Milk Matters! Discovering Dairy

Grades 4-6

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California Foundation for Agriculture in the Classroom

Vision: An appreciation of agriculture by all.

Mission: To increase awareness and understanding of agriculture among California's educators and students.

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The California Foundation for Agriculture in the Classroom is dedicated to fostering a greater public knowledge of the agricultural industry. The Foundation works with K-12 teachers, community leaders, media representatives and government executives to enhance education using agricultural examples, helping young people acquire the knowledge needed to make informed choices.

This unit was funded in 2008 by the California Milk Advisory Board and the California Farm Bureau. To meet the needs of California educators, *Milk Matters: Discovering Dairy* was updated in 2021 to meet Common Core and Next Generation Science Standards. The unit also includes a collection of relevant resources about the dairy industry.

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Introduction

The framework for California public schools emphasizes the need to make education meaningful to students so they can apply what they learn in the classroom to their daily lives. Since all students eat food and wear clothing, one natural connection between academic education and the real world is agriculture. Advancements in agriculture technology are continually making headlines and are an excellent way for educators to connect current trends and innovations to the lives of every student.

Agriculture is an important industry in the United States, especially in California. As more rural areas become increasingly urbanized and challenges continue to arise in the face of a growing global population and limited resources, it is extremely important to educate students about their environment, agriculture and the current technologies and research that continue to make Earth a viable and productive planet.

Milk Matters: Discovering Dairy, designed for use in fourth through sixth grade classrooms, introduces students to the history, production, nutritional value and economic significance of California's dairy industry. Students will study dairy breeds and their connection to world geography, enhance their math skills by engaging in common math challenges found on a dairy farm, and investigate the scientific process of energy transfer that takes place as we consume milk on a daily basis. They will also practice evaluating data tables and graphing as they identify the tremendous economic impact the industry has on our state's economy. A simple activity illustrating the ecological significance of dairy cattle will help students understand the dairy industry's important role in reducing, reusing and recycling. This activity-based unit incorporates cooperative learning, reading comprehension, physical education, mathematics, science, social sciences and art. Together, these activities provide a comprehensive unit that stimulates learning, retention and creative thinking. Individually, these activities can be performed in any order to meet the needs of your students.

This unit teaches subject matter addressed by today's relevant content standards, including Content Standards for California Public Schools, Next Generation Science Standards, and Common Core State Standards. The standards, located on the sidebar of each lesson, specify grade level, subject matter and standard number. A content standard matrix for the entire unit, with specific standards described, is located on pages 46-51. *Milk Matters: Discovering Dairy* is one of many educational units developed and distributed by California Foundation

Unit Overview

Unit Length

Approximately ten 45-minute sessions.

Objectives

The students will:

- Differentiate between different dairy breeds.
- Create a map to illustrate the origin of five popular dairy breeds.
- Investigate the transfer of energy in the process of making milk.
- Demonstrate how energy can be lost during energy transfer.
- Identify the many ways humans and cows use energy.
- Practice realistic math problems found in the dairy industry.
- Discover the various career opportunities within the dairy industry.
- Examine dairy cattle's role in conserving natural resources.
- Create, read and interpret graphs related to dairy's economic impact.
- Explore the economic consequences of a day without dairy.

for Agriculture in the Classroom.

Brief Description

This unit contains five lessons designed to teach students about the history, production, nutritional value and economic significance of California's dairy industry. Students will gain knowledge in social science, mathematics, language arts, science, visual arts and physical education as they learn about the process through which dairy products are produced and transported from cow to consumer. Students will gain a deeper understanding and appreciation for agriculture's role in their daily lives.

The lessons can be used individually or together and taught in any order. To fully address the concepts, however, teaching the unit in its entirety is recommended.

Standards

A concerted effort to improve student achievement in all areas has impacted education nationwide. The California Foundation for Agriculture in the Classroom provides educators with numerous resource materials and lessons that can be used to teach and reinforce the current education standards for California Public Schools including Common Core State Standards. The lessons encourage students to think for themselves, ask questions and learn problem-solving skills while learning the specific content needed to better understand the world in which they live.

This unit, *Milk Matters: Discovering Dairy*, includes lessons that can be used to teach or reinforce many of the educational standards for students in grades four through six. It can be used as a self-contained unit, to enhance themes and lessons already in use, or to provide technical information about the dairy industry and agriculture.

The specific educational standards met are listed on the sidebars of each lesson. A matrix chart showing how the entire unit is aligned with the current standards including Common Core State Standards and Next Generation Science Standards is included on pages 46-51.

Unit Overview

Key Vocabulary

A glossary of terms is located on pages 54-56.

Accountant
Almond hulls
Breed
By-product
Cattle
Chemical energy
Compost
Country of origin
Cow
Dairy farmer
Dairy nutritionist
Decomposer
Demand
Domestication
Economist
Ecosystem
Electrical energy
Energy
Expense
Hay
Kinetic energy
Lactose
Macroorganisms
Market
Marketing manager
Microorganisms
Milk fat
Milk powder
Nitrogen
Nonfat dry milk
Pasteurization
Phosphorous
Photosynthesis
Potassium
Processing plant
Profit
Radiant energy
Safety inspector
Silage
Supply

Evaluation

This unit incorporates numerous activities and questions that can be used to check for student understanding. Embedded assessment includes oral and written responses to open-ended questions, visual representation of concepts, group presentations, and other knowledge-application projects. Specific examples include the graphic organizer in "Cowabunga!", the relay activity in "Sun, to Moo, to You!" and the comprehension questions in "The Ultimate Efficient Recycler".

Visual Display Ideas

- Create a bulletin board display highlighting careers related to the dairy industry. Try to display uncommon careers that students may not be aware of, such as: animal nutritionist, machine salesperson or technical support, veterinarian, marketing manager and/or accountant.
- Assign a specific dairy breed to groups of three to four students. Groups take turns decorating a corner of the room with a "Breed of the Week" theme. Students can bring in photos of the breed and research the history and characteristics of each breed.
- Contact your county Farm Bureau, a local dairy or the Dairy Council of California to bring a dairy cow to your school! Students can learn about milk production, cow care, handling and even practice milking.
- Create a display focusing on the wide range of dairy products available for consumers. Use empty containers of dairy products and enlarge nutrition labels so students understand the nutritional value of each product.
- Ask students to bring in their favorite books about cows. Display the books around the room.
- Pin a world map on the wall. Students can display their drawings of each breed and use yarn to reference each breed to their country of origin.

Unit Overview

Key Vocabulary
(continued)

Thermal energy
Total mixed ration (TMR)
Udder
Veterinarian
Worm cast

Before You Begin

1. Skim over the entire unit. Make appropriate changes to the lessons and student worksheets to meet your teaching style and the needs of your students.

2. The following resources may be helpful to you and your students as you study dairy and other agriculture commodities.

    - California Department of Food and Agriculture's Web site, *www.cdfa.ca.gov.* This site contains general and specific information on various aspects of agriculture.

    - California Farm Bureau's Web site, *www.cfbf.com*. This site has articles on current issues in agriculture as well as agricultural information on each California county.

    - The agricultural organizations listed on pages 59-61.

3. Read "Answers to Commonly Asked Questions" on pages 55-58 to gain background knowledge to use during the unit. Also, review the glossary on pages 52-54. Use these definitions with your students as you see appropriate.

4. Arrange for classroom visits from people involved in the dairy industry. Guest speakers may include dairy farmers, agriculture accountants, veterinarians, milk marketing specialists, animal nutritionists and food safety inspectors.

5. Organize appropriate field trips. Possibilities include local dairies, creameries, milk processing plants, cheese producers or ice cream plants.

6. Obtain the necessary supplies for each lesson.

Thank you for recognizing the importance of helping students understand and appreciate agriculture. We hope you find this resource useful in your teaching endeavors.

Cowabunga! (All About Breeds)

Purpose

In this lesson, students will understand breed characteristics and countries of origin for five different breeds of California dairy cattle. Students will discover why dairy farmers choose individual breeds for specific purposes.

Time

Teacher Preparation:
10 minutes

Student Activities:
Comprehensive reading and corresponding worksheet:
40 minutes

Grades 4 and 5 Pathway:
50 minutes

Grade 6 Pathway:
50 minutes

Materials

For each group:
- Crayons, colored pencils or markers
- Tear sheet
- Labeled diagram of world map or history-social science textbook

For each student:
- *Moos News* Classifieds Page
- *Moos News* worksheet
- *Cowabunga!* worksheet
- Small sticky note (Grade 6 only)

Background Information

California is the nation's leading dairy state, providing Californians with a diverse selection of high quality and nutritious dairy products that place the state among the top dairy regions of the world. In this lesson, students will discover there are five breeds of dairy cows in California. Jersey, Holstein, Brown Swiss, Guernsey and Ayrshire are all breeds used for milk production. Each breed has its own unique country of origin, physical attributes and production traits.

Procedure

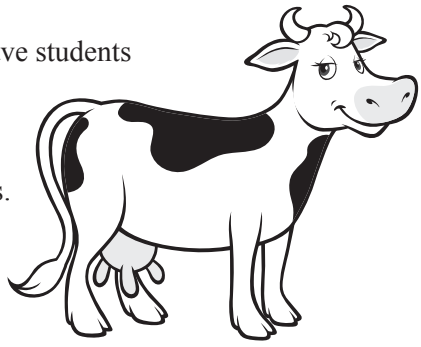
1. Brainstorming. Write the word "Holstein" on the board. Ask students to share their associations, ideas and responses to the word. They can input any related idea, with no criticism allowed. After brainstorming, explain to your students that today they will become experts on not only the Holstein, but also four other popular breeds of dairy cattle.

2. Divide the class into cooperative learning groups. Each group will consist of five students. Explain to your students that they will be given the Jobs Wanted page from the newspaper *Moos News*. Each student will be assigned to read an article submitted by one of the five breeds of dairy cattle searching for a job.

3. Distribute *Moos News* and *Moos News* Worksheet. This is a jigsaw activity, where students will need some time to work individually. Once all group members have completed their individual tasks, students will collaborate and share as an entire group. Instruct students to work individually, reading their job listing carefully and completing their section of the graphic organizer on the corresponding worksheet. Collaboratively, they will share their findings using the information recorded on their worksheet and complete the graphic organizer detailing characteristics of popular dairy cattle breeds.

4. Students will select breeds of dairy cattle to best match the characteristics listed at the bottom of page 11.

5. Review the worksheet questions. Have students explain why they chose breeds for specific purposes. Students should be encouraged to look for facts in *Moos News* to support their opinions.



Cowabunga! (All About Breeds)

California Standards

Grade 4

Common Core English Language Arts
RI.4.1, RF.4.4, SL.4.1

California History-Social Science
4.1.1, HSSA 4

Grade 5

Common Core English Language Arts
RI.5.1, RF.5.4, SL.5.1

California History-Social Science
5.2.1, 5.8, HSSA 4

Grade 6

Common Core English Language Arts
RI.6.1, SL.6.1

California History-Social Science
6.2, HSSA 3

ELL Adaptations

- Students work in cooperative learning groups.
- Review glossary with class before beginning lesson.

(ELL adaptations continued on page 9.)

Grade 4 and 5 Pathway

1. Give each learning group a world map or utilize maps found in class social science textbooks. Use the detailed map on page 13 to find specific locations of countries. Given a tear sheet, each group will draw an enlarged version of the world map. Once students have complete the drawing, they will locate and label the following:

    - Each of the seven continents
    - Country of origin for each breed

2. On a separate piece of paper, students draw an accurate picture of his or her designated dairy breed. Use tape to affix each breed near its country of origin.

3. Using colored pencils, students track one possible route on their map for each breed's arrival to America from its country of origin. Students also create a legend showing what color represents each breed.

4. Students present their maps to the class, describing each breed and its physical characteristics. Example: "This cow is brown because it is a Brown Swiss dairy cow from Switzerland."

5. Review the concepts of longitude and latitude with students. Using the "Cowabunga!" worksheet, students determine the longitude and latitude of each country of origin for dairy breeds. Students find and chart the longitude and latitude for the Netherlands, Scotland, Switzerland, Jersey and Guernsey.

6. Students work together to create a list of technology that made sea exploration (and the arrival of new dairy breeds) possible.

Grade 6 Pathway

1. Explain to students that ancient civilizations used cave carvings or hieroglyphics to record history, tell stories or illustrate religious ceremonies. Often these cave carvings depicted a wide variety of cattle. Discuss with your class:

    - What does this tell us about the historcal importance of cattle?
    - Why do you think cattle were so important to the ancient Egyptians?
    - How could cattle represent different social classes?

2. Write the word "domestication" on the board. Give each student a sticky note and instruct them to write a synonym or definition of

ELL Adaptations (cont.)

- Translate each glossary word into an alternate language; students learn vocabulary in two or more languages.
- Use visual aids to show differences in dairy breeds.
- Copy worksheets onto transparencies and review answers with class.

the word. Students place sticky notes on the board. Choose several creative and accurate responses to share with the class.

3. Students choose one of the five breeds and create a cave drawing that depicts the breed of cattle at work. What might they be doing? Students write an explanation of their hieroglyphics at the bottom of the page.

4. Students share their work in groups or present to the class.

Extensions

- Using online satellite maps, students locate the countries of origin for each of the breeds. Ask students to respond to questions about the terrain, lifestyle, food, etc. Use online references to determine the accuracy of their answers.
- Contact the Dairy Council of California (*www.dairycouncilofca.org/educators/dairydetectives.aspix*) for a free Dairy Detectives CD-Rom. It contains a variety of activities including a dairy breed matching game.
- Based on each grade-level curriculum, students perform a role play by taking on a persona from a particular period in history. This could include Spanish priests, pioneers, miners and more. Include a brief presentation about the time period, what type of cattle was important to their lifestyle, and how they relied on cattle for food and materials.
- Students use *Moos News* and historical documents to create a historical timeline. Students document the period of breed introductions to America as well as major historical events learned previously in class.

Variations

- Students can "show what they know" by repeating the brainstorming process used to introduce the lesson. Students will be excited to compare what they knew before to what they know now.
- Given an encyclopedia set, students research countries of origin and breeds. Record five facts about the country and five breed facts on a tear sheet. Students illustrate their facts with images and participate in student presentations.
- Students read *Moos News* aloud and complete worksheet as a group.

50 CENTS

MOOS NEWS

Jobs Wanted

5TH EDITION

Nessie Will Produce for You!

Nessie is a Holstein cow originating from the Netherlands, a country in northern Europe. Nessie weighs 1,500 pounds and is one of the largest breeds of dairy cattle. She is known around town as a real classy gal, partly because of her simple, black and white wardrobe. She wears all white, with large black spots. Unfortunately, cows don't get to change their clothes; it's what they're born with. Differences in coloring help us indentify breeds. Nessie's great-great-great grandmother entered America by ship in 1852, arriving in Boston, Massachusetts. Holsteins make more milk than any other breed. Nessie is no exception and produces about 10 gallons of milk per day.

A Sweet Swiss

If you travel to Switzerland, a mountainous country in Europe popular for skiing and cheese, you are sure to meet Heidi, a Brown Swiss dairy cow. She enjoys grazing on grass, but she sure does have a sweet tooth!! She produces pure white milk high in lactose, also known as milk sugar. Her milk is perfect for making cheese. Heidi weighs 1,500 pounds and is very athletic. Brown Swiss cattle are famous for strong feet and legs, and for their brown coloring. Heidi's ancestors came to America in 1869, arriving in Massachusetts. Heidi, like her Brown Swiss relatives, lives and works well in both hot and cold climates.

Strike it Rich with a Golden Guernsey!

Gertrude is a Guernsey cow from Guernsey, a very small island nation off the northern coast of France. Gertrude's family came to the Americas by boat in 1840. They entered through a port in New York. Guernseys like Gertrude are famous for producing milk that is golden in color. Everything about Gertrude is golden, including her gold coat with white patches. Gertrude is a medium-sized dairy cow, weighing 1,150 pounds. She will be making milk for you for many years, as her breed is well known for living longer than any other breed.

An Unbelievable Udder

Red and white speckled Adie the Ayrshire is a dairy cow from Scotland, but she can't play the bagpipes. She can, however, produce milk used for high quality butter and cheese. Adie and her relatives weigh about 1,200 pounds each. They are considered medium-sized cows famous for having healthy udders. Ayrshires entered America in 1822. They arrived in Connecticut by ship. Adie's ancestors thrived in the rocky hills and cold weather, similar to their home in Scotland.

Little in Size, but BIG in Milk

If you travel to the small island of Jersey off the coast of France, you will find relatives of Jenny the Jersey. Jenny only weighs 900 pounds and is small compared to other breeds, but she still produces high quantities of milk for her petite size. Many people call Jersey cows, like Jenny, the "prettiest" breed, as they are small and slim through their head and shoulders and have an attractive honey-brown coat color. Jersey cows were first introduced to America in 1850, and continue to be the second most common breed in California.

Cowabunga! (All About Breeds)

1. Complete the following graphic organizer. Add the information for the dairy breed assigned to you first, then work together with your group to complete the entire organizer.

Breed	Country of Origin	Physical Description	Weight	Other Unique Characteristics
Holstein				
Brown Swiss				
Ayrshire				
Guernsey				
Jersey				

2. Work as a group to complete the following questions. Imagine for a moment that you are a California dairy farmer. Which breed would you buy for...

_____ Making ice cream?

_____ A beautiful herd?

_____ Making cheese?

_____ Healthy udders?

_____ A very healthy herd?

_____ Small cows?

_____ Making "golden" milk?

_____ Making butter?

_____ Making a lot of milk?

_____ Running a marathon?

_____ Living in Antarctica?

_____ Living a long time?

Answer Sheet

1. Complete the following graphic organizer. Add the information for the dairy breed assigned to you first, then work together with your group to complete the entire organizer.

Breed	Country of Origin	Physical Description	Weight	Other Unique Characteristics
Holstein	*The Netherlands*	*All white with black spots, largest breed*	*1,500 lbs*	*Makes more milk than other breeds, 10 gallons/day*
Brown Swiss	*Switzerland*	*Athletic, strong feet and legs, brown*	*1,500 lbs*	*Milk high in lactose, used for cheese, likes hot and cold climates*
Ayrshire	*Scotland*	*Red and white*	*1,200 lbs*	*Milk used for butter and cheese, healthy udders, withstanding cold weather*
Guernsey	*Guernsey*	*Gold and white*	*1,150 lbs*	*Makes golden milk, lives a long time*
Jersey	*Jersey*	*Honey-brown, small, "pretty"*	*900 lbs*	*Second most common, high quantity of milk*

2. Work as a group to complete the following questions. Imagine for a moment that you are a California dairy farmer. Which breed would you buy for...

Brown Swiss
Making ice cream?

Brown Swiss, Ayrshire
Making cheese?

Ayrshire, Guernsey
A very healthy herd?

Guernsey
Making "golden" milk?

Holstein, Jersey
Making a lot of milk?

Brown Swiss, Ayrshire
Living in Antarctica?

Jersey
A beautiful herd?

Ayrshire
Healthy udders?

Jersey
Small cows?

Ayrshire
Making butter?

Brown Swiss
Running a marathon?

Guernsey
Living a long time?

Cowabunga! (All About Breeds)

Detailed Map

Think About it!

What technology made sea exploration possible?

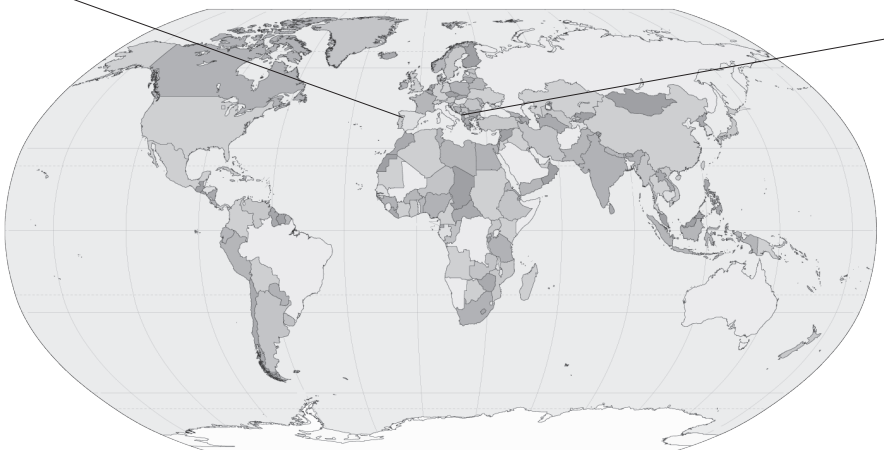
1. _____
2. _____
3. _____
4. _____

Locate each country of origin; record approximate longitude and latitude.

Country	Longitude	Latitude

Cowabunga! (All About Breeds)

Answer Sheet



Locate each country of origin; record approximate longitude and latitude.

Country	Longitude	Latitude
Netherlands	*5°E*	*52°*
Switzerland	*8°E*	*47°*
Scotland	*3°W*	*56°*
Guernsey	*2°W*	*49°*
Jersey	*2°W*	*49°*

Think About it!

What technology made sea exploration possible?

1. *Compass*
2. *Sextant*
3. *Telescope*
4. *Astrolabe*

Sun, to Moo, to You!

Purpose

In this lesson, students will investigate the transfer of energy in the process of making milk. Students will understand that there are different forms of energy, that living things need energy to survive and that the primary source of energy is the sun.

Time

Teacher Preparation:
15 minutes

Student Activities:
60 minutes

Materials

For class:
- Video on the process of making milk, such as "Milk from Cow to Container," found on the Dairy Council of California's Web site (*www.dairycouncilofca.org*)
- Whistle
- White board or tear sheet
- Dry erase markers
- Glass of hay

For each group:
- One set of "Sun, to Moo, to You" relay cards
- Jump rope
- Bouncing ball, such as a basketball or kickball

For each student:
- "Using Energy" worksheet

Background Information

In this lesson, students will discover how the process of making milk involves energy transfer from the sun to dairy cows and, finally to the consumer. Students will understand the difference between chemical, radiant and kinetic energy and that all living things need energy to survive.

Humans and animals get their energy from nutrients produced by plants. Humans and dairy cows can both receive energy from plants in the form of fruits, vegetables or grains. All of the energy in nutrients originally comes from the sun.

Plants absorb the sun's radiant energy and transform it into chemical energy through the process of photosynthesis. The plants use much of this energy to grow and store the remaining energy in their cells. When dairy cows eat feed, such as alfalfa, they are able to use the chemical energy stored in the plants they consume. Dairy cows use this energy to do everything from eating and digesting their food to breathing and producing milk. The milk produced by dairy cows also contains part of this energy. When we drink milk or eat products made with milk, we receive the energy that originally came from the sun. Our bodies rely on kinetic (physical) energy to do work, have fun and accomplish tasks.

Procedure

1. Ask students to think of their favorite sport. How would they feel if they played in the championship game of this sport and had not had anything to eat? Students pair and share their responses.

2. Survey the class for different responses. How many said tired, sick or grumpy? Brainstorm with students why they might feel tired. Ask how they would feel if, after the game, you offered them a nice, cold glass of… hay?! Show students a glass full of hay or grass. Explain that dairy cows convert the feed they eat into the milk we consume on a daily basis. Energy plays an important role in this process.

3. Show students a video on the process of making milk, such as "Milk from Cow to Container," found on the Dairy Council of California's Web site (*www.dairycouncilofca.org*). Instruct students to look for how dairy cows use and consume energy at each step of production. Discuss the video with students and work as a class to construct a production timeline on the board. Explain that in each of these steps, energy transfers. In a moment, they will go outside to see how energy moves between objects and people.

Sun, to Moo, to You!

California Standards

Grade 4

Next Generation Science
4-PS3-1, 4-LS1-1

California Physical Education
1.5, 1.14

Grade 5

Next Generation Science
5-PS3-1, 5-LS2-1

California Physical Education
1.16

Grade 6

Next Generation Science
MS-LS1-6

California Physical Education
1.6, 5.1, 5.2

4. Take students outside. Students form groups of four. Instruct students to pass a ball between their group members in a variety of patterns. The teacher determines the patterns and may wish to blow a whistle to get students' attention in changing patterns. Possible pattern ideas: bounce pass-chest pass, skipping every other person, increasing the number of bounces with each pass, passing the ball clockwise vs. counter-clockwise, etc.

5. Take students inside the classroom to debrief the activity. Ideas for discussion:

   - Use student volunteers to demonstrate how we use kinetic energy to pass the ball.
   - Use student volunteers to demonstrate how we absorb kinetic energy when we catch the ball.
   - What happens to energy when the ball bounces?
   - What happens to the ball when it is windy outside?
   - What happens if you bounce a ball on grass? A basketball court?

6. Explain that just as we used energy to pass the ball, we use energy to do many other things in our daily lives as well. Distribute the "Using Energy" worksheet. Instruct students to first identify and label ways our bodies use energy.

7. Next, they will identify and label how dairy cows use energy. Focus students on the energy dairy cows use to create milk. Ask students to share with a partner where the energy comes from and where it goes when cows create milk. Students share with entire class. Briefly, review the timeline created at the beginning of the lesson and review how energy moves between each step of the process.

*To prepare for the following activity, copy the "*Sun, to Moo, to You" *relay cards onto 3-5 different colored sheets of cardstock. Cut each card out, creating a set of relay cards for 3-5 different teams*.

8. Divide students as equally as possible into teams of seven students. Teams without seven students will need to select one or more members to complete the relay twice. Assign each team a color based on the color of their "Sun, to Moo, to You" relay cards. Outside, students line up with their teams in single file lines. Five yards in front of each team's starting line, place a jump rope. Several feet beyond the jump rope, spread out the team's relay cards face down. Five yards further, place a finish line.

Sun, to Moo, to You!

ELL Adaptations

- At the bottom of each relay card, students label the picture in English and in an alternate language.
- When working in pairs, group ELL students together to encourage communication.
- Create transparencies of all handouts to use as visuals for directions.
- Demonstrate different forms of energy through role-play or individual student examples.

9. Explain to students they are about to participate in a relay race team competition. Build up the importance of supporting each other and contributing to the goals of the team. Demonstrate how each student will individually leave his or her team's starting line. They will run to the jump rope and jump rope five times. Next, they will pick up one of the seven relay cards and run to the finish line. Once they are at the finish line, they will yell, "Moo!" to signal the next teammate in line to begin the relay.

10. Once the entire team has crossed the finish line, the team members will work together to put each of the relay cards in the correct order. The cards will create a sequence showing how energy moves within the process of making milk. When the team has completed the entire relay, team members must all sit quietly in a line. The first team sitting quietly on the grass wins! The winning group reviews the correct order with the class.

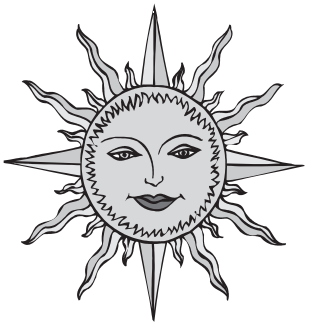
Extentions

- Students keep a journal tracking where they receive energy and how they use energy on a daily basis. By surveying the class, students can create graphs illustrating their personal and/or collective energy cycles.
- Teach students about other forms of energy such as thermal or electrical energy. Bring in visual aids, like a light bulb or a candle, to demonstrate each of the different forms.
- Students learn more about the need of radiant and chemical energy in plant growth. Create a student experiment that allows groups to run trials on plants with or without sunlight.
- Create scenario cards for group role-plays. Cards may include eating a meal at a restaurant, running a race, growing a flower, talking on the phone, sitting in the sun, etc. Each group will perform its role-play without speaking, and the class identifies what forms of energy are present in the role-play.
- Students work in groups to research a form of energy such as radiant, kinetic, thermal, sound or electrical energy. Each group draws an image that represents the concept and explains their drawing to the class.
- As a class, read the book *Energy: Heat, Light and Fuel* by Darlene Stille. Students write and illustrate their own version of the book, creating unique examples for each form of energy.

Variations

- Students play kickball, baseball or another team sport to observe the loss and gain of kinetic energy.
- Take students on a field trip to a dairy to see the actual process of milk production.
- Ask a local dairyman to visit your class as a guest speaker.
- Instead of completing the "Using Energy" worksheet, instruct students to draw a picture of themselves engaged in a daily activity. Ask students to identify and label ten ways they are using energy in the picture.

Sun, to Moo, to You!

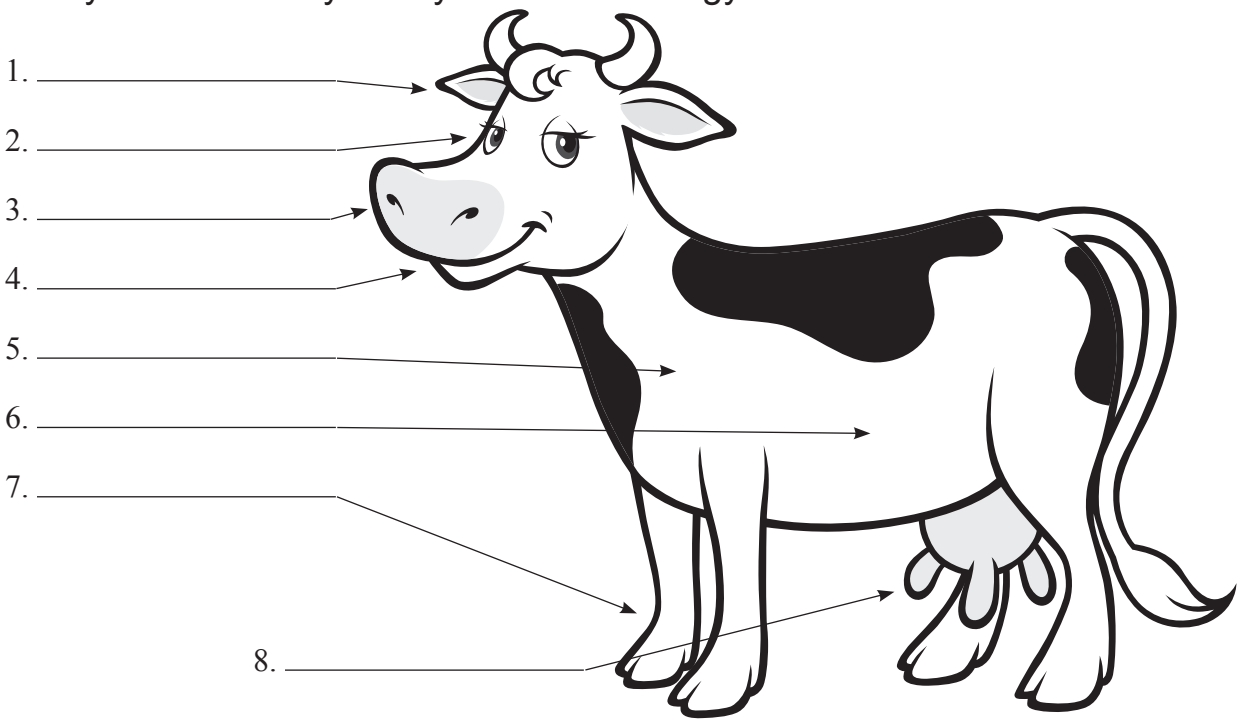


Sun, to Moo, to You!

Using Energy

1. Identify and label ways our bodies use energy.

2. Identify and label ways dairy cows use energy.

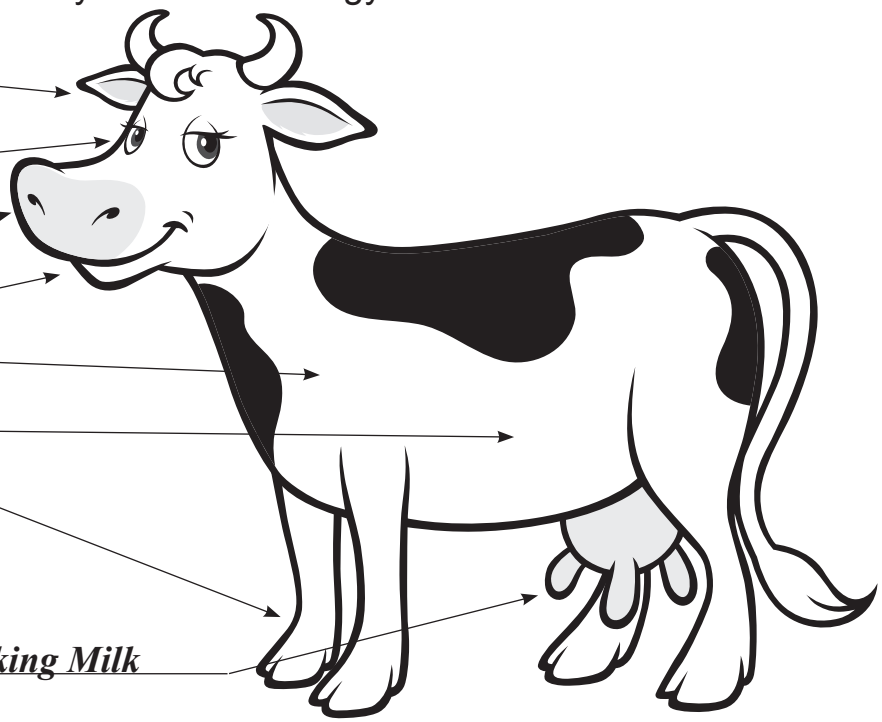


Sun, to Moo, to You!

Using Energy Answer Sheet

1. Identify and label ways our bodies use energy.

2. Identify and label ways dairy cows use energy.



Milk Makin' Math

Purpose

In this lesson, students will learn about the numerous career opportunities involved in the dairy industry. They will also practice real world math problems related to specific careers within the industry.

Time

Teacher Preparation:
20 minutes

Student Activities:
70 minutes

Materials

For class:
- Gallon of milk
- Digital scale
- Syringe with needle removed
- Feed samples (optional)
- One or more photos showing the inside of a milk barn
- Checkbook or sample of a check
- One-dollar bill

For each group:
- Large piece of paper
- Markers

For each student:
- "Milk Makin' Math" Activity Book

Background Information

California milk translates into hundreds of thousands of jobs and billions of dollars in economic impact. In 2007, the California dairy industry provided 435,000 full time jobs. In this lesson, students will discover how many different individuals are required to maintain a productive, efficient and profitable dairy.

Dairy careers require a variety of skills, including skills in science, technology, reading, writing and mathematics. This lesson features real-life math challenges that individuals working in the dairy industry face everyday. Students will make important connections between the math problems completed in school and the math skills essential to employment.

Procedure

1. Draw! Given markers and a large white sheet of paper, students have three minutes to brainstorm dairy-related careers. Working in groups, students draw as many images as possible representing careers found on a dairy.

2. Encourage students to share their drawings with the entire class. Create a master list of careers on the board and brainstorm important skills these individuals need to be successful with their jobs.

3. Discuss and emphasize how math skills are essential for all jobs, including work on a dairy.

4. For this lesson, groups of students (determined by the teacher) will rotate between six different learning stations. Each station should be set up with one table and chairs for each student in the group. Each station will focus on a different dairy career. Students will move around the room, completing math challenges found in each student's "Milk Makin' Math" Activity Book.

Milk Makin' Math

California Standards

Grade 4

Common Core Mathematics
4.OA.A.2, 4.OA.A.3, 4.MD.A.2, 4.NBT.B.4, 4.NBT.B.6

Grade 5

Common Core Mathematics
5.NBT.A.3, 5.NBT.A.4, 5.NBT.B.5, 5.NF.B.3

Grade 6

Common Core Mathematics
6.RP.A.3, 6.RP.A.3.C, 6.NS.B.2, 6.NS.B.3

5. Set up each of the stations as follows:

   Station 1: Dairy Nutritionist
   Visual: Samples of hay, dairy feed components. With each sample, include a label and definition.

   Station 2: Dairy Farmer
   Visual: One or more photos showing the inside of a milking barn.

   Station 3: Veterinarian
   Visual: A syringe with the needle removed.

   Station 4: Accountant
   Visual: A checkbook to represent expenses and a dollar to represent profit. Using index cards, define and label each as profit or expense.

   Station 5: Safety Inspector
   Visual: A large weather thermometer that shows temperature in degrees Fahrenheit.

   Station 6: Marketing Manager
   Visual: Place one gallon of milk on a digital scale.

6. Instruct students who complete stations early to illustrate the cover of their activity book.

7. Review the answers to the problems with the entire class. Conclude the lesson with a class discussion on:

   a. What are your impressions on the amount of math needed to be successful in your career?

   b. Which career would you enjoy most? Why?

   c. Which job is the most difficult? Why?

   d. Which job is the easiest? Why?

8. On an index card, students write down one fact they learned about one of the possible dairy careers. Students will use this "ticket" to be excused for lunch, recess or a nutrition break.

Milk Makin' Math

ELL Adaptations

- Use an overhead projector to review answers for the "Milk Makin' Math" Activity Book.
- Invite a guest speaker who speaks English as a secondary language. Make an important tie to the opportunities available to ELL students.
- Students work in groups or pairs to bridge language differences.

Extensions

- Invite individuals representing dairy careers to sit on a panel for the class. Students have the opportunity to learn about each of the careers by asking questions of each guest speaker.
- Invite individuals from each dairy career to monitor activity stations.
- Students work in groups to research each dairy career. This activity may include interviewing employees in the industry, researching online or role-playing job responsibilities.
- As a review, students work in pairs or trios to create mime-like motions representing the material they have learned. The entire class works together to guess which career the group is acting out.

Variations

- Students move around the stations in pairs. Students complete each math challenge together.
- Students create a dairy "passport." With each completed station, they receive a stamp to show their success.
- Students complete a KWL chart to begin the lesson.

Student Passport

Student Name:

Station 1 Dairy Nutritionist	**Station 2** Dairy Farmer	**Station 3** Veterinarian	**Station 4** Accountant	**Station 5** Safety Inspector	**Station 6** Marketing Manager

Milk Makin' Math Activity Book

Name _____

Milk Makin' Math

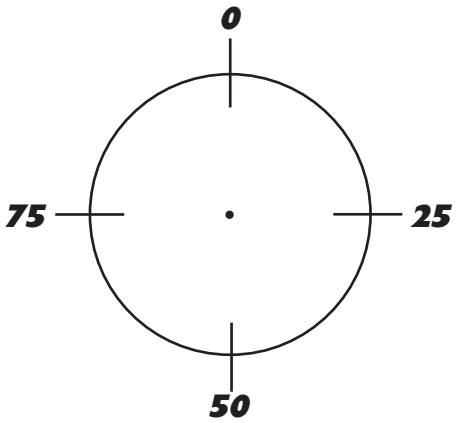
Station One: Dairy Nutritionist

A dairy nutritionist is an animal health professional who specializes in the nutritional needs of dairy cows. Nutritionists recommend the best diets for cows and monitor how cows respond to their feeding program.

	Percent	Decimal	Fraction
Hay			
Silage			
Almond Hulls			

1. A dairy nutritionist recommends feeding 60 pounds of feed to dairy cows every morning. The feed is a mix of hay, silage and almond pulp. The mix is 70 percent hay, 20 percent silage and 10 percent almond hulls. Represent each of these numbers in a percent, decimal and fraction form.

2. Create a pie chart using the percent quantities listed above. Color each ingredient of the feed a different color and include a color-coded key.



Key:

☐ =

☐ =

☐ =

3. Determine how many pounds of each ingredient to include in the feed. If 70 percent of the feed is hay and the feed weighs a total of 60 pounds, how many pounds of hay should you add? How many pounds of silage? How many pounds of almond hulls?

   Example: (percentage of ingredient in decimal form) x 60 = Total Pounds

   Hay _____ x 60 = _____

   Silage _____ x 60 = _____

   Almond Hulls _____ x 60 = _____

Milk Makin' Math

Station Two: Dairy Farmer

A dairy farmer is a farmer who specializes in raising dairy cattle, specifically for milk and/or cheese products.

It takes 10 minutes to milk one group of 20 cows. Answer the following questions and show your work by completing the number lines below.

1. How many minutes will it take to milk 120 cows? _____ Hours? _____

2. How many minutes will it take to milk 200 cows? _____ Hours? _____

3. How many minutes will it take to milk 235 cows? _____ Hours? _____

Milk Makin' Math

Station Three: Veterinarian

A veterinarian is a doctor who treats animals.

1. Part of a veterinarian's job is to protect animals from getting sick. That's why vets give animals shots. Veterinarians measure the amount of medicine to give a dairy cow in cubic centimeters, or cc's. A cc is a very small amount of liquid. Veterinarians also determine how much medicine to give an animal based on how much the animal weighs. Read the medicine label and determine how much medicine to give each of the following dairy cows.

Jersey	900 lbs.	_____
Holstein	1,500 lbs.	_____
Brown Swiss	1,400 lbs.	_____
Guernsey	1,050 lbs.	_____
Ayrshire	1,200 lbs.	_____

Dairyman Dave's Pharmacy
Rx#: 123456

Give 10 cc's of medicine for every 50 lbs. of weight.

2. Would a human or a dairy cow need more medicine? Why?

_____

_____

_____

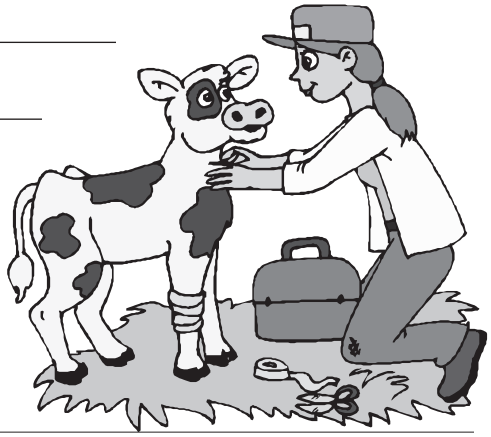
_____

_____

_____

_____

_____



Milk Makin' Math

Station Four: Accountant

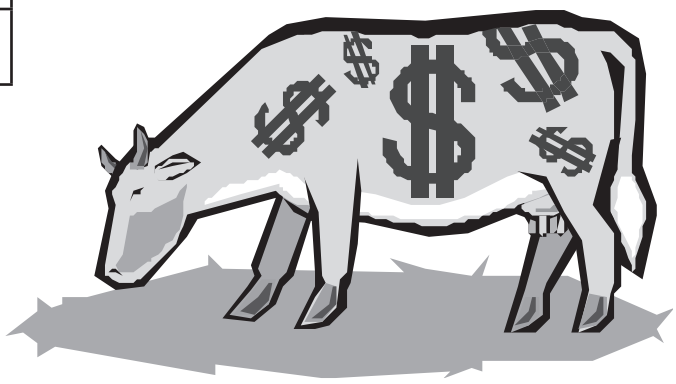
An accountant keeps records of business-related financial transactions. They record business expenses and calculate the profit earned.

1. If a dairy has a herd of 200 cows and each cow produces 10 lbs. of milk each day, how many total pounds of milk does the herd produce each day?

2. If a dairyman sells milk for $18.00 per 100 lbs. of milk, how much will he/she earn before expenses are calculated? Determine using the same herd as in Question #1.

3. Dairy farmers have many expenses in milk production. Using the expenses listed below, determine the total amount spent during the month.

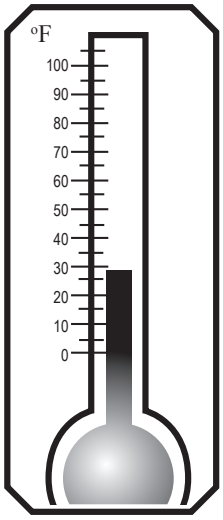
Expense	Amount
Labor	$5,423.12
Feed	$4,630.00
Vet Bills	$415.25
Repairs	$395.15
Supplies	$89.75
TOTAL	



Milk Makin' Math

Station Five: Safety Inspector

A safety inspector helps prevent harm to workers, property, the environment and the general public. Safety inspectors make sure the dairy products we consume are safe and healthy to eat. They also make sure the food we eat is free from germs and stored at the correct temperature.



1. Immediately after milking, the temperature of milk is 101° F. Within four hours, the safety inspector will check to make sure the temperature has dropped to 50° F. How many degrees will the milk need to drop every hour to meet this goal? Express your answer in degrees as a mixed fraction and as a decimal.

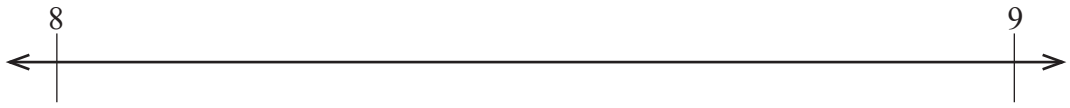
2. At the processing plant, the 50° F milk goes into a batch used for making ice cream. The average temperature for ice cream is 4° F. How long will it take the milk to reach 4° F if the temperature drops 2° F every minute?

Station Six: Marketing Manager

A marketing manager advertises, promotes and sells milk to distributors, processing plants, and, eventually, to the public.

1. How much does a gallon of milk weigh? _____

2. Plot the weight of a gallon of milk on the number line below.



3. Round the weight of a gallon of milk to the nearest whole number. _____

4. A dairy farmer has 800 lbs. of milk to sell. How many total gallons of milk is he/she trying to sell?

   Round to the nearest whole number. _____

Milk Makin' Math

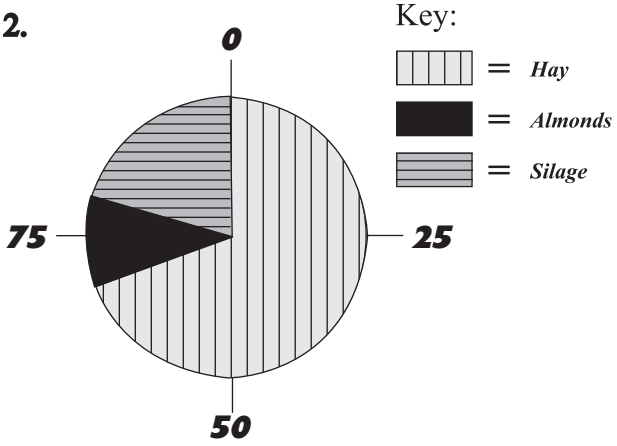
Answer Sheet

Station One: Dairy Nutritionist

1.

	Percent	Decimal	Fraction
Hay	*70%*	*.7*	*7/10*
Silage	*20%*	*.2*	*1/5*
Almond Hulls	*10%*	*.1*	*1/10*

2.



3. Hay ___*.70*___ x 60 = ***42 lbs.***

Silage ___*.20*___ x 60 = ***12 lbs.***

Almond Hulls ___*.10*___ x 60 = ***6 lbs.***

Station Two: Dairy Farmer

1. ***60 min., 1 hr.***
2. ***100 min., 1.66 hrs.***
3. ***117.5 min., 1.96 hrs.***

Station Three: Veterinarian

1. Jersey 900 lbs. ***180cc's***
   Holstein 1,500 lbs. ***300cc's***
   Brown Swiss 1,400 lbs. ***280cc's***
   Guernsey 1,050 lbs. ***210cc's***
   Ayrshire 1,200 lbs. ***240cc's***
2. ***The amount of medicine is based on weight. Since dairy cows weigh more than humans, they would need more medicine.***

Station Four: Accountant

1. ***2,000 lbs. of Milk***
2. ***$360.00***
3. Total: ***$10,953.27***

Station Five: Safety Inspector

1. 12.75°, 12 3/4°
2. 23 minutes

Station Six: Marketing Manager

1. ***8.6 lbs.***
2. ***8.6 lbs.***
3. ***9 lbs.***
4. ***93 gallons***

The Ultimate Efficient Recycler

Purpose

In this lesson, students will examine how cows help conserve natural resources by identifying the important role dairy cattle have in reducing, reusing and recycling food processing by-products. Students will identify each of the stages in the ecological cycle and the important role of decomposers.

Time

Teacher Preparation:
20 minutes

Student Activities:
50 minutes

Materials

For class:
- 5-10 brown paper bags
- 5-10 different feed stuffs (almond hulls, cottonseed, barley, culled carrots, etc. Many feed mills, dairies, universities or animal nutritionists will donate.)

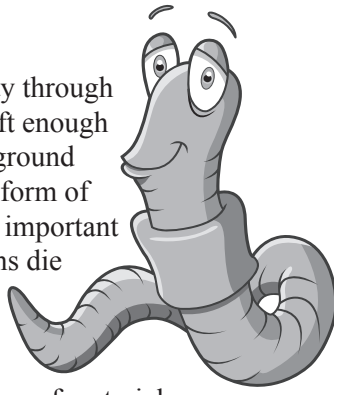
For each group:
- Set of four "Ultimate Efficient Recycler" journal entries

Background Information

Dairy cows are truly efficient recyclers. Because of their complex multi-compartment stomachs, they can consume feedstuffs that would be difficult or impossible for humans to digest, and then convert the feed into dairy products that humans can consume. The ingredients used for cattle feed include food processing by-products that would otherwise be sent to landfills. More than 25 percent of food processing by-products are fed to cattle. These feed products may include sugar beet pulp, almond hulls, canola seed pulp, citrus pulp, potato peels, culled vegetables, bakery waste, corn stalks, tomato pulp, grape skins, cottonseed, soy hulls and more. Eighty-five percent of what cattle eat is material that people cannot digest.

Not only do dairy cows recycle our unwanted leftovers to produce delicious dairy products, they also produce waste that we re-use for a variety of purposes. One way we "re-use" is applying properly composed manure from dairy cows to crops for fertilizer.

Macroorganisms and microorganisms play a vital role in turning cattle waste into a useful resource for humans. Worms, grubs and microbes are all examples of organisms that chew and break down material such as twigs, roots, manure and leaves.



Earthworms are macroorganisms that eat their way through their surroundings, consuming anything that is soft enough for them to chew. All "food" that is consumed is ground up in the gizzard, leaving the worm's body in the form of dark, nutrient-rich castings. These castings are an important contribution to soil fertility. When macroorganisms die and decay, their bodies also add nitrogen and other elements to the compost.

Microorganisms, like bacteria, begin the breakdown of material, making it easier for worms and other macroorganisms to do their job. Many different types of microorganisms are at work in composted manure. Given the right environmental conditions--such as proper moisture, temperature, air, a favorable balance of carbon and nitrogen and lots of surface area to work on--bacteria will thrive. Since bacteria are smaller and less mobile than other organisms, they are less able to escape an environment that becomes unfavorable. A decrease in the temperature of the compost pile or a drastic change in pH can kill these decomposers. Once undergoing the process of decomposition, dairy farmers are able to use properly composted manure to enrich the soil, aiding in healthy plant growth.

The Ultimate Efficient Recycler

California Standards

Grade 4

Common Core English Language Arts
RI.4.1, RI.4.2, RI.4.3, SL.4.1.D

Grade 5

Common Core English Language Arts
RI.5.1, RI.5.2, RI.5.3, SL.5.2

Next Generation Science
5-LS2-1

Grade 6

Common Core English Language Arts
RI.6.1, RI.6.2, RST.6-8.2

Next Generation Science
MS-LS1-5, MS-LS2-3

Dairy farmers add composted manure to crops, which acts like a "homemade" fertilizer. Plants grow healthy and strong with the added nutrients. Dairy farmers use these crops to produce more feed ingredients, such as corn stalks, and the cycle begins again from the beginning.

Procedure

1. Place several types of food processing by-products used for dairy feed in separate, brown paper bags. Students take turns feeling inside the bags and guessing the feed ingredient. Review with students, identifying the original product and the changes that happened to create each by-product foodstuff.

2. Explain to students that dairy cows help us recycle materials that would normally be considered waste. We call these materials "by-products". For example, after farmers harvest ears of corn, the stalks remain. These stalks are a nutritious addition to animal feed. Re-using products is an important way for humans to reduce the amount of waste sent to landfills. By recycling the material and using it as nutritious ingredients for dairy feed, we reduce our impact on the environment. Work with students to identify other waste products that are used in the dairy industry as feed.

3. Being a resourceful consumer of by-products is not the only way dairy cows are ultimate, efficient recyclers. In a moment, students will break into groups and discover the other ways dairy cows reduce, reuse and recycle.

4. Break students into cooperative learning groups of four. Read the following script to students:

The following journal entry was written by 5th grader Lily Longacre.

Dear Journal, *June 5, 2005*

School is finally out for summer, and today my mom and I drove to my grandparents' house in the central valley of California. They raise Holstein dairy cows and live on a small farm called Green Meadow Ranch. Every summer I come to spend two weeks with them out in the country. It's been a whole year since I've seen their dogs, goats, chickens, horses, and my favorite dairy cows, Lola and Lacey. I'm especially excited to visit this year because in science class, we learned a little bit about how dairy cows contribute much more than just milk. Through their eating and excreting, they actually help our food grow and help clean up some of the earth's waste. I can't wait to see Lola, Lacey and the other cows hard at work!

The Ultimate Efficient Recycler

ELL Adaptations

- Create a transparency of the "Ultimate Efficient Recycler" journal entries. Read the entries as a class, highlighting challenging vocabulary words and prompting discussions throughout.
- Students may work in pairs to read and answer questions for an assigned journal entry.
- Students learn in cooperative groups, ranging in mastery of the English language.

Give each learning group a packet of "Ultimate Efficient Recycler" journal entries. Each student reads one of the journal entries and responds to the reading comprehension questions at the bottom of the page.

5. After several minutes, students gather in their assigned cooperative learning groups. Each student summarizes what they read to the group and shares the answers to their questions. Review each of the questions as a class.

6. Instruct students to place their journal entries in the correct chronological order, identifying areas where they see the process of recycling, reducing and reusing. Students should be able to review the process from beginning to end and recognize that these steps are repeated to form an effective cycle.

    a. Cows consume feed, made of food processing by-products.
    b. The dairy farmer creates compost and collects manure.
    c. Manure is used to fertilize the field.
    d. The dairy farmer harvests the field and feeds the by-products to the dairy cattle.

7. Some possible discussions about this lesson may include:

    a. What type of diagram is appropriate to illustrate this process? Is it a timeline or is it cyclical? Why?
    b. What are some lessons we have learned from dairy cows that will help us reduce, reuse and recycle in our own lives?
    c. How are these interactions an example of a viable ecosystem?
    d. How would life be different without decomposers?

Extensions

- As a class, create your own compost pile. Visit The California School Garden Network (*www.csgn.org*) for classroom activities and step-by-step directions. Observe and monitor changes in pH, insect activity, heat and size. Students hypothesize future changes in the compost. Students can also create personal compost piles in plastic water bottles or milk cartons and monitor changes on a smaller scale.
- Contact the California Beef Council (*www.teachfree.com*) for "Things We Could Learn from a Cow and a Worm," a colorful poster with accompanying activities that demonstrate the positive role cattle play in our environment.

- Students research the potential of "catching" methane gas from manure and using it as an energy source. Go on a field trip to a dairy with a methane digester.

- Create a storybook about the efficient and resourceful dairy cycle. Students also create a storybook sharing how they reduce, reuse and recycle.

- Students write their own journal entry, written from the perspective of a dairy cow.

Variations

- Place examples of feed items in film canisters. Given an example of each feedstuff, students identify which ingredient is in each canister, based on the sounds they make.

- Given paper and markers, students work in their groups to create a "cycle" that represents what is happening in the four journal entries

The Ultimate Efficient Recycler

June 6, 2008

Dear Journal,

This morning, before we headed out to the pasture, my Grandpa and I did some checking on the Internet, and we learned that a single dairy cow produces more than 5,000 lbs of dry manure every year! That's as much as our family's minivan weighs! While we walked toward the field where Lola and Lacey live, I asked Grandpa about the different ways that dairy cows help humans. He explained to me that one of the most valuable resources, besides the milk of course, is the cows' manure! It sounded really strange to me, but it made more sense as we watched the cows eating the grass from the field. I thought it was gross at first, but we checked out a few "cow pies" in the pasture, and I began to understand that cows' waste contains a lot of good ingredients.

I watched Grandpa use a tractor to move all the manure in the corral, making a pile outside. Grandpa also let me help take the temperature of the pile using a three foot-long thermometer! He said that the manure needs to be kept at a really high temperature for several days, to make sure any pathogens are killed. Pathogens are germs that can make people sick. If the temperature gets too low, Grandpa turns the pile and adds water. The moisture is necessary for the pile to "cook." This seems like a lot of work to put into a pile of manure, but Grandpa promised that we would benefit from all this hard work. This should get interesting!

Based on the reading, answer the following questions:

1. Why would it be important to use a three-foot long thermometer?

2. How do you think Grandpa and Lily will benefit from all their hard work with the manure?

3. How does this show that dairy cows are ultimate, efficient recyclers?

The Ultimate Efficient Recycler

June 8, 2008

Dear Journal,

Today, I helped Grandma out in her garden. She taught me that Lola and Lacey, the dairy cows, often help her in the garden, too! I thought she was joking at first, but then she told me more. She said that a lot of farmers and gardeners use cows' manure to nourish their plants and crops. She said that when applied to soil, dairy manure increases the amount of nutrients for plants, and is perfect for garden use. More than 75% of the plant nutrients fed to cows, like Lola and Lacey, is released in their manure, so the stuff is an excellent fertilizer! Manure and composted plant materials add organic matter to the earth, which helps soil retain moisture; they also provide nutrients such as nitrogen, potassium and phosphorus.

Later that day, we drove into town. She showed me that properly composted manure from dairy cows and other animals is often sold as bagged manure at garden centers and nurseries. People actually buy the manure of dairy cows to add nutrients to everything from acres of corn and orchards of almonds to school gardens and potted plants. I wonder if Lola and Lacey know how much they're helping California farmers and gardeners?

Based on the reading, answer the following questions:

1. Why is it important to add manure to soil?

2. What do you think "composted manure" is?

3. How are dairy cows ultimate, efficient recyclers?

The Ultimate Efficient Recycler

June 10, 2008

Dear Journal,

We started out this morning by eating an awesome breakfast, using a lot of items produced right here on the farm! We ate eggs from the chickens in the coop out back and had fresh strawberries straight from the garden – Yum! I'm sure some of the milk in the carton from the store even came from Lola and Lacy! Grandma and Grandpa explained that my two favorite dairy cows also consume food that is grown right here at Green Meadow Ranch. "But not the same things that we eat," Grandma said. We headed outside, stopping at the tall rows of corn. "You see, after we harvest the corn for ourselves, we treat the cows to the stalks and husks to supplement their diet," she said. "The Smiths down the road often bring over their grain by-products."

I was unsure of what by-products were, so after dinner I did some reading. I learned that by-products are feed ingredients from sources that are normally waste products of other industries. I began to understand that, in a way, the cows of America clean up after us. They consume leftover food processing products that would otherwise be filling landfills. Our landfills would be stacked to the top with stuff that the cows enjoy eating! I can't believe how much I'm learning about dairy cows this summer, and I can't wait to tell my friends back home how awesome cows really are!

Based on the reading, answer the following questions:

1. What are by-products?

2. How does reusing food processing by-products positively affect our environment?

3. How are dairy cows ultimate, efficient recyclers?

The Ultimate Efficient Recycler

June 15, 2008

Dear Journal,

The days have been jam-packed with all kinds of great stuff to do here on the farm. I'm really starting to like working outside and doing the chores, and I even started waking up early, early in the morning (before the sun comes out!) to help Grandpa milk Lola, Lacey and all the other cows. It's pretty cool to think that the food they eat will affect the milk they produce. Grandpa says that the better quality the food these cows eat, the better the milk, butter and cheese will be that comes from them. That's a good thing because I LOVE dairy and anything with milk! He also says that better quality food will also mean a more healthy manure. Before I came to the farm, I didn't really understand why we would care about the quality of cow manure. I mean, it's just poop! But now I get it – manure makes plants grow better, and better plants mean healthier food for us and eventually for the cows. The cycle keeps going and going. Cows really are one of the most efficient recyclers on earth!

Well, I'm gonna run back outside and make sure the cows have enough water. I think I might tell my mom when she comes to pick me up next week that I want to be a dairy farmer when I grow up! I'll write more later – bye for now!

Based on the reading, answer the following questions:

1. How does the quality of cattle feed affect the production of a dairy cow?

2. Why should we care about the quality of manure from cows?

3. How are dairy cows ultimate, efficient recyclers?

A Day Without Dairy

Purpose

In this lesson, students will create, read and interpret graphs relating to the economic importance of the dairy industry in California. Students will be challenged to understand the economic consequences of a day without dairy.

Time

Teacher Preparation:
15 minutes

Student Activities:
70 minutes

Materials

For class:
- Index cards for vocabulary review

For each group:
- Markers
- Scissors
- Glue or paste

For each student:
- "Day Without Dairy" activity sheet
- Empty, clean, single-serving milk carton
- Graph paper

Background Information

The dairy industry is the largest sector of the California farm economy with milk and cream contributing $61.4 billion to the California economy in 2007. Milk and cream are the essential ingredients for all dairy products, a general term used to describe food and beverages made from milk. This includes everything from sweet ice cream to a glassful of nutrient-packed milk. Dairy products are a diverse group of food items. Just think of the hundreds of varieties of cheese alone! California has been the nation's leading dairy state since 1993 when it surpassed Wisconsin in milk production.

In recent years, California dairies have significantly increased milk production due to an increase in the amount of milk each cow produces and a higher number of cows in our state. Although production has increased, fluid milk demand continues to decrease, forcing many dairy processing plants to convert the increasing supply into butter, milk powder and cheese. In 2007, California's dairies produced 40.7 billion pounds of milk, accounting for 22 percent of the nation's milk supply.

The price of dairy products is determined by many different factors. The products go through several stages of processing that may include health testing, pasteurization, packaging and transportation. When we pay for dairy products at the grocery store, we are also paying for the cost of fuel to transport the product to the processing plant and then to the retail location. When you think about the cost of production, which could include technology, machinery, feed prices, maintenance, veterinary services, farm employees and more, the consumer quickly realizes the money he or she pays for nutritious dairy products supports many workers who help along the way.

Dairy products not consumed in the United States are exported worldwide. Exporting is sending milk, dairy products or any other commodity abroad for trade or sale. People throughout the world are enjoying dairy products from California. Many factors affect the amount of dairy products exported every year, including world weather conditions, natural disasters, market regulations and demand. For example, in recent years, exports of dairy products from the U.S. have increased due to droughts in other dairy- producing nations.

With all these facts, it's hard to imagine a day without dairy. Even a single day without dairy would have a devastating effect on California's economy. The dairy industry provides over 435,000 full-time jobs and brings in approximately 20 million dollars to California's economy every day.

A Day Without Dairy

California Standards

Grade 4

Common Core English Language Arts
W.4.1, L.4.4.C

Grade 5

Common Core English Language Arts
W.5.1, L.5.4.C

Common Core Mathematics
5.NBT.A.4

Grade 6

Common Core English Language Arts
W.6.1, L.6.4.C, RST.6-8.7

Common Core Mathematics
6.SP.B.5, 6.SP.B.5.C

Procedure

1. Take a poll of the class to determine students' favorite type of cheese: Mozzarella, American, Cheddar or Swiss. Create a chart on the board to record students' responses to the poll. Ask students what type of graph should be used to illustrate the information. Students can work in groups or as a class to create the appropriate graph.

2. Review with students the purpose of graphs in displaying important information. A large part of an economist's job is collecting data, creating graphs and interpreting those graphs to determine changes in the market. Why would it be beneficial for someone in the dairy industry (or any other agriculture industry) to be interested in the changes within the agriculture market?

3. Explain that economists and dairy farmers alike use graphs to determine the importance of dairy product sales in the economy. In this lesson, students will create and read different graphs to better understand the role of dairy in our daily lives.

4. It may be helpful to work with students in creating a "word wall" of vocabulary words they will read and write during the lesson. Place definitions of challenging vocabulary words on the board, depending on grade level. Pass out index cards featuring corresponding vocabulary words to each group. Groups take turns matching their vocabulary word to the correct definitions. Direct students to orally use the words in a sentence and/or record the definitions on a separate piece of paper.

5. Students complete the "Day Without Dairy" activity sheet.

6. Discuss the economic impacts of a day without dairy. Work with the students to estimate the quantity of milk consumed daily in California. For example, poll the class to determine the amount of dairy products the class consumes daily. Use multiplication to estimate the amount of dairy products consumed by the entire school, city, state and country. Discuss with the class:

    a. The amount of money lost in a day without dairy
    b. The dairy industry's impact on jobs and employment
    c. The basic concept of supply and demand
    d. If California stopped producing milk, how would we get dairy products? How would this affect prices at the store?

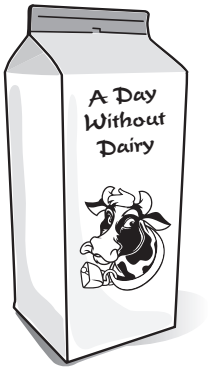
A Day Without Dairy

ELL Adaptations

- Explain each component of the graph before students begin activities. Review key vocabulary words, encouraging student response.
- Create overhead transparencies and demonstrate how to create graphs in front of the class.
- Students may work in pairs to create poster-sized graphs and answer corresponding questions.

7. Review activity. Students review their learning by creating "A Day Without Dairy" milk carton. Students decorate a milk carton depicting newly-acquired concepts on each side. If time allows, they can make their carton colorful and creative.

   Side 1
   Title: *A Day Without Dairy*, Drawing, Name
   Side 2
   Answer the following question, using complete sentences, on lined paper. What would a day without dairy be like?
   A year? Paste your response to the milk carton.
   Side 3
   Paste a copy of the bar graph you created illustrating exports from the United States, Canada and Russia.
   Side 4
   On a separate piece of paper, list all vocabulary words learned, including definitions. Paste your list to the milk carton.



Extensions

- Students work in groups to determine statistics they would like to discover about the dairy industry. Students research and collect the needed information, determine the appropriate type of graph to use and create a graph that accurately represents the information they collected. Groups take turns presenting their findings to the class.
- Students visit the grocery store and record the prices for commonly consumed dairy products. Students keep a "My Day of Dairy" food journal and determine the amount of money spent on the dairy products they personally eat each day.
- Students research factors contributing to dairy product sales. What causes an increase or decrease? Use online tools, write a letter to a dairy farmer or invite a dairy farmer to your class to ask these (and other) questions.

Variations

- Students create a chart reflecting the data graphed for cheddar cheese production in California (pg. 44). Using the chart they created, students find mean, median, mode and range.
- Students work in groups to make milk carton review tools, substituting the pint-sized container with a half-gallon milk carton. Students summarize their findings in front of the class.

A Day Without Dairy

Bar Graph

On a separate piece of graph paper, create a bar graph comparing the amount of cheese, butter and nonfat dry milk exported from the United States, Canada and Russia in 2007.

Total Sales (in 1,000 metric tons)

	Cheese	Butter	Nonfat Dry Milk
United States	99	41	255
Canada	8	16	8
Russia	10	0	15

Determine the following. Round to the nearest tenth. Show all your work.

Mean (average)

Cheese:

Butter:

Nonfat Dry Milk:

Median (middle)

Cheese:

Butter:

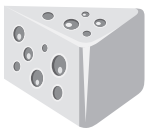
Nonfat Dry Milk:

Range (span)

Cheese:

Butter:

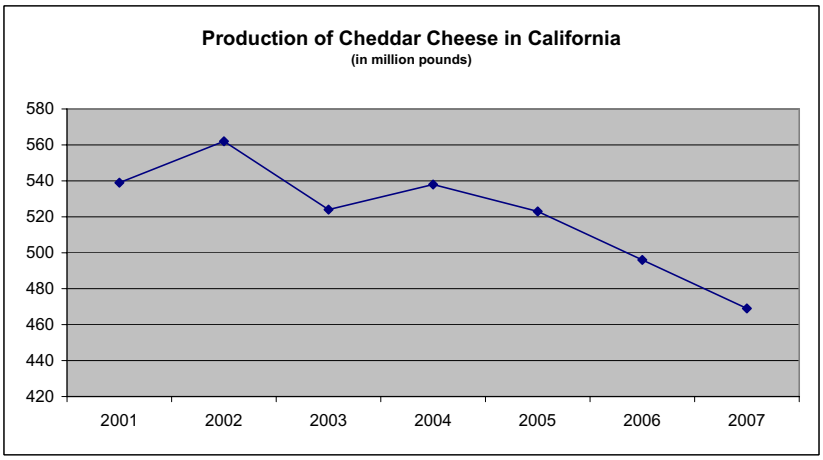
Nonfat Dry Milk:



A Day Without Dairy

Line Graph

Interpret the line graph below to answer the following questions.



Given this line graph:

1. Summarize the production **trends** from 2001 to 2007.

2. What year did the dairy industry experience the least amount of cheddar cheese production? How much did we produce that year?

3. What year did the dairy industry experience the greatest amount of cheddar cheese production? How much did we produce?

4. Predict if cheddar cheese production will increase or decrease in the future and why.

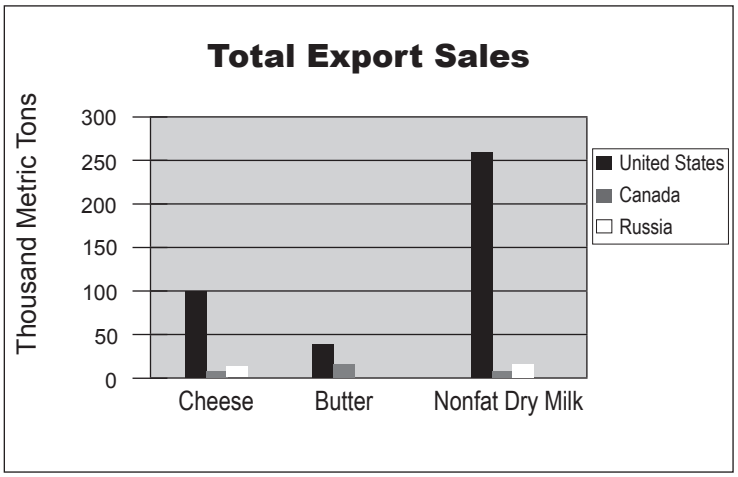
5. Between what two years did the greatest change occur? Was the change an increase or decrease?

6. Label the horizontal (x-axis) and vertical (y-axis) axes.

A Day Without Dairy

Answer Sheet

Bar Graph



Mean

a. Cheese: 39
b. Butter: 19
c. Nonfat Dry Milk: 92.6

Median

a. Cheese: 10
b. Butter: 16
c. Nonfat Dry Milk: 15

Range

a. Cheese: 91
b. Butter: 41
c. Nonfat Dry Milk: 247

Line Graph

1. There is an overall decreasing production trend from 2001 to 2007.
2. The dairy industry experienced the least amount of cheddar cheese production in 2007. We produced about 467 million pounds.
3. The dairy industry experienced the greatest amount of cheddar cheese production in 2002. We produced about 560 million pounds.
4. Based on the history of production, I predict it will decrease in the future.
5. The greatest change was between 2002 and 2003 when production decreased.
6. x-axis: Year; y-axis: Millions of Pounds

Matrix of Standards - 4th Grade

Standard	Standard Description	Cowabunga!	Sun, to Moo, to You	Milk Makin' Math	Ultimate Efficient Recycler	A Day Without Dairy
Common Core English-Language Arts						
L.4.4.C Language	Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation and determine or clarify the precise meaning of key words and phrases.					x
RI.4.1 Reading Informational Text	Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.	x			x	
RI.4.2 Reading Informational Text	Determine the main idea of a text and explain how it is supported by key details; summarize the text.				x	
RI.4.3 Reading Informational Text	Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.				x	
RF.4.4 Reading Foundational Skills	Read with sufficient accuracy and fluency to support comprehension.	x				
SL.4.1 Speaking and Listening	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.	x				
SL.4.1.D Speaking and Listening	Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.				x	
W.4.1 Writing	Write opinion pieces on topics or texts, supporting a point of view with reasons and information.					x
Next Generation Science Standards						
4-LS1-1 From Molecules to Organisms	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.		x			
4-PS3-1 Energy	Use evidence (e.g., measurements, observations, patterns) to construct an explanation relating the speed of an object to the energy of that object.		x			

Matrix of Standards - 4th Grade

Standard	Standard Description	Cowabunga!	Sun, to Moo, to You	Milk Makin' Math	Ultimate Efficient Recycler	A Day Without Dairy
Common Core Mathematics						
4.MD.A.2 Measurement and Data	Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.			x		
4.NBT.B.4 Numbers and Operations in Base Ten	Fluently add and subtract multi-digit whole numbers using the standard algorithm.			x		
4.NBT.B.6 Numbers and Operations in Base Ten	Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.			x		
4.OA.A.2 Operations and Algebraic Thinking	Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.			x		
4.OA.A.3 Operations and Algebraic Thinking	Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.			x		
California History-Social Science						
4.1.1	Explain and use the coordinate grid system of latitude and longitude to determine the absolute locations of places in California and on Earth.	x				
CA.K-5.HSSA 4	Students use map and globe skills to determine the absolute locations of places and interpret information available through a map's or globe's legend, scale, and symbolic representations.	x				
California Physical Education						
1.5 Locomotor Movement	Jump a self-turned rope.		x			
1.14 Manipulative Skills	Serve a lightweight ball to a partner, using the underhand movement pattern.		x			

Matrix of Standards - 5th Grade

Standard	Standard Description	Cowabunga!	Sun, to Moo, to You	Milk Makin' Math	Ultimate Efficient Recycler	A DayWwithout Dairy
Common Core English-Language Arts						
L.5.4.C Language	Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation and determine or clarify the precise meaning of key words and phrases.					x
RF.5.4 Reading Foundational Skills	Read with sufficient accuracy and fluency to support comprehension.	x				
RI.5.1 Reading Informational Text	Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.	x			x	x
RI.5.2 Reading Informational Text	Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.				x	
RI.5.3 Reading Informational Text	Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.				x	
SL.5.1 Speaking and Listening	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.	x				
SL.5.2 Speaking and Listening	Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.				x	
W.5.1 Writing	Write opinion pieces on topics or texts, supporting a point of view with reasons and information.					x
Next Generation Science Standards						
5-LS2-1 Ecosystems	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.		x		x	
5-PS3-1 Energy	Use models to describe that energy in animals' food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun.		x			

Matrix of Standards - 5th Grade

Standard	Standard Description	Cowabunga!	Sun, to Moo, to You	Milk Makin' Math	Ultimate Efficient Recycler	A DayWwithout Dairy
Common Core Mathematics						
5.NBT.A.3 Numbers and Operations in Base Ten	Read, write, and compare decimals to thousandths.			x		
5.NBT.A.4 Numbers and Operations in Base Ten	Use place value understanding to round decimals to any place.			x		x
5.NBT.B.5 Numbers and Operations in Base Ten	Fluently multiply multi-digit whole numbers using the standard algorithm.			x		
5.NF.B.3 Fractions	Interpret a fraction as division of the numerator by the denominator (a/b = a ÷ b). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem.			x		
California History-Social Science						
5.2.1	Describe the entrepreneurial characteristics of early explorers (e.g., Christopher Columbus, Francisco Vásquez de Coronado) and the technological developments that made sea exploration by latitude and longitude possible (e.g., compass, sextant, astrolabe, seaworthy ships, chronometers, gunpowder).	x				
5.8	Students trace the colonization, immigration, and settlement patterns of the American people from 1789 to the mid-1800s, with emphasis on the role of economic incentives, effects of the physical and political geography, and transportation systems.	x				
CA.K-5.HSSA 4	Students use map and globe skills to determine the absolute locations of places and interpret information available through a map's or globe's legend, scale, and symbolic representations.	x				
California Physical Education						
1.16 Manipulative Skills	Pass a ball back and forth with a partner, using a chest pass and bounce pass.		x			

Matrix of Standards - 6th Grade

Standard	Standard Description	Cowabunga!	Sun, to Moo, to You	Milk Makin' Math	Ultimate Efficient Recycler	A DayWwithout Dairy
Common Core English-Language Arts						
L.6.4.C Language	Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning or its part of speech.					x
R1.6.1 Reading Informational Text	Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.	x			x	
RI.6.2 Reading Informational Text	Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.				x	
RST.6-8.2 Science and Technical Subjects	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.				x	
RST.6-8.7 Science and Technical Subjects	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).					x
SL.6.1 Speaking and Listening	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.	x				
W.6.1 Writing	Write arguments to support claims with clear reasons and relevant evidence.					x
Next Generation Science Standards						
MS-LS1-5 From Molecules to Organisms	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.				x	
MS-LS1-6 From Molecules to Organisms	Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.		x			
MS-LS2-3 Ecosystems	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.				x	

Matrix of Standards - 6th Grade

Standard	Standard Description	Cowabunga!	Sun, to Moo, to You	Milk Makin' Math	Ultimate Efficient Recycler	A DayWwithout Dairy
Common Core Mathematics						
6.NS.B.2 The Number System	Fluently divide multi-digit numbers using the standard algorithm.			x		
6.NS.B.3 The Number System	Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.			x		
6.RP.A.3 Ratios and Probability	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.			x		
6.RP.A.3.C Ratios and Probability	Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.			x		
6.SP.B.5 Statistics and Probability	Summarize numerical data sets in relation to their context.					x
6.SP.B.5.C Statistics	Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.					x
California History-Social Sciences						
6.2	Students analyze the geographic, political, economic, religious, and social structures of the early civilizations of Mesopotamia, Egypt, and Kush.	x				
CA.6-8.HSSA 3	Students use a variety of maps and documents to identify physical and cultural features of neighborhoods, cities, states, and countries and to explain the historical migration of people, expansion and disintegration of empires, and the growth of economic systems.	x				
California Physical Education						
1.6 Manipulative Skills	Throw an object accurately and with applied force, using the underhand, overhand, and sidearm movement (throw) patterns.		x			
5.1 Self-Responsibility	Participate productively in group physical activities.		x			
5.2 Self-Responsibility	Evaluate individual responsibility in group efforts.		x			

Glossary

Accountant: A person who keeps records of business-related financial transactions.

Almond hulls: The remains of an almond after the nut is removed during processing.

Breed: A group of organisms having common ancestors and certain distinguishable characteristics.

By-product: Something produced in the making of something else.

Cattle: Group of domesticated bovine animals.

Chemical energy: The energy stored in chemical bonds.

Compost: A mixture of decaying organic matter, as from leaves and manure, used to improve soil structure and provide nutrients.

Country of origin: The country of birth, manufacture, production or growth where an animal, article or product comes from.

Cow: The mature female of a bovine animal.

Dairy farmer: A person who specializes in raising cattle, specifically for dairy products.

Dairy nutritionist: An animal health professional who specializes in the nutritional needs of dairy cows.

Decomposer: An organism, often a bacterium or fungus, which feeds on and breaks down dead plant or animal matter, thus making organic nutrients available to the ecosystem.

Demand: The desire to possess a commodity or make use of a service, combined with the ability to purchase it.

Domestication: To train or adapt an animal to live in a human environment and be of use to humans.

Economist: A specialist in economics.

Ecosystem: A community of organisms, together with their environment, functioning as a unit.

Electrical energy: The energy of electricity.

Energy: The ability to perform work or change an object.

Glossary

Expense: The cost or value of paying for an item or service.

Hay: A dried feed ingredient such as rye, alfalfa, clover, grass and oats usually bundled in bales.

Kinetic energy: The energy of a moving object.

Lactose: A sugar that gives milk its sweet flavor.

Macroorganisms: The animals, mostly invertebrate, living in the soil that are visible to the naked eye.

Market: The opportunity to buy or sell; extent of demand for merchandise.

Marketing manager: A marketing manager advertises, promotes and sells a product to distributors, processing plants and eventually to the public.

Microorganism: A microscopic organism that is too small to be seen by the naked eye.

Milk fat: The fatty portion of milk. Milk and cream are often sold according to the amount of butterfat they contain.

Milk powder: Milk with all the liquid squeezed out, leaving only solids behind.

Nitrogen: A chemical element given to plants to enable quick growth.

Nonfat dry milk: Dehydrated skimmed milk.

Pasteurization: The act or process of heating a beverage or other food, such as milk, to a specific temperature for a specific period of time in order to kill microorganisms that could cause disease, spoilage or undesired fermentation.

Phosphorous: A chemical element given to plants to promote root growth, seed production and flower bloom.

Photosynthesis: The food-making process in green plants that uses sunlight.

Potassium: A chemical element found in plants promoting stem strength and increasing resistance to pests and drought.

Processing plant: A facility that pasteurizes and packages milk that comes directly from dairy farms.

Glossary

Profit: The financial return received after all operating expenses have been met.

Radiant energy: The energy of light.

Safety inspector: A person who prevents harm to workers, property, the environment and the public by inspecting the process of production and the product itself.

Silage: Fermented, high-moisture feed that is eaten by grazing animals such as dairy cows.

Supply: The amount of a product available for meeting a demand or for purchase at a given price.

Thermal energy: Energy that increases as temperature increases; energy as heat.

Total mixed ration (TMR): A nutritionally-balanced animal feed of forage and grain ingredients.

Udder: The part of a cow's body where milk is produced.

Veterinarian: A doctor for animals.

Worm cast: The waste material produced by worms after the digestive process.

Answers to Commonly – Asked Questions

Dairy Background Information

How much milk does a cow produce each day?
On average, a cow can produce 6-7 gallons of milk each day.

What do cows eat?
Cows eat about 100 pounds of feed each day. Dairy feed is a balanced diet of hay, grain and silage (fermented corn or grass). Cows drink up to 50 gallons of water every day.

What are the correct terms for different dairy animals?
Males are called bulls. Females, prior to giving birth, are called calves or heifers. Once they give birth, female dairy animals are called cows.

What are the nutritional benefits of consuming dairy products?
Dairy products are packed with nine essential nutrients, including calcium and vitamin D, that are often lacking in the diets of many Americans. Here are some benefits of drinking three glasses of milk a day:

Dairy's Nutrient Package	Amount in Three Glasses of Milk	Percent Daily Value*
Calcium: A mighty mineral that builds strong bones and teeth	900 mg	90%
Vitamin D: An important bone builder that enhances calcium absorption	300 IU	75%
Vitamin A: Keeps your skin healthy, regulates immune system and helps your eyes see normally in the dark	1,500 IU	30 %
Protein: Vital for building and maintaining muscle	24 g	48 %
Potassium: Maintains your blood pressure, regulates fluid balance and helps your muscles contract	1,170 mg	33 %
Riboflavin: Helps produce energy in all cells of your body	1.2 mg	70 %
Niacin: Helps enzymes function normally in your body	6 NE	30 %
Vitamin B 12: Works closely with folate to make red blood cells and plays a key role in cell growth and division	2.4 mcg	40 %
Phosphorus: Works with calcium to keep bones strong	600 mg	60 %

**Daily values are set by the Government and reflect current nutrition recommendations for a 2,000 calorie/day diet.*

Answers to Commonly – Asked Questions

Dairy Background Information

How much does it cost to produce one gallon of milk?

Input costs, such as processing, labor, transportation and raw product costs, vary considerably. Even the type of milk will have an impact on the final cost, making the cost of producing a gallon of milk inconsistent. However, researchers estimate that it costs between $1.96 and $2.35 for processors to produce a gallon of milk, before transport to the retail store.

How and why is milk pasteurized?

All milk intended for direct consumption should be pasteurized for food safety. Pasteurization is a simple, effective method of killing potentially harmful bacteria without affecting the taste or nutritional value of milk. With standard pasteurization, milk is heated to a temperature of at least 161 degrees Fahrenheit for not less than 15 seconds, followed by rapid cooling.

How should milk and dairy products be stored and handled?

After arriving home from the grocery store, dairy products should immediately be transferred to the refrigerator. With proper handling, milk should last five to seven days after its "sell-by" date. The refrigerator should be 38° to 40°F to slow bacterial growth. Store milk in the back of the refrigerator and away from the refrigerator door. This keeps the temperature lower and more constant. The sealed container will prevent contamination and absorption of flavors from other foods in the fridge. If the milk develops an off-odor smell, it should be discarded. Storing dairy products in their original packaging with a securely closed lid will help decrease spoilage.

In the case of other dairy products, such as cheese and yogurt, bacteria play an important role in flavor, function and good health. Most yogurts, including yogurts made in California, are made by the addition of two or more types of bacteria, including *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. These types of bacteria are called "cultures" and work to create distinct flavors and textures in the yogurt. To ensure the safety of yogurt, store it in the refrigerator in its original sealed container. Moldy yogurt should be discarded.

Cheese is also the product of cultures and an aging process that causes fermentation. There is a wide range of production methods that yield many different flavors and forms of cheese. In general, you should follow the same storage tips as milk and yogurt. If mold is on cheese, the block of cheese can generally still be eaten. If a small patch of mold appears on a piece of cheese, trim it off completely by cutting off and discarding at least one-quarter inch below the mold. Plan to consume the rest if cheese soon. Always check the "sell-by" date before you purchase cheese. If there is mold on fresh cheese, do not purchase it.

Answers to Commonly – Asked Questions

Dairy Background Information

How can people be assured the dairy products they eat are safe?

Personnel from the United States Department of Agriculture, the United States Environmental Protection Agency and other government agencies continually meet with research scientists, technical experts, farmers, ranchers and the general public to discuss food safety issues. They establish guidelines and standards for all food processors, handlers and others involved in food production and distribution. Inspections occur on a regular basis to make sure that dairy products meet government standards and regulations. The United States currently has the safest food supply in the world and continues to work hard to maintain this position. By practicing safe food handling and storage, consumers also play a significant role in food safety.

Why do farmers treat cows with antibiotics?

Sometimes, cows get sick just as some humans do. Without proper medical care, the cows could become seriously ill or die. It is a dairy farmer's job to treat them and make them well again with medications prescribed by a veterinarian. Sick cows still have to be milked, but during treatment their milk is thrown away. Strict U.S. regulations and standards are in place to monitor antibiotic use and assure food safety.

Are there antibiotics in milk?

No. All milk is tested for antibiotics. Any tanker that tests positive is disposed of immediately.

Are there hormones added to milk?

No. Hormones are naturally present in many foods that come from plants and animals, including milk, but farmers don't add hormones to the milk. Some farmers choose to give some of their cows a supplement called bST to increase milk production, but research shows that this practice has no effect on hormone levels in the milk itself.

What is the difference between whole and fat-free milk?

Fat-free milk is made by skimming off the fat. A cup of fat-free milk contains less than one-half gram of fat and is fortified with vitamin A and usually with vitamin D. In the United States, skim or fat-free milk is also known as nonfat milk. Nonfat milk contains comparable amounts of protein, calcium, potassium, phosphorous and other key nutrients found in higher-fat milks such as whole milk.

Answers to Commonly – Asked Questions

Dairy Background Information

What is the difference between organic and regular milk?
Organic milk is identical in composition to regular milk. Organic dairy farmers use only organic fertilizers and organic pesticides, and their cows are not given supplemental hormones. The milk itself, however, is identical to milk produced conventionally. Stringent government standards that include testing all types of milk for antibiotic and pesticide residues ensure that both organic milk and conventional milk are safe and nutritious.

How are dairy farmers practicing sustainable agriculture?
California has the nation's toughest environmental regulations and a deep commitment to stewardship and innovation. Many California dairy farmers have been practicing "new" sustainability methods for generations. Here are some of the ways dairy farmers practice sustainable agriculture:

Homegrown Feed: California dairies grow much of their own feed. Locally grown and fertilized crops save water, fuel and fertilizer.

Waste Watchers: Many food products that were once sent to landfills are now fed to cows, including culled tomatoes, almond hulls, bakery crumbs and more.

Water Wise: Water is a precious commodity. Clean water is used to care for cows and recycled water is used to wash the barn and irrigate crops.

Powering Up: More and more dairies are exploring the opportunities of biogas digestion. This promising technology can generate power for the dairy and its neighboring communities, all while reducing greenhouse gases.

Teacher Resources and References

California Foundation for Agriculture in the Classroom

Dairy Fact and Activity Sheet
This California-specific fact sheet includes information on dairy production, history, nutrition and economic value. The activity sheet provides specific lesson ideas and fun facts on the dairy industry.

Teacher Resource Guide
This guide provides resource listings on materials related to agriculture. Includes lesson plans, posters, Web sites, book lists, phone numbers and California agriculture statistics. Free for California residents. Also downloadable from the Web.

What's Growin' On?
This newspaper highlights the many farms, environments and diverse foods thriving in California. Activities, trivia, readings and graphics are sprinkled throughout, providing a connection for every learner. Available in class sets throughout the year.

California Foundation for Agriculture in the Classroom
2600 River Plaza Drive, #220
Sacramento, CA 95833-3293
Phone: (916) 561-5625
Toll free: (800) 700-AITC
Fax: (916) 561-5697
E-mail: *info@learnaboutag.org*
Web site: *www.LearnAboutAg.org*

CDE Press

The Content Standards for California Public Schools, subject matter frameworks and all other California Department of Education publications are available through this company. They are also available on the California Department of Education Web site

California Department of Education
CDE Press, Sales Unit
1430 N Street, Suite 3207
Sacramento, CA 95814
Phone: (916) 445-1260
Toll free: (800) 995-4099
Fax: (916) 323-0823
Web site: *www.cde.ca.gov/re/pn/rc/*

Dairy Ag Mag

Classroom sets of 30 "Ag Mag" magazines are provided in a set. Topics covered include nutrition, processing, homogenization, breeds and careers.

American Farm Bureau Foundation for Agriculture
600 Maryland Avenue SW, Suite 800
Washington, DC 20024
Phone: (202) 406-3700
Fax: (202) 406-3756
E-mail: *bettyw@fb.org*
Web site: *agfoundation.org/recommended-pubs/dairy-ag-mag*

Dairy Council of California

BreakFAST & Jump To It!
Test your knowledge about the importance of eating a healthy breakfast and what makes up a healthy breakfast.

Deal Me In . . . food and fitness
Deal Me In... food and fitness is a self-contained program that provides fun, hands-on, engaging ways to introduce and reinforce healthy eating and physical activity in after-school programs. Materials include color workbooks for each student, complete full color food cards and parent newsletter in English and Spanish. Updates reflect the USDA's MyPyramid and 2005 Dietary Guidelines.

Teacher Resources and References

Exercise Your Options
A nutrition and fitness program that centers around the uniqueness of teens. This eight-lesson unit offers peer teaching strategies, information and activities on current adolescent issues including: Body Image; Bone Health; Sports Nutrition; Disordered Eating; Navigating Options, Choices and Decisions Away from Home; Realistic Portion Sizes; and Nutrition and Achievement. Included is a CD-ROM which houses eight video clips that help the student engage with the program lessons and learn through multiple learning modalities. This free program supports California state and national standards for language arts, math and science. Updated to reflect the current USDA MyPyramid and 2005 Dietary Guidelines. Newly aligned to several state-adopted text books.

My Very Own Pizza
Learn about the nutrition and history of one of our favorite foods. Newly updated version reflects USDA MyPyramid and 2005 Dietary Guidelines.
Available online

Dairy Council of California
1101 National Drive, Suite B
Sacramento, CA 95834
Phone: (916) 263-3560
Fax: (916) 263-3566
E-mail: *info@dairycouncilofca.org*
Web site: *www.dairycouncilofca.org*

Hilmar Cheese Company

Cow to Calcium Virtual Tour
Join "Daisy" as she takes you on a virtual tour from "Cow to Calcium." Education section of Web site features virtual tour (with animated graphics) and printable activity pages. View *www.hilmarcheese.com/CowTour.cms*

Daisy Dairy ABC's All About Cheese
This student activity booklet, aligned to the state content standards, provides information on cows, cheese production, recycling and careers in agriculture.

Hilmar Cheese Company Visitor Center
9001 North Lander Avenue
Hilmar, CA 95324
Phone: (209) 656-1196
Toll free: (800) 577-5772
Fax: (209) 656-1116
E-mail: *dskidmore@hilmarcheese.com*
Web site: *www.hilmarcheese.com*

Livestock Cards
This full-color set of six cards provides illustrations about livestock, including beef cattle, sheep, dairy cattle, poultry, swine and a vocabulary card. The back side of the card has basic information about each species.
Available free online

Nebraska Foundation for Agricultural Awareness
5225 South 16th Street
Lincoln, NE 68512
Phone: (402) 421-4408
E-mail: *ellenh@nefb.org*
Web site: *www.agclassroom.org/ne*

Milk: From Cow to You
Poster and package describing steps in milk production, processing and marketing. Includes teacher's guide, poster and 30 handouts.

National Dairy Council
10255 W. Higgins, Suite 900
Rosemont, IL 60018
Phone: (847) 803-2000
Fax: (847) 803-2077
E-mail: *barbarae@rosedmi.com*
Web site: *www.discoverundeniablydairy.com*

The Milk Makers
Learn how milk travels from a dairy cow to the neighborhood supermarket in this exciting Reading Rainbow episode created from the story *The Milk Makers* by Gail Gibbons. Available on VHS or DVD.

GPN, LLC
1407 Fleet Street
Baltimore, MD 21231
Phone: (410) 843-6852
Toll free: (800) 228-4630
Fax: (800) 306-2330
E-mail: *shawn.soltesz@smarterville.com*
Web site: *www.shopgpn.com*
Web site: *www.hookedonphonics.com*

The Story of California Milk;
The Cheesemakers
These videos give behind-the-scenes looks at how milk goes from cow to carton in your local supermarket and shows each step from separating curds and whey to packaging aged cheese for distribution.

California Milk Advisory Board
400 Oyster Point Blvd., Suite 211
South San Francisco, CA 94080
Phone: (650) 871-6455
Fax: (650) 583-7328
Email: *askus@realcaliforniamilk.com*
Web site: *www.RealCaliforniaCheese.com*

Related Web Sites

This list is offered as an informational resource only. It contains Web sites established by various entities and, at the time of printing, included information on dairy or a subject matter related to the instructional materials unit *Milk Matters: Discovering Dairy*. The list is not considered to be all-inclusive. The entities or contents of the sites on this list are not endorsed by California Foundation for Agriculture in the Classroom or by the authors of *Milk Matters: Discovering Dairy*.

American Society of Animal Science
www.asas.org

California Department of Education Curriculum and Instructional Leadership Branch
www.cde.ca.gov/ci

California Department of Food and Agriculture
www.cdfa.ca.gov

California Department of Food and Agriculture-Kids
www.cdfa.ca.gov/kids

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

California Milk Advisory Board
www.realcaliforniamilk.com

Dairy America
www.dairyamerica.com

Dairy Council of California
www.dairycouncilofca.org

Heifer International
www.heifer.org

Hilmar Cheese Company
www.hilmarcheese.com

Moo Milk
www.moomilk.com

National Dairy Council
www.discoverundeniablydairy.com

Purina Mills, Dairy
www.dairy.purinamills.com

Real California Cheese
www.realcaliforniamilk.com

USDA Agriculture in the Classroom
www.agclassroom.org

Related Literature

Aliki. ***Milk: From Cow to Carton***. HarperTrophy, 1992. Learn how milk travels from cow to farmer to container.

Barraclough, Sue. ***Animals on the Farm***. Raintree, 2006. Learn the sights and sounds of typical farm animals by reading this simple text accompanied by colorful photographs.

Basel, Roberta. ***From Milk to Cheese***. Capstone Press, 2006. Follow the journey of cheese, from the milk of a cow to a factory for processing.

Bell, Rachael. ***Cows***. Heinemann Library, 2001. Discover interesting facts, like how cows are used around the world, through colorful photographs and simple text.

Brady, Peter. ***Vacas***. Bridgestone Books, 1999. This book, with Spanish text, shows the raising and caring of cattle.

Chan, Harley. ***Ice Cream for You***. National Geographic, 2001. In this early reader, learn where milk comes from and how it turns into ice cream.

Christian, Eleanor and Lyzz Roth-Singer. ***Let's Make Butter***. Capstone Press, 2000. Learn where butter comes from and how it is made in this emerging reader with colorful photographs.

Duffield, Katy. ***Farmer McPeepers and His Missing Milk Cows***. Rising Moon, 2003. Farmer McPeeper cannot find his milk cows so he tours the town in a wacky adventure.

Fandel, Jennifer. ***Louis Pasteur and Pasteurization***. Capstone Press, 2007. Formatted like a graphic novel, this book tells the story of Louis Pasteur's invention of the pasteurization process and the effects of this invention on the spread of disease through food.

Gibbons, Gail. ***The Milk Makers***. Aladdin, 1987. Text and pictures explain how cows produce milk and how it is processed before being delivered to stores.

Hall, Margaret. ***Cows and Their Calves***. Capstone Press, 2003. This nonfiction primary reader shows how calves are raised to become mature adults.

Jackson, Woody. ***Counting Cows***. Red Wagon Books, 1999. A whimsical counting book features cows and cow terminology.

Related Literature

Kalman, Bobbie. ***Hooray for Dairy Farming***. Crabtree Publishing Company, 1997. Learn about the many aspects of the dairy industry through color photographs and simple text.

Keller, Kristin Thoennes. ***From Milk to Ice Cream***. Capstone Press, 2005. Follow along as cows are milked, the milk is taken to the dairy and made into ice cream

Knight, Bertram T. ***From Cow to Ice Cream***. Children's Press, 1997. Through colorful photographs and simple text, take a journey and discover how ice cream is made.

Leeper, Angela. ***Dairy Plant***. Heinemann Library, 2004. Take a field trip to a dairy plant and learn how milk is processed into butter, cheese and ice cream.

Lesser, Carolyn. ***What a Wonderful Day to be a Cow***. Alfred A. Knopf, 1995. Every month of the year, the animals on the farm enjoy their way of life. Describes seasons of the year on a farm.

Llewellyn, Claire and Helaine Cohen. ***What's for Lunch? Milk***. Franklin Watts, 2003. This book reveals how milk is produced and the many products made from it.

Longenecker, Theresa. ***Who Grows Up on the Farm? A Book About Farm Animals and Their Offspring***. Picture Window Books, 2002 Full-color illustrations and fact-filled text discuss the various kinds of babies that grow up on a farm. Includes factual charts and tables.

Maze, Stephanie. ***I Want to Be a Veterinarian***. Harcourt, 1999. Photos and facts describe different kinds of vets, how veterinary science began, and where it is headed. Also shows how to begin exploring the career.

Murphy, Andy. ***Out and About at the Dairy Farm***. Picture Window Books, 2002. This picture book gives factual information about milk production.

Older, Jules. ***Cow***. Charlesbridge, 1998. A lighthearted, nonfiction book on cows, breeds and milk production.

Older, Jules. ***Ice Cream: Including Great Moments in Ice Cream History***. Charlesbridge, 2002. Learn about one of America's favorite desserts through fun historical facts.

Pukite, John. ***A Field Guide to Cows***. Penguin Books, 1998. Describes the 52 breeds of cattle in a format that assists in their identification.

Related Literature

Schuh, Mari C. ***Cows on the Farm***. Capstone Press, 2001. Learn, through photographs and primary text, how farmers raise cows.

Schuh, Mari C. ***The Milk Group***. Capstone Press, 2006. Using the USDA's MyPyramid, learn how dairy products should be a part of your diet.

Shuter, Jane. ***Farming & Food***. Heinemann Library, 1999. Take a trip into the past to discover the world of the Ancient Egyptians in regards to their food sources and farming methods.

Taus-Bolstad, Stacy. ***From Grass to Milk***. Lerner Publishing Company, 2003. Through color photographs, learn how farmers work to get the milk you drink to the kitchen table.

Warnock, Natalie Kinsey. ***A Farm of Her Own***. Dutton Children's Books, 2001. When Emma was 10, she went to spend the summer with Aunt Ada and Uncle Will at Sunnyside Farm, opening a whole new world to her. She milked cows, gathered eggs and appreciated her relatives who lived there.

Woods, Michael and Mary B. Woods. ***Ancient Agriculture***. Runestone Press, 2000. Explains in simple terms how the story of agriculture is also the story of civilization. Also describes how ancient cultures left a rich legacy of agricultural knowledge and technology.