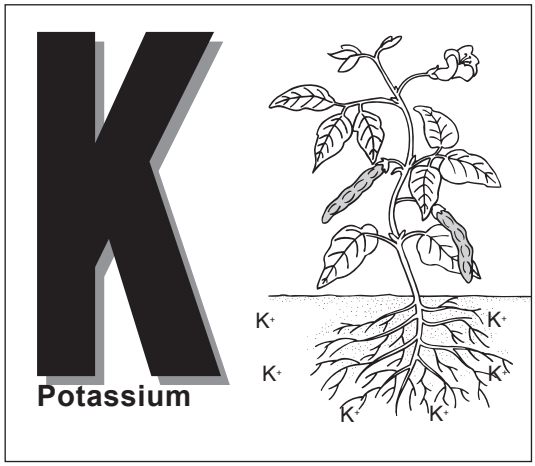
This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Natural Resources Fact Sheet

Plant Nutrients–Potassium

Information compiled by the Western Plant Health Association

Plant Utilization – Potassium, one of the 17 chemical elements required for plant growth and reproduction, is often referred to as the "the regulator" since it is involved with more than 60 different enzyme systems in plants. Potassium helps plants to resist drought and effects from excessive temperatures. It also increases crop resistance to disease. Potassium aids plants in the production of starches, controls root growth, and regulates the opening and closing of pores in plant cells (called stomata), which is important for efficient water use.



All plants require potassium, especially crops high in carbohydrates, like potatoes. Studies have shown that adequate amounts of potassium may promote the growth of long, strong cotton fibers; increase the shelf life of fruits; increase the stem length and quantity of roses; enhance the green color and growth of turf grass; and increase the size and quality of fruits, grains, and vegetables.

Production – Potassium is the seventh most abundant element in the Earth's crust, yet only one to two% is available to plants. The rest is incorporated in the structure of the rocks and unavailable to plants. Farmers often apply potassium fertilizer for optimum plant growth.

Most potassium is mined from underground deposits and is shaft mined, like coal. Some shafts are drilled as deep as 3,000 feet. In some cases, solution mining is also used in which case water is pumped into the shaft to dissolve the ore. The solution is extracted and allowed to evaporate, leaving behind potassium salts. Some potassium comes from the evaporation of water from natural salt lakes, such as the Great Salt Lake in Utah, and the Dead Sea in Israel and Jordan. Tobacco stems, wood ash, wool waste, sugar beet factory waste, and flue dust also contain potassium, but their use as a fertilizer is limited.

Forms – Potassium is symbolized as K_2O on fertilizer labels and is the third number on the label. Plants absorb potassium in the form of the ion K^+ which dissolves readily in water.

Ninety-five% of all potassium fertilizers come in the form of muriate of potash, also known as potassium chloride. For crops unable to tolerate chloride, potassium sulfate, potassium nitrate, and other chloride-free salts are used. Potassium comes in both liquid and granular form and is usually mixed in the soil or placed directly near the root zones of plants. Application of chloride-free foliar sprays are sometimes used on certain crops.

History – The letter K, used to symbolize potassium, comes from the German word kalium. Before the industrial era, people burned wood and other organic matter in pots to manufacture soap. The ashes were rinsed and the water was allowed to evaporate, leaving a residue of potassium salts. People called the residue "pot ashes" or potash. These salts were boiled with animal fat to produce soap.

In 1868, Samuel William Jackson, a botanist in Connecticut, burned plants and analyzed the ash. Jackson found plants consisted of large amounts of potassium, and other minerals. His work led to the use of fertilizers to promote an increase in crop yields. The very first US patent issued by the United States government was for an improved method of potash production.

Top Producing Regions – Canada leads the world potash fertilizer production and exports, producing nearly 8 million tons in 2009. Russia, Belarus and Germany are also top producers of potash. U.S. production has been stable with most domestic production occurring in New Mexico. Lesser amounts are produced in Utah and Michigan. The price of potash fertilizer has increased significantly in the past few years, causing mining companies to seek new sources of the raw material throughout the world.

China is the world's leading potash consumer, using 8 million tons in 2009. The U.S. and India are the next leading consumers of potash. Approximately 20% of the 6.5 million tons of potash used in the U.S. is domestically produced.

Economic Value – United States farmers pay $900 million annually for potassium fertilizers, with California farmers paying, approximately $30 million each year.

For additional information:
California Fertilizer Foundation
(916) 574-9744
Website: www.calfertilizer.org

California Fertilizer Foundation

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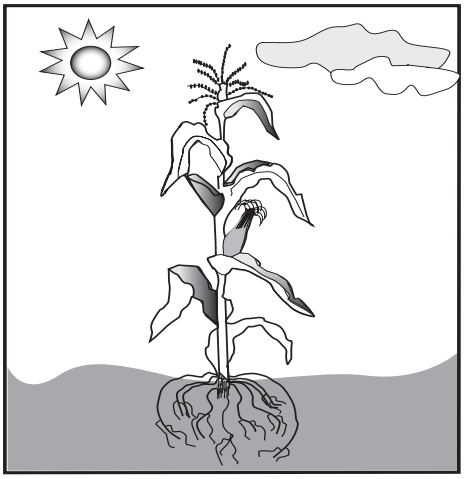
This is one in a series of fact sheets composed by the California Foundation for Agriculture in the Classroom (CFAITC). For additional educational materials: CFAITC, 2600 River Plaza Drive, Suite 220, Sacramento, CA 95833-3293 • (916) 561-5625 • (800) 700-AITC • Fax: (916) 561-5697
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Potassium Activity Sheet

How Potassium Functions in Plants

- *Helps retard crop diseases.*
- *Builds cellulose needed for stalk and stem strength.*
- *Aids in photosynthesis and food function.*
- *Increases root growth and improves drought resistance.*



- *Produces grain rich in starch.*
- *Necessary for plant protein formation.*
- *Reduces water loss and wilting.*
- *Assists many enzyme actions.*

Lesson Ideas

- On a world map, color the major potassium exporters blue and the major importers red.
- On a map of North America, locate and color the areas where potassium is mined.
- Research how humans utilize potassium and find out what foods are high in potassium.
- Make a poster illustrating the various roles potassium plays in plant growth and health.
- Locate potassium on the periodic table of elements. Learn about its physical and chemical properties.
- Find two points that are 3,000 feet apart so students can appreciate the depth of some potassium mine shafts.
- Research the Colonial soap-making process and the various uses of potash.
- Find out how agronomists determine the potassium content of soils.

Fantastic Facts

1. Canada is the world's leading exporter of potassium.
2. Potassium is obtained by underground mining.
3. Potassium is sometimes called "the regulator" because it controls many plant enzyme systems.
4. Potassium helps plants by aiding protein and starch formation, stimulating root growth, providing winter hardiness, and opening and closing cell pores called stomata.
5. New Mexico processes the most potassium in the United States.
6. Historically, potassium was called "potash" because it was sourced from the residue found in wood ashes.
7. California is the largest importer of potassium.
8. Some potassium is obtained from The Great Salt Lake in Utah.
9. The very first US patent issued was for an improved method of potash production.

Lesson Plan: The World of Potassium

Introduction: Potassium is an essential nutrient for plants and animals. It also has many other uses, depending on its chemical formulation.

Objective: Students will research potassium and its various uses. They will create a wall-length mural that depicts their findings.

California Standards: CC ELA: W.3-12.7; RI.3.5; RI.4-5.9; RST.6-10.2, 7

Materials: Reference materials, including encyclopedias, human nutrition books, plant nutrient requirement books, butcher paper, paint or markers, glue.

Procedure:

1. Write the following phrases on index cards: plants which produce fibers for clothing; annual crops, such as celery; forage crops, such as alfalfa; tubers, such as potatoes; disinfectant; human nutrition; component in soap; plant guard cells; potassium forms which are usable by plants; agricultural by-products which contain potassium; roses and other flowers.
2. Divide the students into groups of three or four and distribute one index card to each group.
3. Each group is responsible for researching how potassium relates to the key words on the index card. After they gather the details, the group is to decide how they will depict their knowledge on a wall mural called "The World of Potassium."
4. In a class discussion, determine what the class mural will look like so that all aspects of potassium use will be displayed.
5. Have each group create their graphics and text for the mural and then place it on the mural.
6. Display the mural at a science night or in the library. This may be displayed with other murals made for other elements, such as nitrogen and phosphorus.

07/20 Learn About Ag This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Ag-Bites

Bite-sized activities for bringing agriculture into your classroom.

LearnAboutAg.org

18

Ag TransPORTation

Grades 5-8

Explore how to create a scale model of a shipping container and learn about agricultural commodities that are shipped around the world!

The Facts

A port is a location where ships, trucks, and trains come to load and unload cargo. Cargo ships carry shipping containers that hold many products, including California agricultural commodities such as almonds, walnuts, grapes, raisins, tomatoes, rice and citrus. The Port of Oakland exports these commodities to China, Japan, South Korea, Hong Kong, Taiwan, and Europe. Check out the *What's in the Box?* video at LearnAboutAg.org/AgBites.

Materials

The Challenge (Part 1)

- World Map to show export countries and to use as an example of scale
- ¼- or ½-inch graph paper; construction paper or heavy paper
- Pencil, Scissors, Tape

The Competition (Part 2)

- Aluminum foil (pre-cut sheets are best)
- Dish pan, sink, or kiddie pool
- Various agricultural commodities

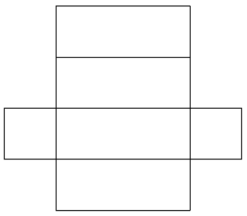
Tips

For more information about ports visit www.portofoakland.com.

For information about California commodities visit LearnAboutAg.org/factsheets.

The Challenge (Part 1)

- Cargo ships can hold as many as 18,000 shipping containers, with the most common size of container measuring 8' x 8' x 40'. Create a scale model shipping container based on an actual 8' x 8' x 40' shipping container's dimensions.
- Discuss the different meanings of scale – for instance the scale used for a map. Show the world map and point out ports in California, the West Coast, Asia, and Europe. Discuss distances and what scale is used.
- Clarify what scale means in math – the ratio of a model in comparison to a life-size object. The first number represents the model, the second is the life-size object.
- Challenge students to create a scale model container that fits on graph paper. Allow students time to create and find solutions that would be proportional.
- As a class, determine the scale to use for the 8' x 8' x 40' container (Let 1 in = 8 ft). Find the scale factor: 1 in/8 ft x 1 ft/12 in = 1/96. The size of the scale model is 1/96 the size of the actual container or the container is 96 times larger than the scale model! (8'/96 = .083 ft, .083 ft x 12 in/ft = 1 in and 40'/96 = .4167 ft, .4167 ft x 12 in/ft = 5 in) It works well to use 1" x 1" x 5" (1 in = 8 ft and 5 in = 40 ft) as the scale model size to draw a net of the container on graph paper. Ask students what shape is this? (A rectangular prism)



- Cut out the net. Fold and tape all sides except one. You can also measure and cut out a net on thicker paper such as construction paper. Decorate your scale model container. Save for part 2.

The Competition (Part 2)

- Test out your scale model in the **Aluminum Ship Competition**. Build a cargo ship out of aluminum foil that will carry agricultural commodities and stay afloat. Compete with others in your class! Visit LearnAboutAg.org/AgBites for instructions and extension ideas.

Classroom Activities

Science:

- Exporting fresh fruits and vegetables requires special care. Develop an experiment to measure the best way to preserve fresh produce – consider drying, refrigerating, or canning.

Technology:

- Cranes load container boxes onto ships. Using classroom supplies, build a machine that will load a box. Create a video to show how it works. Check out Simple Machines at LearnAboutAg.org/resources/lesson/simple.pdf for lessons about simple machines.

Engineering:

- Design a container that will safely transport an egg, pear, or avocado. Test your container by dropping it from different heights.

Math:

- Exports and imports travel to and from ports all over the world. Visit ports.com to find the distance from the Port of Oakland to ports in China, Japan, South Korea, Hong Kong, and Taiwan. Calculate round trips and convert to nautical miles.

California Standards

Grade 5

Math CC: 5.NF.5b, 6, 5.MD.1, 3, 5b

NGSS: 5-ETS-1, 2, 3

Grade 6-8

Math CC: 6.RP.1, 2, 3, 6.G.1, 3, 4; 7.RP.2, 7.G.1, 6

NGSS: MS-ETS1, 2, 3, 4

PORT OF OAKLAND

Funding for this Ag-Bite was provided by Port of Oakland

This is one in a series of Ag-Bites developed by CFAITC. Ag-Bites meet the standards of the California Department of Education.
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Reasons for the Seasons

Have you ever wondered why you can buy fresh melon in December, but you can't seem to grow it in your garden? See if you can arrive at a reasonable answer to this question by using the information and investigations on this page.

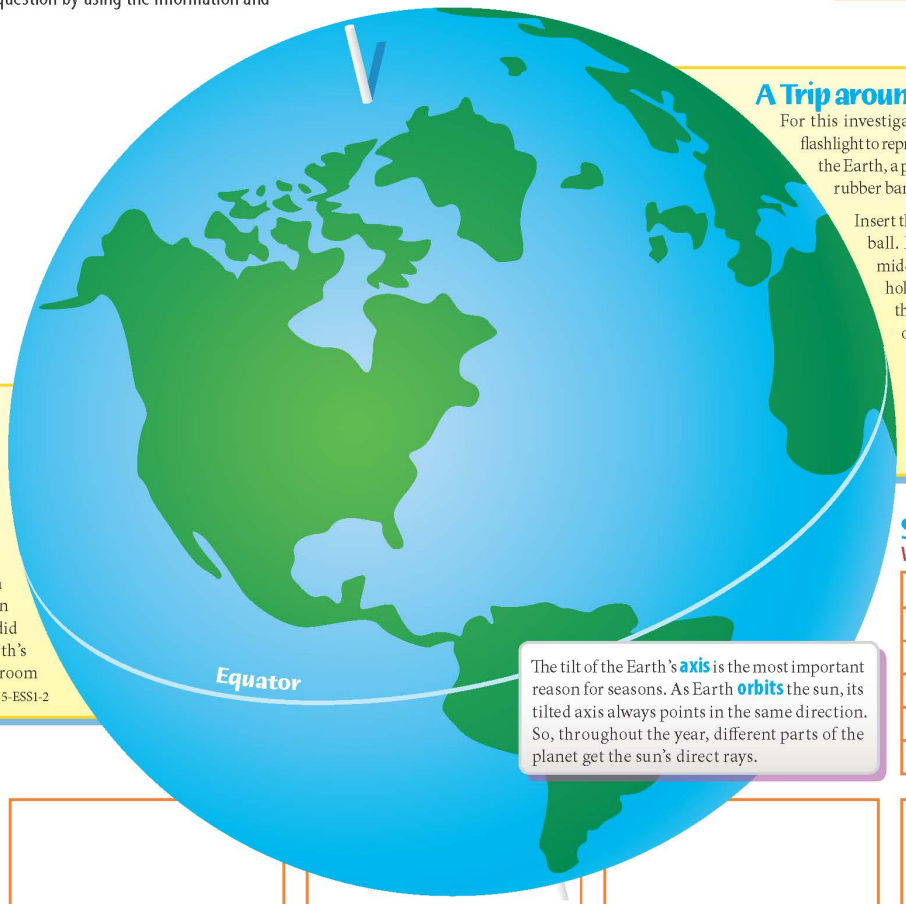
California Spotlight

California's mild temperatures and Mediterranean climate make it an ideal location for producing a wide variety of agricultural commodities (more than 400), some of which cannot be produced anywhere else in the nation.

Northern Hemisphere

What's growing in...

June/July	Dec/Jan
Blueberries	Lettuce
Melon	Cauliflower
Grapes	Apples
Peaches	Broccoli
Tomatoes	Peas



A Trip around the Sun

For this investigation, you will need a lightbulb or flashlight to represent the sun, a foam ball to represent the Earth, a pencil to act as the Earth's axis, and a rubber band to represent the equator.

Insert the pencil in the bottom of your foam ball. Place the rubber band around the middle of the foam ball. Have one person hold the light source stationary. Holding the pencil at a constant angle, have the other partner move earth around the light source. Reflect on these questions: What do you notice about the way the light hits the Earth? When is it most light? When is it darkest?

Standard: NGSS: MS-ESS1-1

Make Your Own Sundial

A sundial is a device that tells time using the position of the sun. To make your own, find the center of a paper plate and make a small hole. Force a pencil through the hole. Place your sundial outside. Use tape or a small stone to keep it **stationary**.

The pencil will create a shadow on the plate. Use a marker to trace the shadow and record the time on the edge of the plate. Repeat every hour. What did you notice? What does this tell you about the earth's movement? Do you see anything else in the classroom that resembles your sundial? Standard: NGSS: 5-ESS1-2

The tilt of the Earth's **axis** is the most important reason for seasons. As Earth **orbits** the sun, its tilted axis always points in the same direction. So, throughout the year, different parts of the planet get the sun's direct rays.

Southern Hemisphere

What's growing in...

June/July	Dec/Jan
Broccoli	Tomatoes
Lettuce	Peaches
Beets	Cucumber
Cabbage	Strawberries
Cauliflower	Cherries

The Four Seasons of Farming

California crop farmers are busy year-round. Here are some typical tasks a farmer completes throughout the year. Add your own drawings to illustrate what happens on the farm during each season. Stds: CA Visual Arts: Grade 3-8: 2.0

Spring	Summer	Fall	Winter
Preparing the ground, planting, and hiring employees	Watering, weeding, and fertilizing	Harvesting, transporting, and processing	Planning, making a budget, and buying equipment

Did You Know?

June 21 marks the day when the Earth is turned the most toward the sun. This is known as summer solstice. It is the longest, sunniest day of the year.

Sources: NASA (*nasa.gov*)
National Geographic (*nationalgeographic.com*)
Harvest of the Month (*harvestofthemonth.cdph.ca.gov*)

GREAT READS ABOUT Agriculture

For Elementary, Middle School & High School Students

Learn About Ag®
California Foundation for Agriculture in the Classroom

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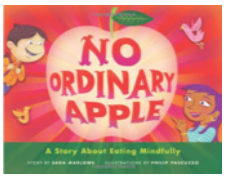
Books About Agriculture
for elementary students



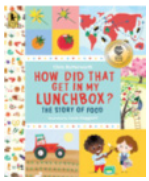
No Ordinary Apple: A Story About Eating Mindfully *written by Sarah Marlowe, illustrated by Phil Pascuzzo*
On an otherwise ordinary day, Elliot discovers something extraordinary: the power of mindfulness. Elliot is disappointed by his afternoon snack, but when encouraged to carefully and attentively look, feel, smell, taste, and even listen to the apple, Elliot discovers that this apple is not ordinary at all.

'Til the Cows Come Home *written by Jodi Icenoggle, illustrated by Normand Chartier*
A delightful cowboy interpretation of the old Jewish folktale, "The Button." In this book, a resourceful cowboy finds a way to use one beautiful piece of leather in a variety of situations, making the piece last 'til the cows come home. This book has strong themes of caring for livestock, family belonging, and Western living.

When Grandma Gives You a Lemon Tree *written by Jamie L.B. Deenihan, illustrated by Lorraine Rocha*
When grandma gives a lemon tree for her birthday, a young girl tries to hide her disappointment. But when she follows the narrators careful—and humorous—instructions, she discovers the tree was exactly what she wanted after all. This story celebrates the patience, hard work, and community required to grow your own food.

Right This Very Minute *written by Lisl H. Detlefsen, illustrated by Renée Kurilla*
Framed around children's mealtimes, this brightly illustrated picture book answers the essential question, "Where does my food come from?" Showcasing farmers producing a variety of agricultural commodities, children learn facts about crop rotation, soil sensors, and how produce gets to market.

The Seagoing Cowboy *written by Peggy Reiff Miller, illustrated by Claire Ewart*
By 1945, Poland had been ravaged. Its cities and farmland had been bombed badly, the people who had survived were in need of food. This fictional picture book expands on the true story of seagoing cowboys who delivered livestock to countries in desperate need of rebuilding after the war's devastation.



How Did That Get in My Lunchbox? The Story of Food *written by Chris Butterworth, illustrated by Lucia Gaggiotti*
From planting wheat to mixing dough, climbing trees to machine-squeezing fruit, picking cocoa pods to stirring a vat of melted bliss, this book features the steps involved in producing popular kid foods. Vibrant illustrations and diagrams highlight the complex processes that result in of food production.

Who Grew My Soup? *written by Tom Darbyshire, illustrated by C.F. Payne*
Phineas Quinn will only agree to eat vegetable soup if his mother can tell him who grew it. Enter Mr. Mattoo, chief soup soupervisor, and his tomato-shaped balloon. Phin spends the day flying from farm to farm, learning how the vegetables in soup are grown, and vastly increasing his love for vegetable soup.

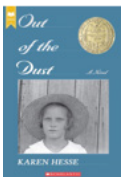
The Midnight Farm *written by Reeve Lindbergh, illustrated by Susan Jeffers*
A lyrical book that reveals what happens on the farm after the sun goes down. Detailed illustrations capture each mystery as it is uncovered—in the orchard, barnyard, stable, and home. This is a rare depiction of the midnight hour not only as a safe, snug place, but as a celebration of life, hope, and wonder.

The Tree Farmer *written by Chuck Leavell and Nicholas Cravotta, illustrated by Rebecca Bleau*
Through the interactions of a grandfather and his grandson, this story explains the vital role trees play in our lives—providing us with the wood for our homes, furniture, and other products. The Tree Farmer educates readers about timber, while celebrating a farmer's love of the land and the wise use of its resources.

Books About Agriculture
for middle school students

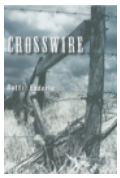
Hattie Big Sky *by Kirby Lawson*
After inheriting her uncle's homesteading claim in Montana, 16-year-old orphan Hattie Brooks travels from Iowa to "prove up" his claim and a make permanent home for herself. Hattie is quickly acquainted with the many hardships facing a young homesteader, but finds a family of loyal friends along the way.

Squashed *by Joan Bauer*
Ellie Morgan's life would be almost perfect if she could get her potentially prize-winning pumpkin to put on about 200 pounds before the Rock River Pumpkin Weigh-In. Sprinkled with humor, agriculture wisdom, and a bit of teenage romance, Squashed is a novel that celebrates rural life and the unwavering devotion of a young farmer.

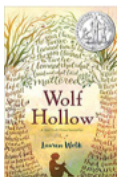


Out of the Dust *by Karen Hesse*
Told in free-verse poetry of dated entries that span the winter of 1934 to the winter of 1935, 5-year-old Billie Jo relates the hardships of living on her family's wheat farm in Oklahoma during the Dust Bowl years of the Depression. The quiet strength displayed by young Billie Jo while dealing with unspeakable loss is as surprising as it is inspiring.

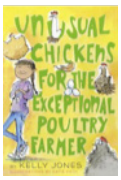
The Circuit *by Francisco Jiminez*
This series of short stories about the life of a migrant child follows a family through their circuit of work over the year as they move from one labor camp to the next. From picking cotton and strawberries to topping carrots—this book captures the complexity of agriculture production and introduces readers to the people behind the product.



Crosswire *by Dotti Enderle*
The cruel Texas drought of 1883 has Jesse and his family in turmoil. Crops are drying out, and desperate free-range cattlemen are cutting fences and trespassing with their thirsty herds, threatening the family's precious water supply. When a lone drifter is hired to help around the farm, Jesse becomes determined to uncover his mysterious secret.

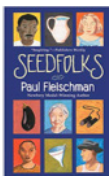


Wolf Hollow *by Lauren Wolk*
Annabelle and her family have lived a mostly quiet, steady life on their small Pennsylvania farm. When Annabelle encounters Betty, a new student who proves to be both cruel and manipulative, she must face injustice with courage and kindness. This novel introduces readers to rural living in 1943—harvesting apples, fetching eggs, and raising livestock.



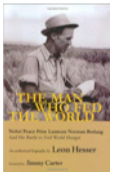
Unusual Chickens for the Exceptional Poultry Farmer *by Kelly Jones.*
After inheriting her great uncle's farm (and his most unusual chickens), Sophia and her family move from Los Angeles to rural Northern California. Part instructional manual and part tall tale, this humorous book chronicles the adventures of Sophia as she learns to care for her newly-inherited flock.

Becoming Felix *by Nancy Hope Wilson*
JJ's family has been in the dairy business for generations, yet all around them other small farms are going bankrupt. With themes of family and friendship, Becoming Felix examines what it means to choose between two competing dreams. JJ is torn between spending his time playing his grandfather's clarinet, or helping to save the family farm that once belonged to his grandfather.



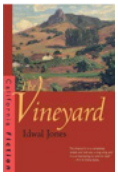
Seedfolks *by Paul Fleishman*
In an inner-city neighborhood, a young girl plants a handful of lima beans in an empty lot which soon blossoms into a community garden, tended by a notably diverse group of local residents. Readers may not gain a greater appreciation for gardening, but they will come away understanding that people can work side by side despite different attitudes, skills, and cultural backgrounds.

Books About Agriculture
for high school students

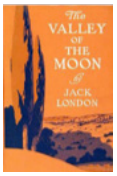


The Man Who Fed the World by Leon Hesser
Dr. Norman Borlaug, Nobel Peace Prize recipient for averting hunger and famine, is credited with saving hundreds of millions of lives from starvation. Beginning with his fieldwork in Mexico during the 1940s, developing strains of disease-resistant wheat, and continuing to transform grain production in Mexico, Pakistan, India, Asia, and Africa.

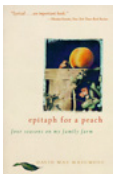
Bloodvine by Aris Janigian
A dramatic tale of two half-brothers, second generation Armenians, who make decisions about the 40 acres of prime vineyard they inherit. Based on a true story, the author skillfully captures the history of genocide, the migration to the U.S., the embracing of agriculture, and the deep scars that eventually tear the family apart.



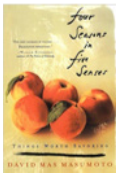
The Vineyard by Idwal Jones
Set in the Napa Valley at the turn of the century, this novel provides a vivid history of winemaking in California. Plucky Alda Pendle is the daughter of a viticulturist. When he dies, leaving her without property, her skills make her indispensable to one of the oldest vineyards in the valley.



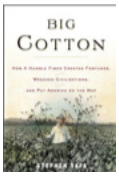
The Valley of the Moon by Jack London
Set in the troubled economic times and labor strikes at the turn of the century, Billy and Saxon Roberts struggle to find success. After much hardship, they leave Oakland and travel through Central and Northern California in search of land they can farm independently. They find land, contentment, and many friends along the way.



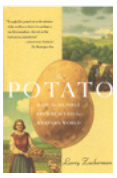
Epitaph for a Peach by David Mas Masumoto
Masumoto is a third-generation Japanese-American peach and grape farmer in California. In this book, he takes readers on a quiet journey through a year in the farming life, including the grueling off-season work of preparing the fields and the near-despair of losing a raisin crop to heavy September rainfall.



Four Seasons in Five Senses by David Mas Masumoto
In this collection of essays, the author, a peach and raisin farmer, invites readers to consider the farmer behind each piece of food you eat. Masumoto chronicles his life and work on the farm through the seasons as experienced by each of the five senses: sight, hearing, taste, smell, and touch.



Big Cotton by Stephen Yafa
A novel that discusses how the cultivation and production of cotton profoundly helped shape human history and impacts the way we live. From the exploitations of Christopher Columbus to impoverished cotton farmers in Mali, Yafa helps readers understand the significance of cotton in the past, present, and future.



Potato: How the Humble Spud Rescued the Western World by Larry Zuckerman
The Potato tells the story of how a humble vegetable, once regarded as trash food, had as revolutionary an impact on Western history. Using Ireland, England, France, and the United States as examples, Zuckerman shows how daily life from the 1770s until World War I would have been unrecognizable—perhaps impossible—without the potato.

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Food Safety from Farm to Fork

An Interdisciplinary Educational Unit for Grades 5-7

Why Teach About Food Safety?

Americans enjoy the safest food supply in the world, yet the most common intestinal ailments in the United States are caused by foodborne illnesses. How can this be?

Food Handling Is The Key!

This unit provides fifth through seventh graders a better understanding of food safety through real-life examples and enjoyable activities. They learn that everyone has a responsibility in minimizing foodborne illnesses—farmers, transporters, restaurants, grocery stores… and the consumer! Through reading, games, puzzles, math problems and science investigations, participants identify the roles each one of us plays to ensure the food we enjoy is safe to eat.

The majority of foodborne illnesses associated with fresh fruits and vegetables is due to improper food handling at the foodservice or consumer level.

Food gathering and preparation have changed over time. Americans have gone from growing and preparing their own food to enjoying convenience foods grown by a fewer number of farmers and prepared by someone other than themselves. Thus food safety practices are important in every stage of food production, preparation, and consumption. Here are a few examples of food safety practices from each area.

The Farm

Good Agricultural Practices have been developed jointly by the agricultural industry and government. These provide guidelines that reinforce already stringent laws governing food safety on U.S. farms.

A small percentage of foodborne illness outbreaks can be traced back to the growing, packing, shipping, or processing of fruits and vegetables.

The Food Handlers

Grocery stores, transportation companies, storage facilities and restaurants have food safety rules and require employees to abide by them. Stringent regulations imposed by national, state and local governments, based on sound science, ultimately benefit the consumer.

Did you know? It is common to find bacteria on produce, but this bacteria is not harmful to people.

The Consumer

This educational guide is part of a consumer food safety education program. The consumer, the person who eats the food, is responsible for making sure that the food is prepared and stored properly. This is crucial since most foodborne illness outbreaks are associated with improper handling at the restaurant or home.

Nutrition! Throughout the lessons, discuss the importance of eating right. The human body has natural defense mechanisms that work best when we eat right, get plenty of exercise, drink lots of water and get enough sleep!

So take a look through the guide. See how you can use it to teach your students about foodborne illnesses and reduce the number of foodborne illness incidents. At the same time your class will practice reading and writing, investigate and experiment, apply math to real situations, and practice thinking critically about a topic that impacts all of us daily—food safety!

Links to Current California Standards

Students learn and retain information best when they can relate what they learn in the classroom to their personal lives. This multidisciplinary, thematic unit on food safety includes lessons that teach or reinforce many educational standards for California Public Schools. Each activity includes a listing of the specific standards addressed. Refer to the California Department of Education Website (www.cde.ca.gov) for descriptions of the educational standards.

Table of Contents

PLAYING IT SAFE

Description

Students will learn the basic science of food safety and the importance of safe food practices while playing a board game, performing "fact or opinion" and "cause and effect" activities, and then writing an essay on what they learned.

Activity

1. Explain that students will learn about the science of food safety.
2. Discuss the differences between "facts" and "opinions." Select students to read dictionary definitions of these two terms.
3. Have students number a piece of paper from 1-6. Instruct them to listen to the statements that you read to them. They are to write an "F" next to the number if they think the statement is a fact, and an "O" if the statement is an opinion. Read the statements below, one at a time, and have the students record their answers. Discuss the answers.

Fact or Opinion?

❑ F ☑ O 1. People should only eat cooked foods since, according to a media report, all bacteria in food are harmful.

☑ F ❑ O 2. Microorganisms can live almost anywhere, even in food.

☑ F ❑ O 3. To maintain your health, it is important to eat five or more servings of fruits and vegetables per day.

☑ F ❑ O 4. A single bacterium is too small to see without a microscope.

☑ F ❑ O 5. Scientific research has shown that the mishandling of food by the person who prepares or eats it accounts for most foodborne illnesses.

❑ F ☑ O 6. People should not eat fresh foods since your aunt says they can carry bacteria like *E. Coli* and *Salmonella*.

4. In preparation for the game, orally read *What's All the Talk About Food Safety?*
5. Create groups of three to four students. Explain *Playing it Safe* and then have the students play the game.

Directions:

a. Shuffle the playing cards and place them face down on the board.

b. Place the sponge markers on "Start."

c. The first player draws a card from the top of the stack, reads it aloud, and then moves the number of spaces directed. All students should listen to the fact stated on the card, making a mental note that the statement is indeed a "fact." If a person must move "back" but is already on "Start," then the player should remain on "Start."

d. The next player takes a turn. Continue until one player crosses the finish line. Reuse the cards, if necessary.

6. Remind students that a "cause" is something that makes something else happen. What happens is the "effect." Have groups do the *Cause and Effect* activity located on the game board. Students should agree on the answers and discuss as a class.
7. Have each student write a three paragraph essay that covers the following information. Once written, have students edit for proper grammar, spelling, and punctuation, including capitalization.

a. What is food safety and why is it important to use safe food practices?

b. Define "foodborne illness" and provide specific examples of foodborne illnesses.

c. Describe several things a person could do to prevent foodborne illnesses.

Time

One 50-minute session

Materials

For teams of 3-4:

- Four ½" pieces of sponge; four colors
- *What's All The Talk About Food Safety* Student Page (page 4)
- *Playing It Safe!* Game Board (page 5)
- *Playing It Safe!* Game Cards (page 6)

California Standards

Common Core English Language Arts

Grade 5
RI.5.5
W.5.2
SL.5.1
L.5.1, 5.2

Grade 6
RI.6.7
W.6.2
SL.6.1
L.6.1, 6.2
RST.6.8

Grade 7
RI.7.3
W.7.2
SL.7.1
L.7.1, 7.2
RST.7.8

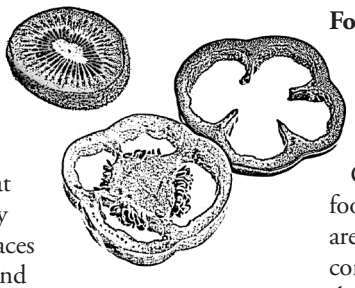
CAUSE & EFFECT ACTIVITY ANSWER KEY

No.	Cause	Effect
1	not refrigerated	turned sour
2	washed hands	healthful salad
3	warm summer temperatures	more foodborne illnesses
4	added rennet (bacteria)	made cheese
5	core in bin	decomposed to compost

What's All the Talk About Food Safety?

Did you ever have an upset stomach or something that people call the 24-hour flu? If your symptoms lasted less than a day, chances are your brief illness was caused by a foodborne illness. You will learn about ways you can minimize the number of foodborne incidents you have in your lifetime.

What is a foodborne Illness?



A **foodborne illness** is a disease that is carried to animals or humans by food. Foodborne illnesses are caused by microorganisms such as bacteria. Not all bacteria cause disease in humans. Those that do are called **pathogens**. They grow rapidly when conditions are right—dark, damp places where temperatures range between 40° F and 140°F. Any type of food can be a source of a foodborne illness; however, high protein foods are responsible for most of them. Examples include milk and milk products, eggs, meats, poultry, fish, seafood, and soy protein food such as tofu.

What is food safety ?

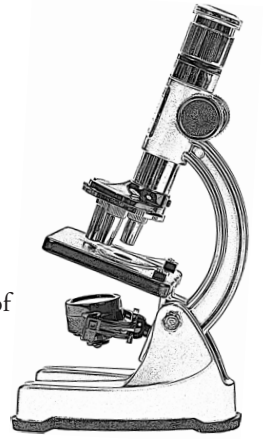
Food safety is the practice of making sure that people have the healthful food they need for an active, healthy lifestyle. Some foods, particularly fresh fruits and vegetables, are not cooked before we eat them. These foods must be handled correctly to make sure they are safe to eat. The Centers for Disease Control reports the majority of foodborne illnesses associated with fresh fruits and vegetables are due to improper food handling at the foodservice or consumer level. They are contaminated with pathogens and then not cooked or stored properly. Since you handle food, you can do your part to keep your food safe.

Who is responsible?

All people have a personal responsibility to keep food safe. Farmers are the first people responsible for producing healthful food. They must know how to plant, cultivate, irrigate, harvest, and store the food so that the final product is safe for the consumer. Farmers are responsible for making sure that the people involved in their operations follow the guidelines established by the United States Department of Agriculture (USDA). In the 1990s, the agricultural industry adopted some guidelines called GAPs—Good Agricultural Practices—that keep food safe at the farm level.

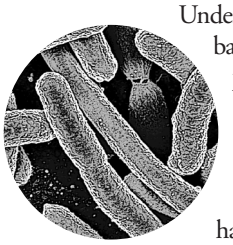
People who pack, process and transport food must make sure that food is kept at proper temperatures, and handled and washed appropriately. Storage facilities must be kept clean. Grocers and those who prepare and serve food at restaurants are responsible for using proper food safety procedures. You, the at-home consumer, must do your part too! It requires teamwork.

What is a microorganism?



Microorganisms, also known as microbes, are single-celled organisms so tiny that millions of them can fit between the eye of a needle. Individually, they can only be seen with a microscope. Colonies of microorganisms, such as mold on bread, may be visible with the eye alone. Common microbes associated with foodborne illnesses are bacteria.

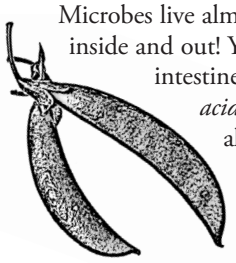
Bacteria Out of Control!



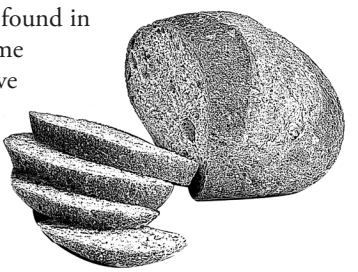
Under certain conditions, a bacterium can double in population every 10 to 30 minutes—usually in warm, damp and dark places. People can get sick when they eat foods that have been contaminated by harmful bacteria. *Salmonella* and *E. Coli* are common bacteria that cause foodborne illnesses. Seems funny that one form of *E. Coli* is inside our gut, but if we eat another form, it can make us sick. That's strange but true!

Since pathogens can live almost anywhere, it is important to clean, separate, chill, and cook your food properly… and then eat it in a timely manner.

Beneficial Microbes



Microbes live almost everywhere! In fact, you are covered with microbes inside and out! Your mouth contains more than 600 kinds! Your large intestine contains *Escherichia coli*, a bacterium. *Lactobacillus acidophilus* turns milk into yogurt. *Saccharomyces cerevisae*, also known as yeast, makes bread rise. *Bacillus thuringiensis (Bt),* a natural pesticide, is found in the soil and is used by farmers and home gardeners. Rhizobia are bacteria that live in the nodules of some plant roots, such as beans and alfalfa, and convert nitrogen into a form plants can use. Without microbes to decompose things, the world would be covered with waste. In fact, Earth as we know it would not exist!



PLAYING IT SAFE

START

CARDS

Sneezed on food. Miss one turn

END

Cause and Effect

Read each of the following statements. Underline the "cause" and circle the "effect."

1. The milk was not refrigerated, so it turned sour.
2. Miguel washed his hands before making a tasty, healthful salad.
3. There are more foodborne illnesses in the summer because bacteria multiply quicker in warmer temperatures.
4. Grandma made cheese after adding rennet to milk.
5. Sandra threw her apple core into the outdoor bin so it would decompose and become compost.

PLAYING IT SAFE GAME CARDS

Instructions: Copy and cut one set of game cards for each group.

		You used a clean paper towel to wipe off the kitchen counter and then disposed of it properly. MOVE AHEAD 3 SPACES.
You washed your hands for 20 seconds with warm water and soap before helping make dinner. MOVE AHEAD 3 SPACES.	You pet your dog and let him lick your hand. Then you helped mom cut up lettuce for the salad without washing your hands. GO BACK 2 SPACES.	You used a scrub brush to wash under your fingernails before preparing dinner. MOVE AHEAD 4 SPACES.
You cooked your scrambled egg until all of it was firm. MOVE AHEAD 3 SPACES.	You washed your cutting board under hot soapy water after cutting the eggs, but before you started slicing the potatoes for the salad. MOVE AHEAD 3 SPACES.	You were tired, so you left the potato salad on the counter for 2 hours before putting it away. MOVE BACK 2 SPACES.
When your dad barbecued, you washed the raw meat juices off the platter with warm soapy water before he put the cooked meat back on it. MOVE AHEAD 3 SPACES.	You washed the plastic cutting board in the dishwasher after dinner. MOVE AHEAD 4 SPACES.	You washed your hands but a towel was not close by. You wiped them on the legs of your pants. MOVE FORWARD 2 SPACES, THEN BACK 2 SPACES.
You cut up the chicken for fajitas with a sharp knife and then cut your veggies without rinsing the knife or cutting board. MOVE BACK 4 SPACES.	Before talking on the phone, you helped your mom put the leftovers in the refrigerator as soon as dinner was over. MOVE AHEAD 3 SPACES.	You put your dish sponge in the microwave on high for one minute before you wiped off the counter. MOVE AHEAD 3 SPACES.
You asked the bag clerk at the supermarket to put the chicken in a separate bag from your fruits and vegetables. MOVE AHEAD 4 SPACES.	You cut up cheese slices but didn't clean the cutting board when you finished. MOVE BACK 2 SPACES.	You let the kitchen sponge soak in the dishwater overnight. In the morning you wiped down the counter with it. MOVE BACK 3 SPACES.
Mom called and asked you to put the ground beef out to thaw. You placed it on the counter top all day to defrost. MOVE BACK 3 SPACES.	As your chicken defrosted in the refrigerator, the juices dripped onto the refrigerator shelf. An apple rolled into the juices. MOVE BACK 3 SPACES.	Your steak was barely warm and looked under-cooked when you went out to dinner with your friends. You didn't want to say anything, so you ate it anyway. MOVE BACK 2 SPACES.
You dried the dinner dishes with the cloth that had been hanging all week on the refrigerator door. MOVE BACK 3 SPACES.	You remembered to tie back your hair while you were making a cake for your brother's birthday. MOVE AHEAD 3 SPACES.	You understand the importance of keeping hot foods hot and cold foods cold, and not cross-contaminating raw food with cooked food. MOVE AHEAD 4 SPACES.

OPERATION KITCHEN IMPOSSIBLE

Description

In this lesson, students become the head chef in a virtual kitchen. They will use mathematical knowledge, problem-solving skills and food safety guidelines to prepare a safe and nutritious meal.

Activity

Part 1: Introducing Food Safety

1. Brain Dump! Ask students, "What can we do to keep food safe?" Give students 30 seconds to capture their ideas on a personal sheet of paper. Capture thoughts on a common share sheet.
2. Instruct one student to read Chef Al's recipe card (pg. 8) out loud.
3. Divide students into four collaborative working groups. Assign each group one of the four safety tips below. Each group is to develop and present a 30-second song, rap, or poem sharing important information about their safety tip. Divide a large class into eight groups and feature each tip twice.
4. After each presentation, have the class identify an anchoring movement to recall the important concept presented. For example, students may make a motion with their hand like they are opening the refrigerator door to represent the First In, First Out (FIFO) principle.

Part 2: Applying What We Know

1. Lead students in a review of safety tips and anchoring movements.
2. Have students work individually or with a learning partner to complete the scenario- based problems on the Operation Kitchen Impossible handout (page 8). Students should use a separate sheet of paper to solve problems and record answers.
3. Don't forget it! Have one student read problem 10 of the handout about farmers and ranchers' commitment to food safety. Challenge each student to share with the class one personal commitment to food safety.

ANSWER KEY

1) a. ¼ hour; b. 1½ hours; c. ¾ hour
2) 20°
3) 159°
4) 142.5 pounds beef
5) 25.5 gallons milk
6) 6 bags
7) x = 2 cups
8) 48 ft.^{2}
9) 6 oz. solution
10) Answers will vary by student.

Safety Tips

Buy it Cold—Keep it Cold!

Take food straight to the fridge after buying. Choose packages tightly wrapped without tears or holes. Freeze fresh meat if you can't use it within two days. Defrost meat in the refrigerator or using the microwave—don't leave it out!

FIFO!

When storing meat, label each package with the date and item. Practice the FIFO system, First In (the fridge), First Out!

Heat it Up Before You Eat it Up!

Foods must reach a certain temperature to be considered safe. Keep these in mind: poultry 165˚, ground beef 160˚, beef roasts and steaks 145˚, pork 160˚, leftovers 165˚.

Separate—Don't Cross-Contaminate!

Keep raw meat, poultry and seafood away from other foods to prevent the spread of bacteria. Use separate cutting boards for meat and other foods. Always wash your hands and food preparation areas with soap and water before and after use.

Time

Part 1: 60 minutes
Part 2: 30-45 minutes

Materials

For class as a whole:

- Share sheet
- Markers
- Safety tips, cut out (4)

For each student:

- *Operation Kitchen Impossible* handout
- Personal sheet of paper
- Pencil
- Calculator (if desired)

California Standards

Common Core English Language Arts

Grade 5
SL.5.2, 5.5

Grade 6
SL.6.2, 6.5

Grade 7
SL.7.2, 7.5

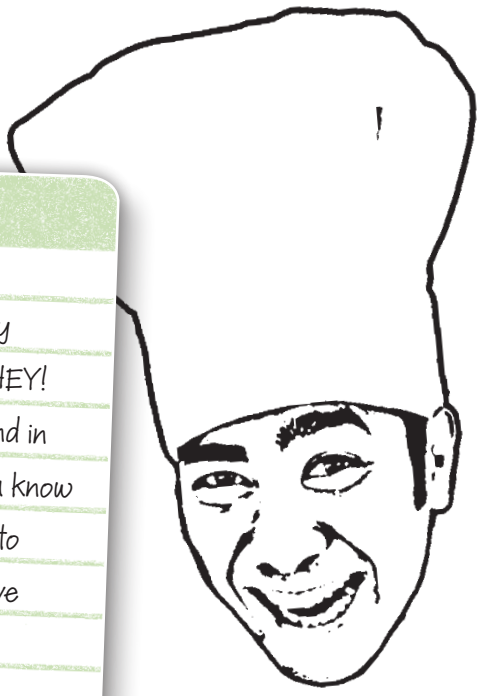
Common Core Mathematics

Grade 5
5.NF.3
5.NF.6
5.NF.7

Grade 6
6.RP.3
6.EE.2
6.G.1

Grade 7
7.NS.2
7.NS.3
7.EE.3
7.EE.4
7.G.6

OPERATION KITCHEN IMPOSSIBLE



HELP! My name is Chef Al Fredo and I have been taken by hungry kidnappers who want my secret recipes! Tonight my restaurant, "HEY! PASTA BOWL TO ME!" will be full of guests, and I need you to stand in as head chef. I trust you will create safe and delicious food! Did you know that foodborne illness is often due to bacterial contamination linked to how the food is handled? Next to each light bulb in my kitchen I have important safety reminders. Read them first and then get cooking!

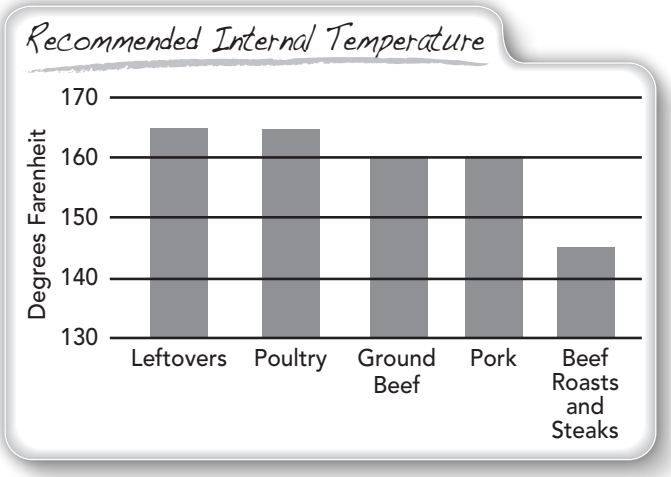
– Chef Al

Warming up!

1. Cooking food for the appropriate length of time is important in food safety! Chef Al left these times in code, by writing them as decimals. Convert the following cooking times from decimals to fractions.

A) 0.25 hours B) 1.5 hours C) 0.75 hours

Use the graph on the right to answer questions 2 and 3.



2. What is the difference in recommended internal temperature between poultry and beef steaks?

3. What is the average internal temperature for all foods listed?

Now you're cooking!

4. Chef Al warned you not to leave too much food out or it will spoil. He uses 95 lbs. of beef for 200 people, but tonight you are expecting 300 people. How many pounds of beef should you put in the fridge to thaw?

5. Dairy products need to be refrigerated so they don't go bad. Calculate how many gallons of milk you will need to make Chef Al's famous Alfredo sauce. He uses 17 gallons to serve 200 people, but you are expecting 300.

6. You pull out frozen pizza dough from the freezer that Chef Al has carefully labeled with the contents, date and amount of dough. You need 15 lbs. of dough to thaw for dinner. If each bag weighs 2½ lbs. how many bags do you need to take out of the freezer?

On fire!

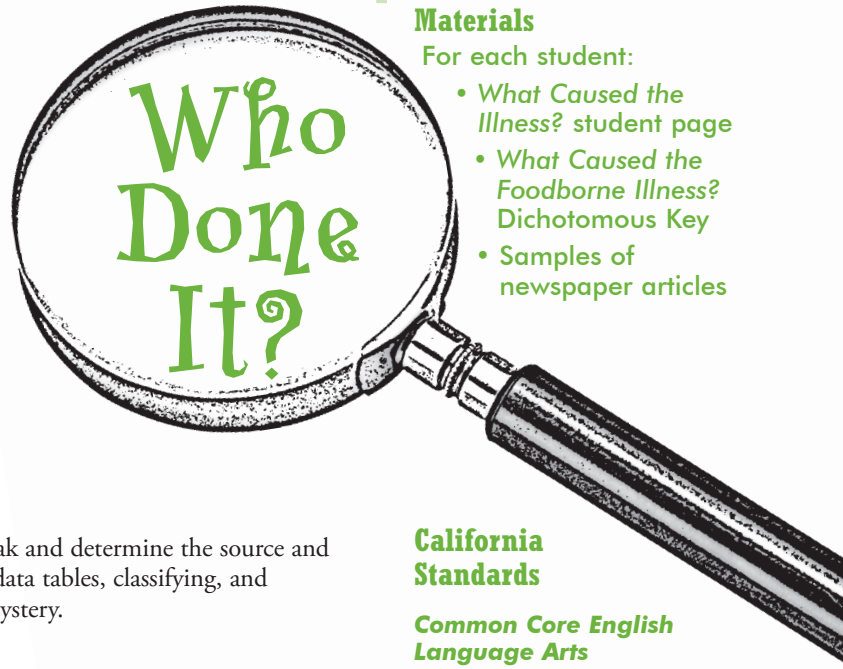
7. Chef Al left his pasta recipe in a secret code. For the amount of flour, Chef Al wrote $2(3x+4) = 20$. Solve for the variable to determine how many cups of flour are needed.

8. Make sure you don't cross-contaminate! You must clean the counter in the kitchen before you begin preparing food. The counter is 4 ft. wide and 12 ft. long. What is the area of the counter?

9. The antibacterial cleaning bottle says that you need ½ ounce of solution for every 4 square feet of surface area. Using your answer from problem 8, how many ounces of antibacterial solution do you need to make sure your counter is clean?

10. American farmers and ranchers are committed to continued research in the area of food safety. What is your food safety commitment? Take a moment to write down three specific actions you will take to commit to food safety in your home.

Mighty Microbes



Time
Two 50-minute sessions

Materials
For each student:
- *What Caused the Illness?* student page
- *What Caused the Foodborne Illness?* Dichotomous Key
- Samples of newspaper articles

Description
Students, acting as epidemiologists, look at the facts of an outbreak and determine the source and cause of an illness that makes many picnickers sick. Interpreting data tables, classifying, and reading are incorporated into this investigative epidemiological mystery.

Activity
1. Explain to the students that they will become epidemiologists and determine the cause of an illness that affected many people in a community. Have someone read the dictionary definition for "epidemiology" and discuss its meaning. Also, discuss that actual epidemiology cases are much more complex than the hypothetical case they are about to analyze.
2. As a class read the foodborne illness outbreak scenario on page 10.
3. Discuss the terms "outbreak" and "dichotomous," as well as any others the students may find difficult. Create a class vocabulary list if necessary.

Have student duos complete the activity as described on the student worksheet.

NOTE: Have newspaper articles handy for students to use as a guideline for writing their news article as described on page 10.

ANSWER KEY

The unhealthy microbes in the fruit juice were most likely transmitted by an ill worker who had a foodborne illness himself. His improper handling of the cups and juice, along with warm temperatures, spread the disease to the juice. The dichotomous path used to reach this conclusion is: 1a, 2a, 3a, 4a, 5a.

California Standards

Common Core English Language Arts

Grade 5
R.5.4, 5.7
W.5.2, 5.4
L.5.2, 5.4

Grade 6
R.6.4, 6.7
W.6.2, 6.4
L.6.2, 6.4
RST.6.3, 6.7

Grade 7
R.7.4
W.7.2, 7.4
L.7.2, 7.4
RST.7.3, 7.7

Next Generation Science Standards

Grades 6-7
MS-LS1-5

Local Health Department Conducting Investigation!

What Caused the Illness?

Name _____

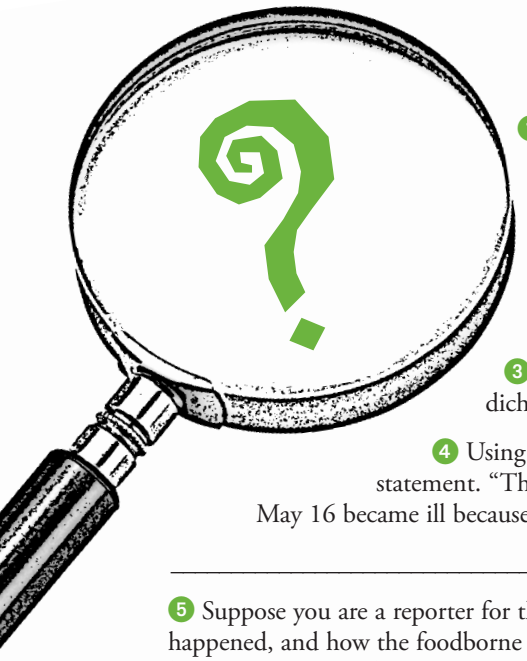
Scenario

The local hospital has treated numerous people for dehydration due to uncontrollable vomiting followed by diarrhea. The county health department is conducting an investigation to determine the causative agent. It was determined that all the patients ate at a community get-together on May 16 and that the illnesses were caused by a foodborne pathogen, a disease-causing microorganism obtained from something the people ate or drank. Look at the data chart above. Each of the 20 people in the chart were hospitalized. Determine what food was responsible for the food poisoning.

PATIENT DATA CHART:

Patient	Hot Chocolate	Fruit Juice	Bottled Water	Granola Bar	Popcorn	Cut Vegetables	Veggie Dip	Watermelon
A	-	+	+	-	-	-	-	-
B	-	-	+	+	+	+	+	+
C	+	+	-	-	-	-	-	-
D	+	+	+	-	-	+	+	+
E	-	+	-	-	-	-	-	-
F	-	-	+	-	+	+	-	+
G	-	+	+	-	-	-	-	-
H	-	+	-	+	-	-	-	-
I	-	+	-	-	-	-	-	-
J	+	+	-	-	+	-	+	+
K	-	+	+	+	-	+	+	+
L	-	+	-	-	+	+	+	-
M	+	+	-	-	-	+	-	-
N	-	+	+	+	-	-	-	-
O	-	+	-	-	-	-	-	+
P	-	+	-	-	-	-	-	+
Q	-	+	-	-	-	-	-	-
R	+	+	-	-	+	-	-	-
S	-	+	-	-	-	-	-	-
T	+	+	-	+	-	+	-	-

+ = that person ate item - = that person did not eat item



1. From the data above, what food do you suspect caused the illness?

_____

2. In one complete sentence, describe your reasoning.

_____

_____

3. Discuss your reasoning with the lead epidemiologist (your teacher) and then obtain the dichotomous key to continue your investigation.

4. Using the dichotomous key, determine the actual source of the illness. Complete the following statement. "Through scientific investigation, my team has determined that the people at the get-together on May 16 became ill because:

_____

5. Suppose you are a reporter for the local newspaper. Write a three to five paragraph article that describes what happened, why it happened, and how the foodborne illness could have been avoided. Before writing your story, examine a newspaper article to see how it is set up. Make sure your article has:

- a headline
- authors listed
- facts of what happened
- facts about foodborne illnesses in general
- how this incidence could have been avoided
- quotes from experts or witnesses (pretend you interviewed patients, event planners, food handlers, epidemiologists, etc.)
- been proofed for spelling, capitalization, proper punctuation, sentence structure, and flow of story

What Caused the Foodborne Illness? Dichotomous Key

Instructions: Read number 1. Determine which statement, a or b, best reflects the incident and information. Proceed as directed, until the illness is traced back to its source. This is called a "trace-back," something that epidemiologists do on a regular basis.

1 The fruit juice was made from frozen fruit juice concentrate, which was pasteurized at the plant. Pasteurization is when something is heated to a temperature high enough to kill microorganisms. The can had a batch number of 10394-PR on its end. A bacterial count was determined from a frozen concentrate with the same batch number. Look at the chart above.

Juice Batch Number	Bacterial Count
10393-PR	0 per 3 ml juice
10394-PR	0 per 3 ml juice
10395-PR	0 per 3 ml juice

a. If the bacterial count was 0 in 3 milliliters of juice, the illness was not likely caused by the concentrate itself. Go to 2.

b. If the bacterial count was 1 per 3 milliliters of juice or greater, the illness was likely caused by the bacteria in the concentrate before preparation. Illness came from fruit juice concentrate.

2 Water used to dilute the juice concentrate came from the tap and is tested by the city's Public Works Department on a regular basis. Here are the data for a 3-week period.

a. If the bacterial level of the water was 0 or less, the water was not the cause. Go to 3.

b. If the bacterial level of the water was 1 or higher, bacteria from the water could be the culprit.

Test Performed	May 10	May 17	May 24	Max. Allowable Level
Bacterial Count	None detected	None detected	None detected	None detected
Copper (ppm)	40	30	40	170
Nitrates (mg/l)*	22	19	21	45
Calcium (ppm)**	48.2	41.7	48.1	300
Lead (ppb)***	None detected	None detected	None detected	None detected
Fluoride (ppb)***	110	98	110	2000

* mg/l = milligrams per liter ** ppm = parts per million *** ppb = parts per billion

3 Ice was added to the juice. The ice came from ice cubes made of city water and were made fresh with clean ice cube trays.

a. The ice was probably not the source of illness. Go to 4.

b. The ice could have been the problem.

4 The prepared juice was at the park for the entire event on May 16 from 2 p.m. until 5 p.m. Use the following information gathered from the event manager to make an appropriate choice.

The juice was prepared at noon on May 16th in insulated jugs that each hold 5 gallons. The juice concentrate was frozen at the time it was made and was mixed with tap water. The coordinator made the volunteers wash their hands before making the juice. A few ice cubes were put into the insulated container, which the volunteers rinsed out with hot, soapy water prior to using. It was stored at room temperature until 1 p.m. at which time it was taken outside to the picnic tables. At the event, juice was removed from the container through the push button spout and placed into paper cups. The filled cups were on the table throughout the event. When necessary, new paper cups were filled with juice. The coordinator said that less people attended the event than expected but that everyone had a great time. The event ended at 5 p.m.

a) The juice seemed to be prepared following food safety procedures. Go to 5.

b) The juice was not prepared following basic food safety procedures. Go to 6.

5 A quick survey of the overall health of the workers indicated that one of the workers at the fruit juice station had a severe stomachache and was feverish the night before the event.

a) A sick worker could have spread a foodborne illness to the guests at the event.

b) A sick worker could not have spread a foodborne illness to the guests. Go to 6.

6 Most bacteria grow best between the temperatures of 40°F and 140°F. View the chart below and the description in 4 and determine whether the outside temperature could have aided in bacterial contamination.

a. Outdoor temperatures could have caused contamination.

b. Most likely outdoor temperatures did not contribute to the illness. Go to 7.

Temperatures at Park on May 16	
Time	Temperature
10 a.m.	62
11 a.m.	69
noon	71
1 p.m.	80
2 p.m.	85
3 p.m.	86
4 p.m.	88
5 p.m.	88
6 p.m.	87
7 p.m.	82
8 p.m.	75
9 p.m.	69
10 p.m.	61

7 How the juice was dispensed or stored could be the problem.

a. The juice could have sat in the cup for longer than two hours, as much time as it takes for harmful bacteria to reach a population that could cause illness. Juice that was not kept cool enough was most likely the problem.

b. The illness was caused by something other than handling. Further investigation needs to occur before a probable cause can be determined at this time.

Time

One 30-minute session

10 minutes alternate days, two weeks

Three 50-minute sessions

Materials

- White bread without preservatives, two pieces per team
- Re-sealable plastic bags
- Thermometer
- Dark closet or shoebox with lid
- Hand lenses or microscopes
- Water
- Eye droppers
- Refrigerator access

California Standards

Common Core English Language Arts

Grade 5

W.5.7, 5.10

SL.5.5

Grade 6

W.6.7, 6.10

SL.6.5

RST.6.3, 6.7, 6.8, 6.9

WHST.6.2, 6.7, 6.8, 6.10

Grade 7

W.7.7, 7.10

SL.7.5

RST.7.3, 7.7, 7.8, 7.9

WHST.7.2, 7.7, 7.8, 7.10

Next Generation Science Standards

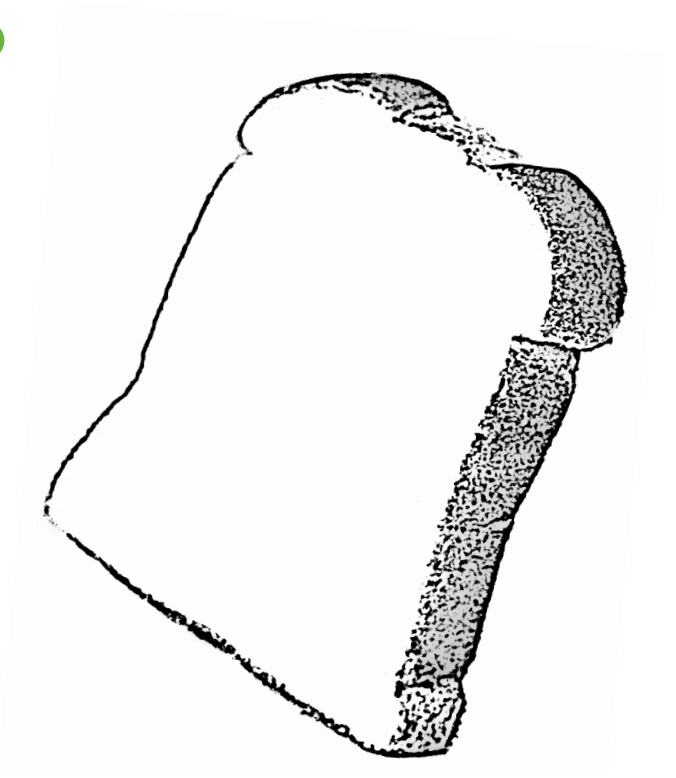
Grade 5

5-PS1-2

Grade 6-7

MS-LS1-5

SO... How Fast Will They Grow?



Description

Students, acting as scientists, will explore bacteria and fungi. They will design an experiment that will promote or minimize the bacterial and fungal growth on a piece of white bread.

Activity

1. Prior to this activity, students should understand what bacteria are and that most are beneficial. Those which cause illness are called pathogens. Review if necessary.
2. Show the students the supplies for an experiment they will design. The goal is to either promote or minimize bacterial/fungal growth on a piece of white bread over a two-week period.
3. Have the students design and complete their experiments, record observations every other day and, after two weeks, write a formal lab report using the guidelines provided.
4. Discuss what is needed for bacteria to grow and what might minimize their growth. Relate this to food preservation and safety.
5. Divide students into teams of three. Assign each group one method of food preservation — drying, freezing, canning, fermenting, smoking, salting, pasteurizing. Using books and on-line sources, they are to:

- Research their assigned form of food preservation
- Learn about its history
- Create a list of examples
- Find out how it is done today
- Create a poster with pictures and words that describes their food preservation process.

!

SAFETY NOTE:

The plastic bags which contain bread must be kept sealed and disposed of properly. Do not allow students to open the bags under any circumstances! Harmful microorganisms could be in the bag.

SO...

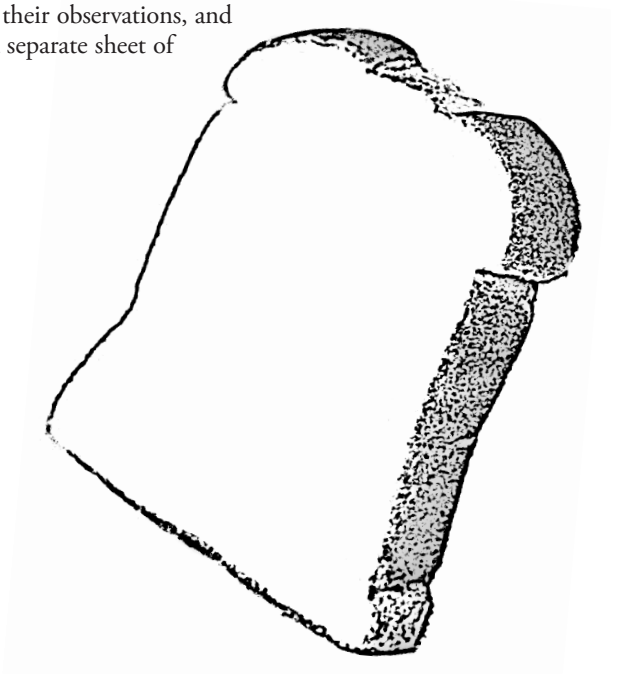
How Fast Will They Grow?

Introduction

Bacteria and fungi are all around us. They are responsible for many things. Most importantly, they decompose dead plants and animals and convert them into soil and nutrients that other living things can use. They are a part of all ecosystems. Some bacteria and fungi, however, can be harmful. These are called pathogens. It important for people to understand how to minimize the amount of pathogens so that the food they eat can be nutritious and safe.

You and your partner are to design an experiment that will encourage or discourage bacteria and fungi from growing on a piece of bread. Before you place it in the plastic bag, you may expose it to a doorknob, backpack, notebook, or even moisture or heat. Or, you may expose it to nothing other than the container it was in. You decide! Design your experiment, have your teacher approve your procedure, and then perform your experiment.

Remember, scientists always create hypotheses, list their procedures, record their observations, and write conclusions. So, as a scientist, you will complete all of these steps on a separate sheet of paper. Here is how your completed write-up should look.

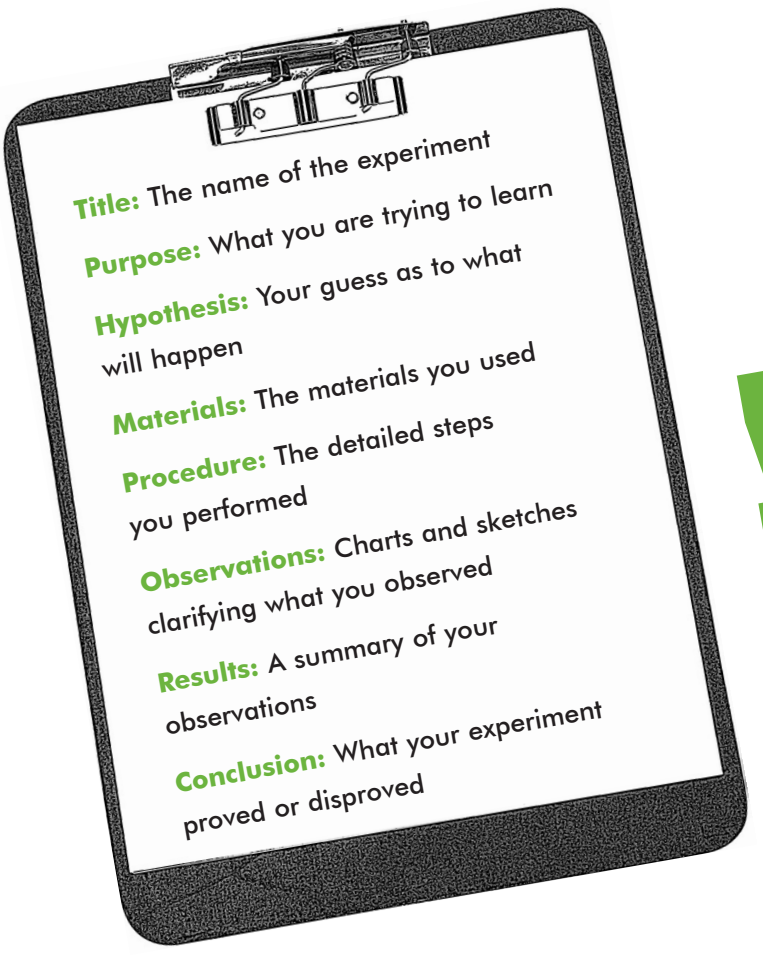


Think About It!

Do bacteria and fungi prefer light or dark places?

What about moisture?

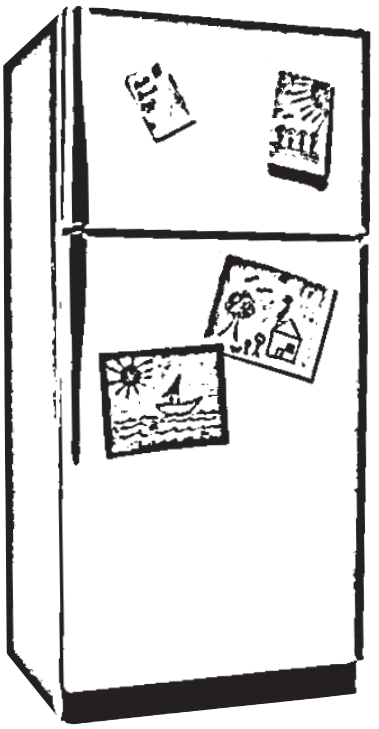
What about heat?



SAFETY NOTE:

Once you place your bread in the plastic bag and seal it, you may not open it under any circumstances. Some bacteria and fungi can be harmful. When finished with the experiment, give your bread, still in the sealed bag, to your teacher for proper disposal. You don't want to get a disease from a pathogen!

How Safe Is Your Kitchen?



Description

Restaurants and school kitchens are inspected each year by state health inspectors. They check to make sure that safe food preparation guidelines are in practice. Inspectors check equipment, storage facilities, and preparation areas.

Food safety should also be practiced at home. Choose a meal. Evaluate your kitchen during its preparation and clean-up by using the form below. Discuss your findings with your family.

Kitchen Inspection Evaluation

Inspector: (your name) _____

Date:_____ Time_____

Meal Inspected (circle one): Breakfast Lunch Dinner Snack

Clean

Food preparer washed hands with warm, soapy water before handling food.	Yes	No
Counter tops were cleaned before use.	Yes	No
Cutting board was cleaned after preparing **each** food item and before going on to the next food item.	Yes	No

Separate to Prevent Contamination

Raw meat, seafood, poultry and other foods were kept separate from each other in the refrigerator.	Yes	No
A separate cutting board was used for meat or the cutting board was washed before a different food item was prepared on it.	Yes	No
Knives and cooking utensils were washed immediately after they came in contact with raw meat or eggs.	Yes	No
Cooked meat was placed on a clean dish.	Yes	No
Raw egg shells were thrown away and any areas where raw eggs were used were washed with soapy water.	Yes	No

Cook to Proper Temperatures

Meat was cooked completely, and hot food was completely heated.	Yes	No

Chill: Refrigerate Promptly

Leftover food was placed in the refrigerator within two hours of preparation.	Yes	No
Food meant to be cold was served cold.	Yes	No

Total number of "Yes" answers: ___ X 10 = _____

Total number of "No" answers: ___ X 0 =_____

Total Score: _____

If your score was:

90-110: You are **"A"** safe cook

70-89: You need to **"B"** a little more aware of food safety procedures.

50-69: You need to **"C"** the food safety rules and use them!

below 50: Sorry, your kitchen has been **"D"**-stroyed by microorganisms!

WHAT'S YOUR GRADE?

Wash Up and Sing! Wash your hands thoroughly with warm, soapy water prior to preparing food. While washing, sing "Happy Birthday" to yourself. This will ensure you have washed your hands long enough to adequately remove dirt, grime and germs.

Be Careful Crossing the Meat! Wash hands, utensils, plates and cutting boards immediately after they have been in contact with raw meat, poultry, seafood or eggs and before they come in contact with any other food, especially fresh produce.

Microwave it! Microwave sponges and dishcloths on high for one minute to remove any harmful bacteria.

When in Doubt, Throw it Out! If you think something may be old or spoiled, throw it out! Follow the old adage: It's better to be safe than sorry—or home with a bad stomachache!

OTHER ACTIVITIES

1. Create flyers which encourage handwashing, proper food preparation and storage. Post in restrooms, lunchrooms and in areas where lunchboxes are stored.

2. Submit student-written editorials to your local newspaper on what the public can do to reduce foodborne illnesses.

3. Create a student-made refrigerator magnet that encourages proper food handling and storage.

4. Check your local public health department website and review inspection reports of your favorite local restaurants.

RESOURCES

Food Safety Music

Carl Winter, Ph.D. has combined his passion for music with his expertise in food toxicology to teach students and adults about food safety. Three CDs are available on a donation basis. Appropriate for all ages.

Carl Winter, Ph.D.
Food Science and Technology Department
University of California
One Shields Avenue
Davis, CA 95616-8598
Phone: (530) 752-2647
Fax: (530) 752-4759
E-mail: *ckwinter@ucdavis.edu*
Website: *foodsafe.ucdavis.edu*

Science and Our Food Supply—Investigating Food Safety From Farm to Table

Kit includes interactive video, comprehensive reference guide, career guide, and varied activities that can be incorporated into all curricula. Separate guides for middle school and high school science teachers.

National Science Teacher's Association

Website: *www.nsta.org/conferences/fda.aspx*

Your Game Plan for Food Safety: A Fight BAC!® Food Safety Education Program for 4th, 5th and 6th Grade Classrooms

This comprehensive program includes video, posters, experiments, activities, home survey, take-home BAC-Catchers, and a teacher's activity and experiment guide.

It is available free from the Fight BAC!® website. Grades K–3 and 9–12 curricula also available.

Fight BAC!®

Website: *www.fightbac.org*

LITERATURE

Capeci, Anne, Bruce Degen, John Spears and Joanna Cole. ***The Giant Germ.*** Scholastic, 2001.

Cobb, Vicki. ***Dirt & Grime, Like You've Never Seen.*** Scholastic, 1998.

Latta, Sara. ***Food Poisoning and Foodborne Diseases.*** Enslow Publishers, Inc., 1999.

Leavitt, Judith Walzer. ***Typhoid Mary.*** Beacon Press, 1997.

Satin, Morton. ***Food Alert!: The Ultimate Sourcebook for Food Safety.*** Checkmark Books, 1999.

Woods, Michael and Mary B. Woods. ***Ancient Agriculture.*** Runestone Press, 2000.

WEBSITES

Alliance for Food and Farming:
www.foodandfarming.info

California Department of Education:
www.cde.ca.gov

California Foundation for Agriculture in the Classroom:
www.LearnAboutAg.org

Centers for Disease Control:
www.cdc.gov

Fight BAC!®:
www.fightbac.org

Food Detectives Fight BAC!®:
www.fooddetectives.com

Food Safety Information and Inspection Service:
www.fsis.usda.gov/food_safety_education

FoodSafe:
foodsafe.ucdavis.edu

Gateway to Government Food Safety Information:
www.foodsafety.gov

MicrobeWorld:
www.microbeworld.org

LearnAboutAg®
California Foundation for Agriculture in the Classroom

For additional educational resources, contact CFAITC
2600 River Plaza Drive, Suite 220
Sacramento, CA 95833
(800) 700-AITC (2482)
www.LearnAboutAg.org

California Foundation for Agriculture in the Classroom (CFAITC) is a non-profit, 501(c)(3) organization dedicated to spreading awareness of agricultural literacy and an appreciation for the safe, fresh and abundant agricultural products we are fortunate to enjoy in California. The Foundation provides educators with free and low cost teacher-tested and standards-based resources.

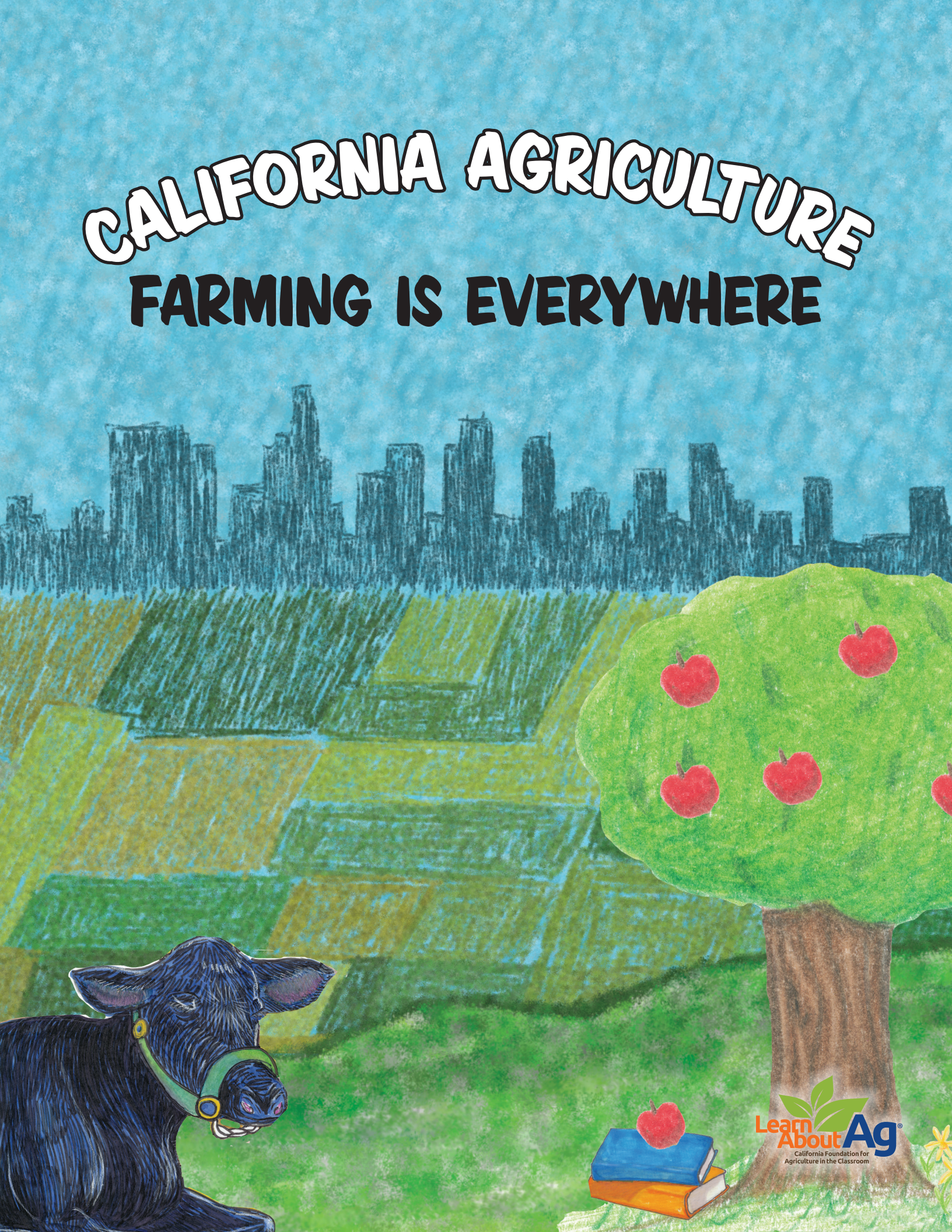
CALIFORNIA BEEF COUNCIL

cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

ALLIANCE FOR FOOD & FARMING
Your information source on food safety and farming

CALIFORNIA AGRICULTURE

FARMING IS EVERYWHERE



Learn About Ag®
California Foundation for Agriculture in the Classroom

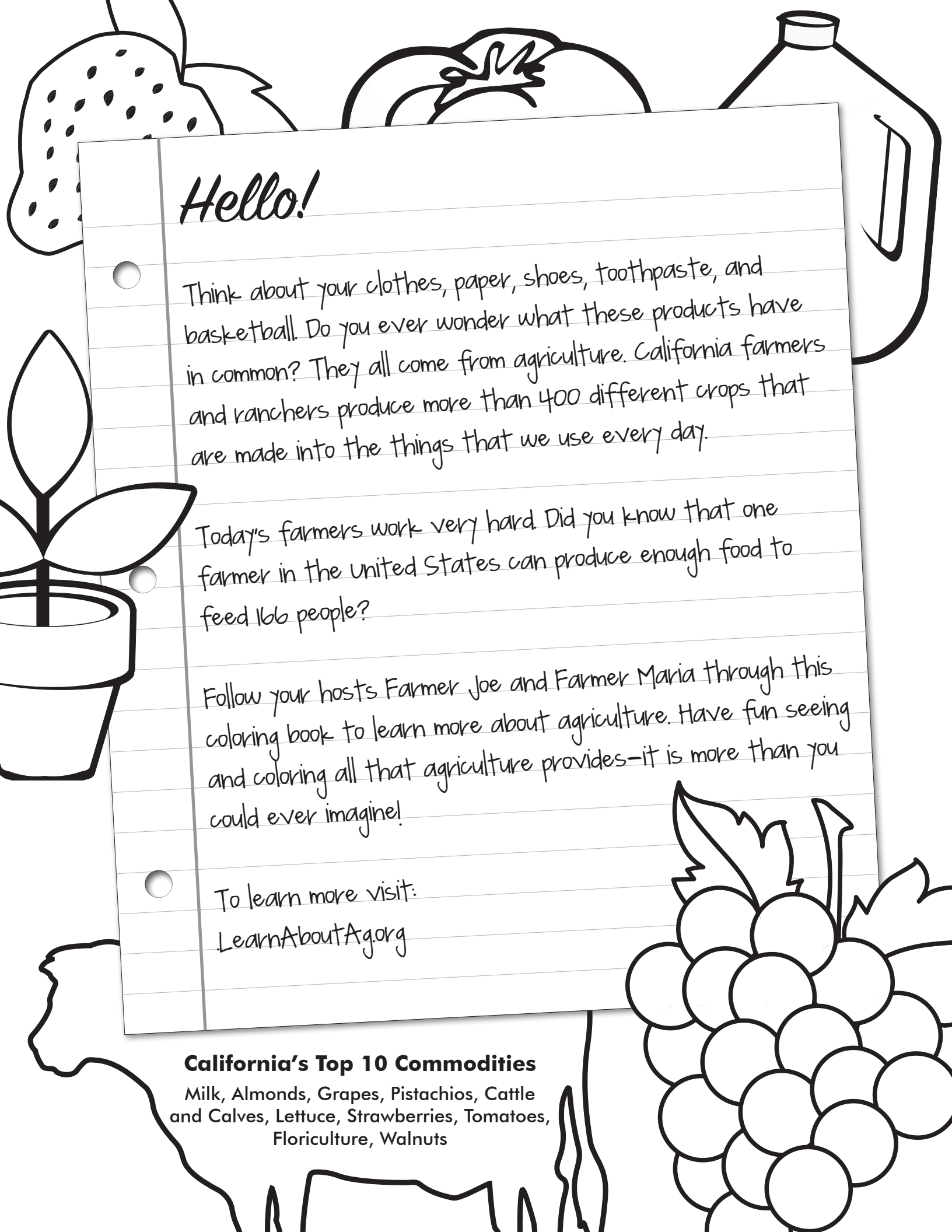
Hello!

Think about your clothes, paper, shoes, toothpaste, and basketball. Do you ever wonder what these products have in common? They all come from agriculture. California farmers and ranchers produce more than 400 different crops that are made into the things that we use every day.

Today's farmers work very hard. Did you know that one farmer in the United States can produce enough food to feed 166 people?

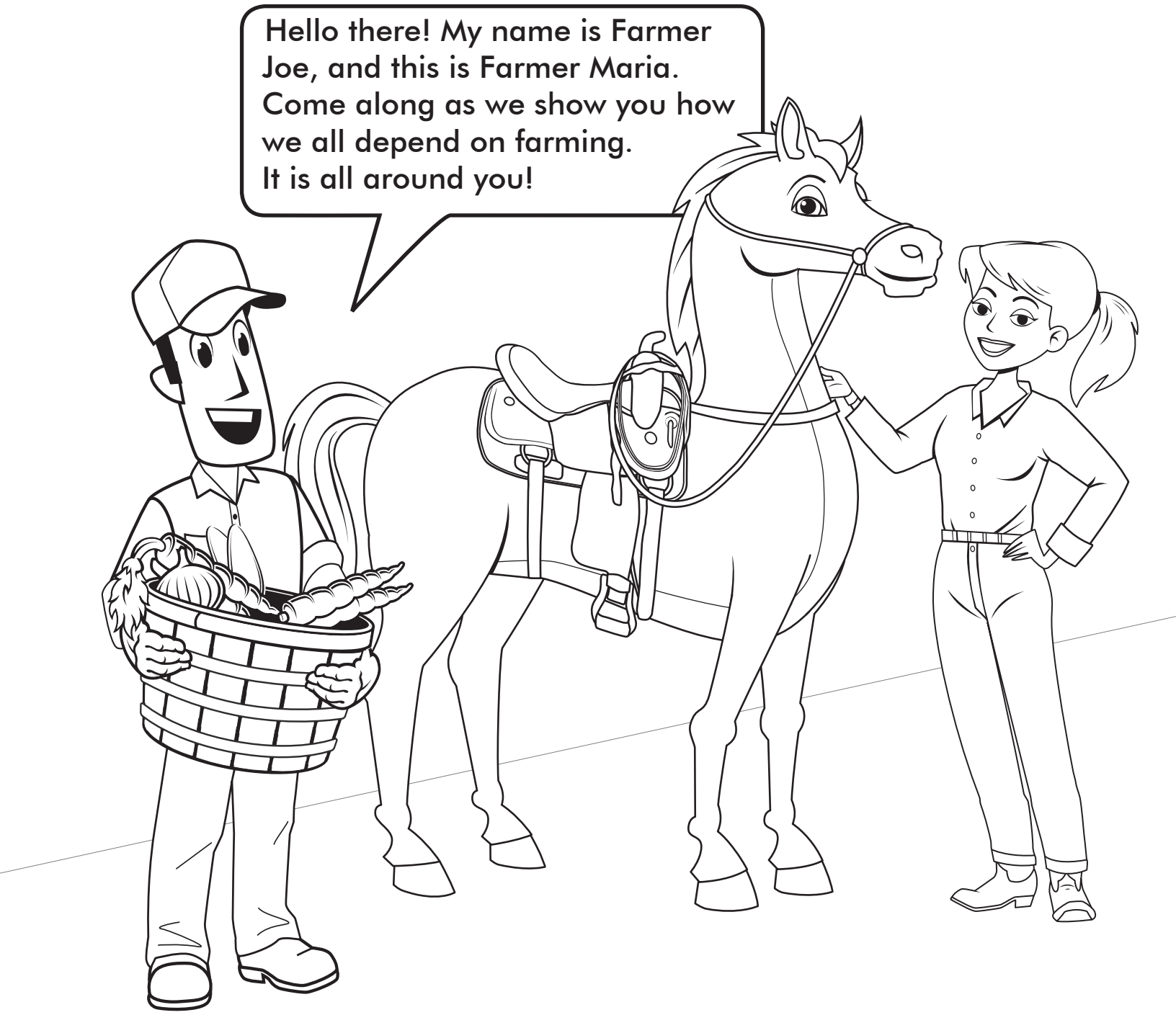
Follow your hosts Farmer Joe and Farmer Maria through this coloring book to learn more about agriculture. Have fun seeing and coloring all that agriculture provides–it is more than you could ever imagine!

To learn more visit:
LearnAboutAg.org



California's Top 10 Commodities

Milk, Almonds, Grapes, Pistachios, Cattle and Calves, Lettuce, Strawberries, Tomatoes, Floriculture, Walnuts



Here is an easy way to remember what agriculture is:

The Five F's

FOOD

FIBER

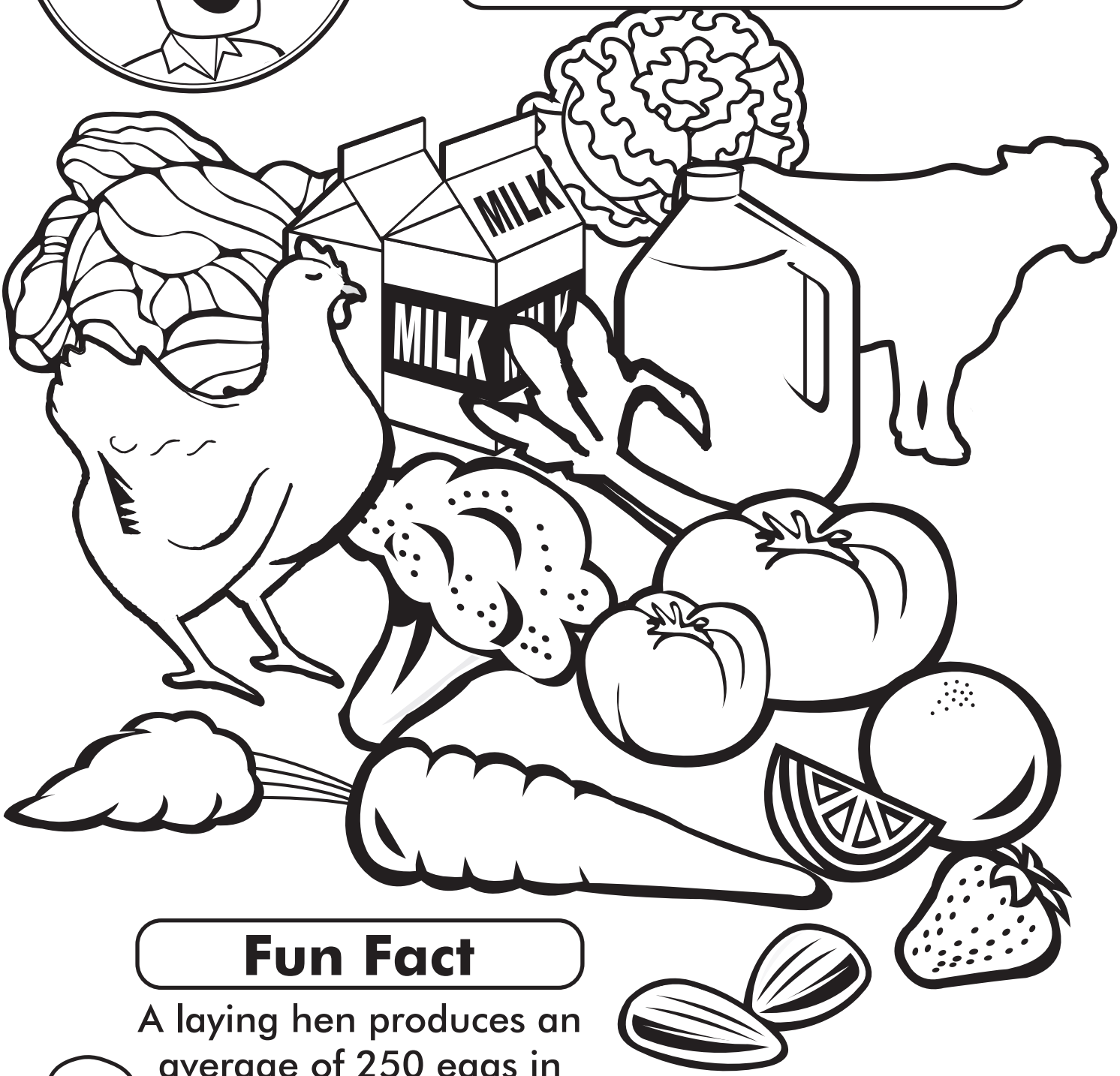
FUEL

FORESTS

FLOWERS

FOOD

Farmers and ranchers grow many different kinds of **FOOD**... from the strawberries growing in fields to the hamburger on your dinner plate.

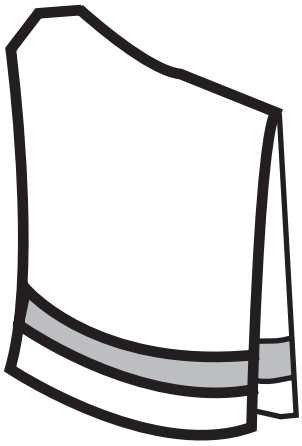


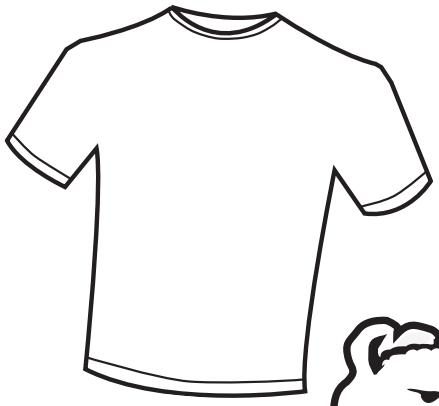
Fun Fact

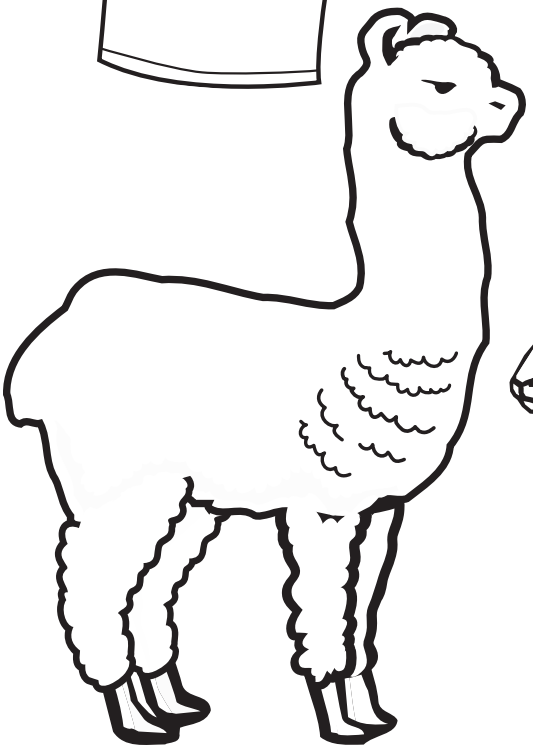
A laying hen produces an average of 250 eggs in one year.

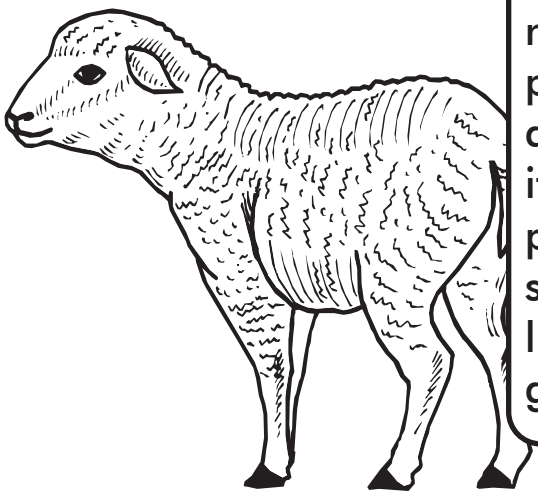
FIBER

Cotton from plants and wool from animals are types of textile fiber. Many products that we use every day are made from **FIBER**.









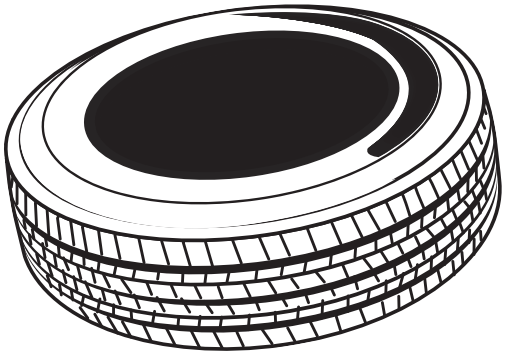
Cotton plants are used to make clothing such as jeans and household items such as towels.

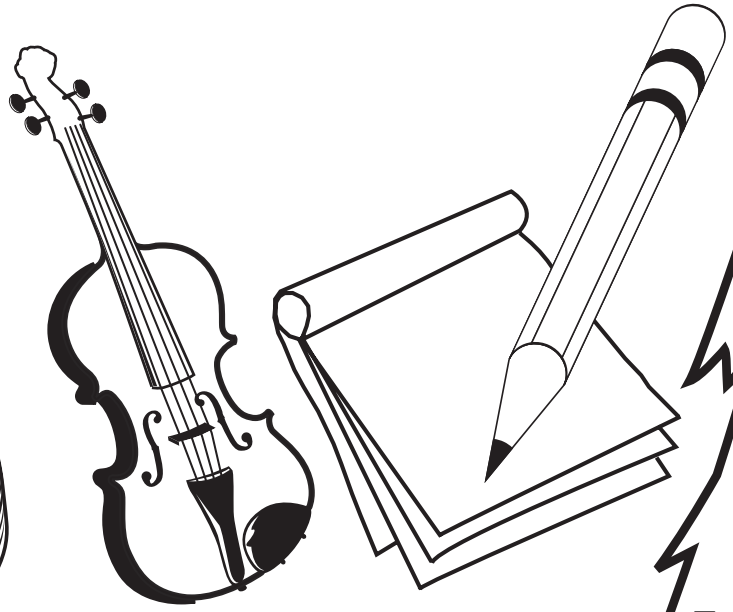
Another plant that is used to produce fiber is flax which is used to make linen.

Some animal fur can be used to make textiles for the production of clothes and other household items. Animals that produce fiber include sheep, alpacas, llamas, and some goats.

FORESTS

Trees from **FORESTS** are used to make more than 5,000 products that we use everyday.





Trees are used to make:

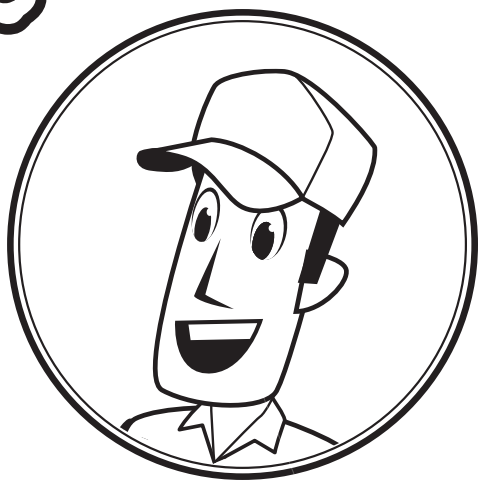
Paper
Pencils
Wood
Cardboard boxes
Maple syrup
Firewood
Laundry soap
Tires
Cosmetics
Postage stamps
Baseball bats
Musical instruments
Toothpaste
Nail polish
Chewing gum

Fun Fact

California forests are home to more than 4,000 native plants and 650 wildlife animals.

FLOWERS

FLOWERS are a big part of California agriculture. Cut flowers, fruit trees, nursery plants, and house plants are all a part of agriculture.



Fun Fact

Mother's Day and Valentine's Day are very popular days to buy flowers.

FUEL

FUEL can be used to make energy. There are many uses for energy on the farm. Cow manure can be made into **FUEL** that can heat or cool buildings, or provide lighting and electricity. Corn can be made into ethanol, which is used to fuel cars, trucks and tractors.

Now that you have learned the meaning of **THE FIVE F'S**, it is time to review.

Activity

Match the product with the related "F."

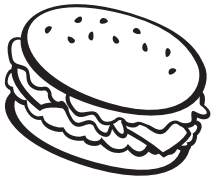
FIBER

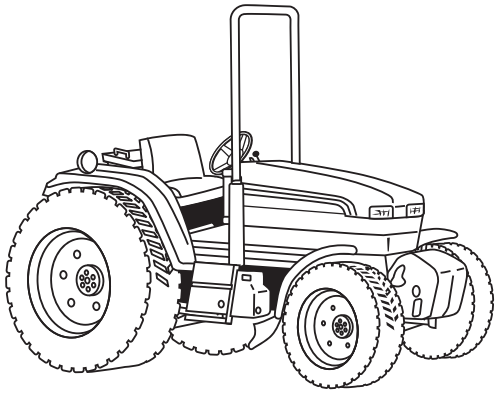
FORESTS

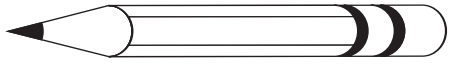
FOOD

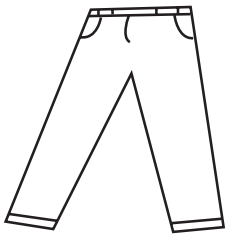
FLOWERS

FUEL









THERE'S A FARM IN MY PIZZA?

Follow the trail of how pizza is made, from the farm to the parlor.

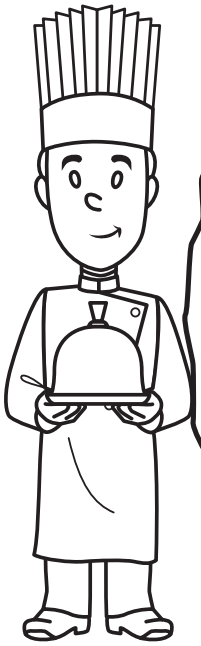
It all starts on the farm. **FARMERS** grow wheat, tomatoes, olives and vegetables. They raise dairy cows for milk and pigs for meat.

FARM WORKERS spend time growing and harvesting our food.

TRUCK DRIVERS transport the products to be processed.

WORKERS turn some products into the food people eat.

- Wheat is milled into flour for the crust.
- Tomatoes are cooked into sauce.
- Milk is made into cheese.
- Olives and vegetables are prepared and packaged.
- Sausage comes from pigs.



CHEFS cook the pizza—just the way you like it!

Color this pizza with your favorite toppings!

FARMERS MARKETS

FARMERS MARKETS have existed since we began farming 10,000 years ago. Historically, when families produced more food than they needed, they would meet in the town square to sell or trade their excess commodities. Farmers Markets became a traditional way of selling local agricultural products.

How many items can you find that would be sold at a Farmers Market?

S	T	U	N	L	A	W	P	U	S	S	T	D	J	T
C	E	L	M	S	S	E	M	G	B	E	Y	G	R	R
Q	P	T	L	H	A	I	K	V	S	K	V	X	L	K
T	O	J	A	C	A	B	N	O	E	O	D	I	K	F
F	R	A	H	N	S	A	I	D	T	H	I	D	L	S
H	N	E	T	M	A	H	I	J	A	C	U	T	G	O
R	S	Z	U	U	C	R	H	D	D	I	F	I	G	S
F	I	L	Z	A	L	A	G	T	G	T	E	R	C	P
Q	P	C	T	M	A	H	L	E	G	R	R	A	K	M
C	M	S	E	J	U	V	I	M	M	A	W	I	K	Z
K	I	W	I	F	R	U	I	T	O	O	J	S	X	J
P	A	M	W	Q	C	B	E	Z	O	N	P	I	J	E
K	F	S	G	T	L	Q	J	M	Q	D	D	N	K	R
G	U	I	P	O	G	H	Y	Y	T	W	A	S	O	O
V	O	A	K	Z	D	I	T	K	T	G	W	Q	R	V

Word Bag

ALMONDS
ARTICHOKES
DATES
FIGS
KIWIFRUIT
OLIVES
PEACHES
PISTACHIOS
PLUMS
POMEGRANATES
RAISINS
RICE
WALNUTS

FARMING IS EVERYWHERE

Top 3 Crops by County

Alameda Grapes, Cattle & Calves, Fruits & Nuts

Alpine Pasture, Cattle & Calves, Hay

Amador Grapes, Cattle & Calves, Pasture

Butte Rice, Almonds, Walnuts

Calaveras Cattle & Calves, Poultry, Grapes

Colusa Almonds, Rice, Walnuts

Contra Costa Cattle & Calves, Corn, Tomatoes

Del Norte Milk, Cattle, Nursery

El Dorado Apples, Forest Products, Grapes

Fresno Almonds, Pistachios, Poultry

Glenn Almonds, Rice, Walnuts

Humboldt Milk, Nursery Products, Cattle & Calves

Imperial Cattle, Vegetables, Hay

Inyo Cattle & Calves, Nursery Products, Hay

Kern Grapes, Almonds, Pistachios

Kings Milk, Pistachios, Cattle & Calves

Lake Grapes, Pears, Livestock

Lassen Hay, Alfalfa Hay, Vegetables

Los Angeles Nursery, Field Crops, Apiary

Madera Almonds, Milk, Pistachios

Marin Milk, Poultry, Cattle & Calves

Mariposa Cattle & Calves, Pasture, Livestock

Mendocino Grapes, Forest Products, Cattle & Calves

Merced Milk, Almonds, Chickens

Modoc Cattle & Calves, Hay, Potatoes

Mono Hay, Cattle & Calves, Sheep & Lambs

Monterey Strawberries, Lettuce, Broccoli

Napa Grapes, Cattle & Calves, Livestock Products

Nevada Cattle & Calves, Vegetables, Grapes

Orange Nursery, Fruits & Nuts, Vegetables

Placer Rice, Cattle & Calves, Walnuts

Plumas Forest Products, Hemp, Cattle

Riverside Nursery, Milk, Hay

Sacramento Grapes, Milk, Poultry

San Benito Vegetables, Salad Greens, Grapes

San Bernardino Milk, Eggs & Chickens, Cattle & Calves

San Diego Nursery, Flowering & Foliage Plants, Vegetables

San Francisco Field Crops and Apiary Products

San Joaquin Almonds, Milk, Grapes

San Luis Obispo Strawberries, Grapes, Vegetables

San Mateo Nursery Plants, Vegetables, Nursery Products

Santa Barbara Strawberries, Cauliflower, Broccoli

Santa Clara Mushrooms, Nursery, Vegetables

Santa Cruz Strawberries, Raspberries, Nursery Products

Shasta Forest Products, Hay, Cattle

Sierra Forest Products, Cattle, Hay

Siskiyou Nursery Plants, Hay, Forest Products

Solano Vegetables, Almonds, Tomatoes

Sonoma Grapes, Milk, Livestock

Stanislaus Almonds, Milk, Chickens

Sutter Rice, Walnuts, Peaches

Tehama Walnuts, Almonds, Olives

Trinity Cattle & Calves, Pasture, Grapes

Tulare Milk, Oranges, Cattle & Calves

Tuolumne Livestock, Pasture, Forest Products

Ventura Strawberries, Lemons, Avocados

Yolo Tomatoes, Grapes, Almonds

Yuba Rice, Walnuts, Livestock

Circle the county you live in and identify the top crops.

2020-21 statistics information obtained from California Agricultural Statistics Review.

2600 River Plaza Drive, Suite 220, Sacramento, CA 95833-3377 • info@learnaboutag.org • **LearnAboutAg.org**

Source Search (Grades 6-8)

Grade Levels

6-8

Purpose

In this lesson students will learn that agriculture provides nearly all of the products we rely on in any given day by participating in a relay where they match an everyday item with its "source."

Estimated Time

30 minutes

Materials Needed

- Glue
- Colored index cards or card stock in 2 different colors (for mounting product pictures)
- *Source Search Pictures,* 1 copy*
- Four boxes labeled "Stores," "Factories," "Farms," and "Natural Resources"*
- *Source Search Item Reference List,* 1 copy for the teacher*

*These items are included in the Source Search Kit (https:/ / agclassroomstore.com/source-search/), which is available for purchase from agclassroomstore .com

Essential Files (maps, charts, pictures, or documents)

- Source Search Item Reference List (https://cdn.agclassroom.org/media/uploads/2017/10/17/Source_Search_Item_Reference_List_l.pdf)
- Source Search Pictures (https://cdn.agclassroom.org/media/uploads/2020/09/03/source_search_2_1.pdf)

Vocabulary Words

agriculture: the science or practice of farming, including cultivation of the soil for the growing of crops and the rearing of animals to provide food, wool, and other products

mineral: a solid inorganic substance of natural occurrence obtained from mining

natural resources: materials or substances such as minerals, forests, water, and fertile land that occur in nature and can be used for economic gain

source: a place, person, or thing from which something originates

Did You Know? (Ag Facts)

- Fiber is the word farmers and ranchers use to describe the raw product for fabric. The two most important farm-produced fibers are wool and cotton.
- More than 24 million American workers (17 percent of the total U.S. work force), process and sell the nation's food and fiber.
- About 18 percent of all U.S. agricultural products are exported yearly.
- Mason jars were invented in 1858, for home canning purposes.

Background Agricultural Connections

If you were to take a moment to look around and identify the items you rely on every day they would likely include food, clothing, modes of transportation such as a car or bike, building materials such as steel and wood, various technological devices such as cell phones or computers, and several tools or machines. Where did these items and the raw products used to makethem originate? This lesson helps students answer that question.

Many people might recognize that farms provide us with whole, raw foods like fruits, vegetables, milk, meat, and eggs. They

may even recognize that foods such as bread, pasta, cheese, frozen chicken nuggets, and canned foods also come from a farm, but are first prepared and packaged at a food processing facility. However, in reality, **agriculture** also provides us with a wide variety of raw materials used to make clothes, books, cosmetics, medicines, sports equipment, and much more.

Everything we make and use in society can originally be found somewhere in our environment or it is produced on farms by using **natural resources** such as land and water. Resources such as metal and glass are made from **minerals** that are extractedfrom the earth through the process of mining. Most plastics are a byproduct of oil which is extracted from beneath the Earth's surface. Other items we rely on from day to day are a product of agriculture. Farms exist in numerous sizes and various locations and include many different products ranging from food and clothing to fuel and building supplies.

While many day-to-day items were built, processed, or manufactured at a factory and eventually sold at a store, it is important for students to understand that they each began as a resource of the natural world and/or a product of agriculture.

Interest Approach - Engagement

This lesson has been adapted for online instruction and can be found on the 6-Bth grade eLearning site(https://agclassroom.org/ eLearning/ grade3/).

1. Ask students what they did to get ready for school. Make a list of the common items used and foods eaten by the students in preparation for school each morning. Write the list on the board.
2. Once the list has been made, choose several random items and ask the students where or how that item was originally created. For example, where was the food they ate for breakfast produced? What was used to make the car that drove them to school? Allow students to offer their prior knowledge as you discuss these items.
3. Inform students that they will be participating in an activity to learn about the sources of many day-to-day items.

Procedures

Preparation

1. Print and cut out the attached *Source Search Pictures* showing 40 everyday items.
   - Optional: If you prefer to get your students involved in the preparation stage (and have time), have students gather their own pictures of everyday items. Gather a variety of magazines or slick ads from the Sunday newspaper and instruct your students to cut out pictures that represent items they use regularly (food, cars, soap, clothes, computers, etc.) Avoiding duplication, select 40.
2. Randomly divide the 40 pictures into two groups. Use two colors of index cards (or card stock) and glue the pictures onto the cards. Laminate the pictures for future use.
3. Obtain four containers (boxes, plastic tubs, paper box lids, or paper grocery bags) and label each with one of the following: *"Stores," "Factories," "Farms,"* and *"Natural Resources."*
4. Identify a suitable location for a relay race such as an area outside, a wide hallway, or the gymnasium.

Activity

1. Divide the class into two teams. Divide the laminated pictures by color. You should have 20 pictures in each pile. If you areusing red and blue index cards, you will have a red and blue team.
2. Take the students to the location of the relay race and place each team in a single file line. Be sure to have all the picturesface down in front of the first person in each line. Locate the tubs 20-50 feet away from the lines.
3. Give students the following instructions: "This is the source relay. Your job is to place each card in the tub representing the *original* source of the everyday item that is pictured. When you are at the front of the line, pick up a card, look at the picture, then run to and place the picture in the correct tub based on the product's "source"- either *"Stores," "Factories,"*
   "Natural Resources," or *" Farms ."* Keep in mind that you are looking at the product, not the packaging. The next person in line goes when the person in front of them returns and crosses over the start line or hand-tags them. The returning player should go to the end of the line."
   - **Optional Alternative:** Rather than a relay race, you can also play the Source Search Kahoot (https://create.kahoot.it/share/source-search/45ca298b-4e91-4f45-9a9c-3441lf12bd6e) game or Source Search Quizziz (https://quizizz.com/ admin/quiz/5eb407b557lace00lcb36e8e).
4. Ask students if they have any questions and clarify as needed. Begin the relay race and continue until all of the pictures have been sorted. The first team to finish the sort wins temporarily, but the ultimate winner will be determined by accuracy.

5. After the relay is over and the pictures are sorted, return to the classroom or have the students gather around you in a suitable location to go through the cards and discuss the correct answers. As you hold up each picture, the students can show whether they agree or disagree with the sort using the "thumbs up" or "thumbs down" signal, or another response as chosen. Use the attached Source Search Items Reference List (https:/ / cdn.ag classroom.org/ media/uploads/ 2017/ 10/ 09/ Source_Search_ It em_Reference_List .pdf) for the correct answers and explanations for each card. If you choose to keep score to identify a winner, have a student keep a tally for each team of the cards placed in the correct box.
   - **Farms:** Explain that if the item contains ingredients or raw products from a farm, the item is in the correct box. Examples would be any food items such as cereal, cookies, and milk, or any clothing item made from a natural fiber such as cotton (jeans) or wool (coat). Some items from a farm that are not eaten or worn include paint (this contains linseed or soybean oil) or fuel such as ethanol.
     - Note: After most relays, the *"Farms"* container will typically have only a few items in it.
   - **Natural Resources:** Explain that items in this tub should be products we get from the ocean, from plants or animals that occur naturally without management from humans, or from mining. Examples of items that should be in this box are: fish or shrimp (wild; however, note that fish and shrimp can also be farmed), cars, salt, water, plastic (plastic starts as oil, which is mined), synthetic fabrics (polyester, petroleum or oil products), computers, cell phones, and any metallic items. Wood products may be in this box, but many wood products come from timber grown on farms. Let the class decide how to divide these. You might decide to "split the difference;" put one (the fish) into the *"Farms"* box and the wood into the *"Natural Resources"* box. Remind your students that this is the "source" search. What is the "real" source of the things weuse every day? Nearly all are grown or mined - farmed or extracted from the natural world.
     - Note: This tub is also likely to only have a few items inside.
   - **Factories:** Explain that a factory is a place where raw ingredients are changed into the useful items we need or want; wood into furniture, ore into steel for cars, wheat into bread, and potatoes into chips. A factory assembles items to later be sold in a distribution center or store. With this information ask students, "Are there any items that can originally be sourced to a factory?" *(No.)* Proceed by sorting every card in the *"Factories"* box into either the *"Farms"* or *"Natural Resources"* container. After doing this, your students should understand that all originally sourced products have either been grown or mined.
   - **Stores:** Move to the box labeled "Stores." After receiving the explanation about factories, check for understanding by asking, "What type of things can be sourced to a store?" Students should realize that, like the *"Factories"* container, nothing should be in the *"Stores"* container; this is just where we purchase the items, it is not their original source. Clarify that factories and stores rely on raw ingredients from the farm and natural world. Every picture or product should now be in either the *"Farms"* or *"Natural Resources"* container.
6. To increase the level of understanding, ask students, "What natural resources do farms need in order to produce the products used to make all of these items?" *(Soil, water, light, and air are natural resources that farmers rely on.)* To illustrate, place the *"Farms"* box inside the *"Natural Resources"* box.

Concept Elaboration and Evaluation

After conducting this activity, consider repeating the relay a second time using only two containers, *"Farms"* and *"Natural Resources"* to assess student understanding.

Review and summarize the following key concepts:

- Natural resources are materials or substances that occur on or in the earth natura lly.
- Natural resources such as water and land are used by farmers to grow crops and raise livestock which can provide us with food, fiber, fuel, and shelter.
- Natural resources such as minerals mined from the earth or petroleum fuels mined from below the earth's surface are used tomake glass, metal, and some plastics.
- We depend on natural resources for the items we rely on day-to-day. They should be used and managed wisely.
- Processing and manufacturing raw goods from farms or natural resources into food, tools, machines, and other itemsincreases their value.

We welcome your feedback (https://usu.col.qualtrics.com/jfe/form/SV_4HhIVpN4L8IC2IT)! Please take a minute to tell us how to make this lesson better or to give us a few gold stars!

Enriching Activities

- Ask students to research some ways to conserve or manage our natural resources, including farms, and share their findings with the class.
- Ask your students to create a concept web with one of the pictures used in the "Source Search" activit y. Each picture should be placed in the center of a piece of large paper and the web drawn to identify associations or links to careers, natural resources or other products.

Sources

Activity adapted from Project Season, by Deborah Parrella.

Suggested Companion Resources

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Author

Debra Spielmaker

Organization Affiliation

Utah Agriculture in the Classroom

Source Search (Grades 6-8)

Grade Levels

6-8

Purpose

In this lesson students will learn that agriculture provides nearly all of the products we rely on in any given day by participating in a relay where they match an everyday item with its "source."

Estimated Time

30 minutes

Materials Needed

- Glue
- Colored index cards or card stock in 2 different colors (for mounting product pictures)
- *Source Search Pictures,* 1 copy*
- Four boxes labeled "Stores," "Factories," "Farms," and "Natural Resources"*
- *Source Search Item Reference List,* 1 copy for the teacher*

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Vocabulary Words

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natural resources: materials or substances such as minerals, forests, water, and fertile land that occur in nature and can be used for economic gain

source: a place, person, or thing from which something originates

Did You Know? (Ag Facts)

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Preparation

1. Print and cut out the attached *Source Search Pictures* showing 40 everyday items.
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6. To increase the level of understanding, ask students, "What natural resources do farms need in order to produce the products used to make all of these items?" *(Soil, water, light, and air are natural resources that farmers rely on.)* To illustrate, place the *"Farms"* box inside the *"Natural Resources"* box.

Concept Elaboration and Evaluation

After conducting this activity, consider repeating the relay a second time using only two containers, *"Farms"* and *"Natural Resources"* to assess student understanding.

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Enriching Activities

- Ask students to research some ways to conserve or manage our natural resources, including farms, and share their findings with the class.
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Author

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Utah Agriculture in the Classroom

USDA ChooseMyPlate.gov
United States Department of Agriculture

Food labels tell you the nutritional content of a food item. You can compare two different items by using the Nutrition Facts label to choose the healthier option.

Nutrition Facts
Serving Size 1 CUP (237mL)
Servings Per Container 2

Amount Per Serving	
Calories 160	Calories from Fat 35
	%Daily Value*
Total Fat 4g	**6%**
Saturated Fat 0.5g	**3%**
Sodium 680mg	**28%**
Total Carbohydrate 24g	**8%**
Dietary Fiber 8g	**32%**
Sugars 5g	
Protein 7g	
Vitamin A 45% •	Vitamin C 20%
Calcium 6% •	Iron 15%

Not a significant source of *trans* fat, cholesterol.
* Percent Daily Values are based on a 2,000 calorie diet.

Nutrition Facts
Serving Size 1 CUP (237mL)
Servings Per Container 2

Amount Per Serving	
Calories 160	Calories from Fat 35
	%Daily Value*
Total Fat 4g	**6%**
Saturated Fat 0.5g	**3%**
Sodium 340mg	**14%**
Total Carbohydrate 24g	**8%**
Dietary Fiber 8g	**32%**
Sugars 5g	
Protein 7g	
Vitamin A 45% •	Vitamin C 20%
Calcium 6% •	Iron 15%

Not a significant source of *trans* fat, cholesterol.
* Percent Daily Values are based on a 2,000 calorie diet.

Use the Nutrition Facts label to compare food choices. The example above shows two soup options. The Nutrition Facts labels show us that the reduced-sodium vegetable soup has less sodium per serving than the original vegetable soup -- in this case half the amount. This makes the reduced-sodium vegetable soup the healthier choice, as long as the serving sizes are about the same size.

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All Forms Count!

Fruits and vegetables come in many different forms.
Fresh, frozen, canned, dried
– even 100% juice.
They're all good for you!

Put a check mark (✓) next to each form you find for the fruits and veggies listed:

	Fresh	Canned	Frozen	Dried	100% Juice
Carrots	☐	☐	☐	☐	☐
Oranges	☐	☐	☐	☐	☐
Corn	☐	☐	☐	☐	☐
Apples	☐	☐	☐	☐	☐
Spinach	☐	☐	☐	☐	☐
Apricots	☐	☐	☐	☐	☐
Bananas	☐	☐	☐	☐	☐
Cranberries	☐	☐	☐	☐	☐
Grapes	☐	☐	☐	☐	☐
Strawberries	☐	☐	☐	☐	☐
Pineapples	☐	☐	☐	☐	☐

Were you able to find any fruits or vegetables in all 5 forms?
Name them here: _

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Eat Your Colors Everyday!

It's important to eat a variety of colorful fruits and vegetables every day.
See if you can find 5 different fruits and vegetables in each of these colors.
Write your answer in the space provided.

Colors	Fruits and Veggies
Red	1._____ 2._____ 3._____ 4._____ 5._____
Blue/Purple	1._____ 2._____ 3._____ 4._____ 5._____
Yellow/Orange	1._____ 2._____ 3._____ 4._____ 5._____
Green	1._____ 2._____ 3._____ 4._____ 5._____
White	1._____ 2._____ 3._____ 4._____ 5._____

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I'm Stuck on Fruits & Veggies

Collect the PLU stickers from each piece of fruit or veggie you eat at home.
Place them on a space on this card.
(You can tape the sticker to the card, if needed.)

When your card is full,
give it to Mom and Dad for a special treat,
then begin another card!

Eat a colorful variety of fruits and veggies from all 5 color groups every day to stay healthy and fit!