DAIRY COUNCIL® OF AZ & NV

STEAM LESSONS

K-12 GRADES

A guide for educators that covers lessons that enhance problem-solving skills in students through creativity and innovative ways.

DAIRY COUNCIL® OF AZ & NV

LESSONS FOR GRADES K-5

Engineering: Farming Equipment

Science: Butter in a Cup

Math: Recipe Ingredients

Science: Ice Cream Making

K-5

Engineering

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Dairy Farm Equipment

Imagine a big farm where cows happily munch on grass and give us great milk! But do you know how farmers take care of these cows and make sure they stay healthy? They use **special equipment!** Machines used to harvest and grow cow feed, pasteurize and transport milk are essential parts of a dairy farm. Careers developing, maintaining, and improving these machines would continue to optimize milk production and sustainability.

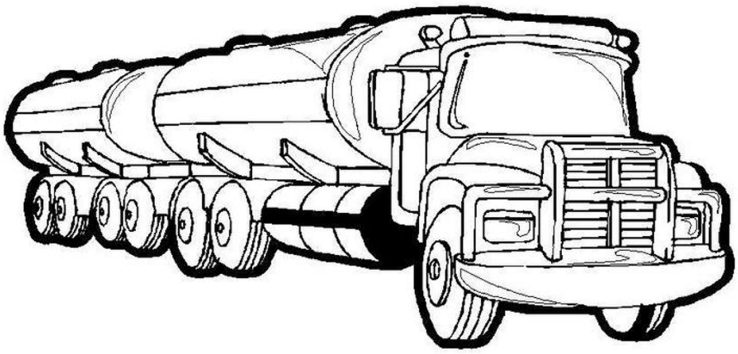
Immerse your class in learning about what each machine does and how it contributes to dairy farming practices.

Hands-on:

Learn about dairy farm equipment with these downloadable coloring pages!

A Tanker Truck is used to transport milk to places like your school!

View coloring sheets



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K-5

Food Science

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Butter in a Cup

Teach your students the food **science behind fat:** how it changes the texture of food, the breakage of bonds through physical alterations, and what happens to whipping cream when fat globules join together with an activity to make butter from whipped cream.

Explain it!

Cream is composed mainly of water and fat. The shaking causes fat globules to interact with each other. When making butter, the fat molecules break free from their globules and join together to form butter.

Hands-on:

View lesson

Or Scan QR code

K-5

Mathematics

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Recipe Ingredients

In this activity sheet, students will get exposure to different dairy-centered recipes and measuring values. Students will be able to identify dairy ingredients in these recipes. Educators will also have the opportunity to **teach measuring units.**

Moreover, by identifying and working with dairy ingredients in these recipes, students will deepen their knowledge of the nutritional value and versatility of dairy products in cooking. With educators guiding the way, this activity provides a fun and educational opportunity for students to explore the world of dairy and measurement in the kitchen.

Hands-on:

Download the activity sheet

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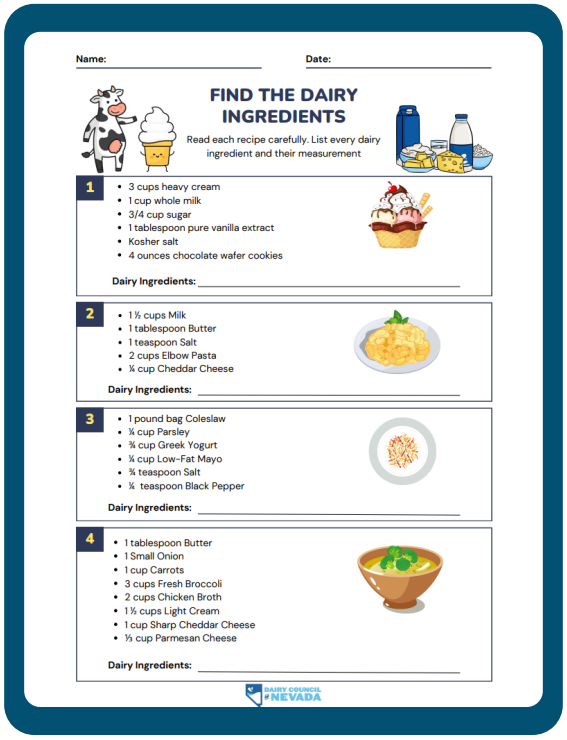

Name: _____ Date: _____

FIND THE DAIRY INGREDIENTS

Read each recipe carefully. List every dairy ingredient and their measurement

1
- 3 cups heavy cream
- 1 cup whole milk
- 3/4 cup sugar
- 1 tablespoon pure vanilla extract
- Kosher salt
- 4 ounces chocolate wafer cookies

Dairy Ingredients: _____

2
- 1 ½ cups Milk
- 1 tablespoon Butter
- 1 teaspoon Salt
- 2 cups Elbow Pasta
- ¼ cup Cheddar Cheese

Dairy Ingredients: _____

3
- 1 pound bag Coleslaw
- ¼ cup Parsley
- ¾ cup Greek Yogurt
- ¼ cup Low-Fat Mayo
- ¾ teaspoon Salt
- ¼ teaspoon Black Pepper

Dairy Ingredients: _____

4
- 1 tablespoon Butter
- 1 Small Onion
- 1 cup Carrots
- 3 cups Fresh Broccoli
- 2 cups Chicken Broth
- 1 ½ cups Light Cream
- 1 cup Sharp Cheddar Cheese
- ½ cup Parmesan Cheese

Dairy Ingredients: _____

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K-5

Science

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Ice Cream Making

Teach your students the science behind the process of changing stages of matter in a fun and unique way. This lesson will dive into the freezing process of turning liquid into solid with milk!

As they engage in the process of freezing milk, students will not only observe the physical changes occurring but also gain a deeper understanding of the underlying scientific concepts at play. They'll explore the **concepts of temperature, energy transfer,** and **molecular structure,** uncovering the intricate mechanisms that govern the transition from liquid to solid.

Hands-on:

Download lesson

Or Scan QR code

Print the recipe

Or Scan QR code

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LESSONS FOR GRADES 6-8

Science: Remarkable Ruminants

Nutrition: Organic Foods

Science: Pasteurization

Technology: High-Tech Farming

6-8 DAIRY COUNCIL OF AZ & NV

Science

Remarkable Ruminants

The **ruminant digestive system** of cows actually helps us use feed resources that would otherwise be discarded as waste. These waste products are known as **byproducts or incidental products** created by the manufacture of something else. An example is a potato peel. Humans cannot digest the majority of what cows eat, making them helpful members of a **sustainable food system.**

Talking Points:

A ruminant is an animal that uses a series of stomach compartments and chews its cud in order to digest plant cellulose.

Grazing cows can improve the quality of rangelands, keeping the area grassy and preventing soil erosion.

Grazing cows also benefit rangeland by providing natural fertilizer for the land in the form of manure.

Hands-On:

In this lab from **Agriculture in the Classroom**, students will follow the farm to fork process of producing beef, learn how cattle and other ruminants convert grass into nutrient-rich foods such as milk and meat, discover ways cattle recycle food waste, and identify careers in the beef cattle industry.

Click for Lesson Plan

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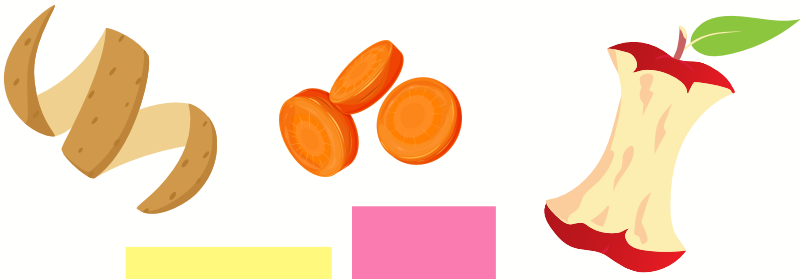

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Organic Foods

Nutrition

Many questions can arise as consumers walk through their local supermarket. In one hand, they have a **conventionally produced** milk gallon. In the other hand, they have a gallon labeled as "**organic**." Both milk gallons provide 13 essential nutrients, including calcium, protein, and vitamin D. The conventionally produced milk costs less and is a proven family favorite. But the organic milk has a label that says "USDA Organic." Does that mean it's better?

Talking Points:

Conventional farming may include the use of genetically modified organisms, synthetic fertilizers, pesticides and other chemical and biological inputs.

Organic is used to classify methods that limit the use of some common practices such as biotechnology and types of fertilizer or pesticide.

Hands-On:

This lab from **Agriculture in the Classroom** students utilize the *claim, evidence and reasoning* model, to compare and contrast organic vs conventionally produced foods to discover the differences and similarities of each farm production style.

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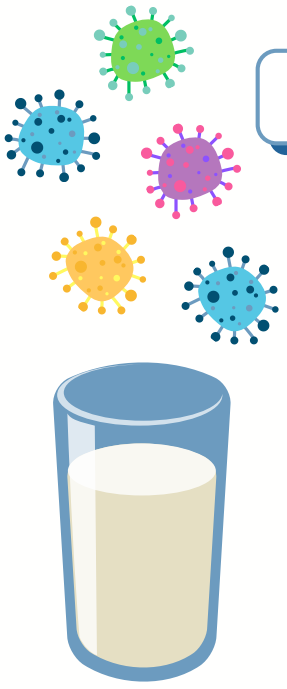
Pasteurization

Science

Pasteurization is used to kill harmful bacteria in milk. The most common practice is **High-Temperature Short-Term (HTST) Pasteurization** or **"Flash Pasteurization."** Raw milk is heated between heated stainless-steel plates until 161°F is reached. It stays at this temperature for at least 15 seconds to kill bacteria before it is quickly cooled back to its original temperature (39°F).

Talking Points:

- This method extends milk's shelf life for 2-3 weeks.
- Pasteurization does not diminish the nutritional quality of milk.
- Pasteurization was developed over 150 years ago by Louis Pasteur.



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Hands-On:

This lab from **Agriculture in the Classroom** introduces students to the effect temperature has on reducing and controlling the growth of bacteria. Students will use conventionally pasteurized and ultra-high-temperature (UHT) milk to observe how different temperatures (hot, room temperature, cool, and freezing) affect the growth of spoilage bacteria. They will also learn about the importance of pasteurization in keeping food safe.

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High-Tech Farming

Technology

In the 1940s, one farmer in the United States produced enough food to feed 19 people. Today, one US farmer produces enough to feed 172 people! The increase in U.S. food production is directly related to the advancement of **agricultural technology**. Agricultural robots automate **repetitive farming tasks**. Robots are used for harvesting, weed control, mowing, pruning, seeding, spraying, sorting, and packing. By automating sub-minimum wage jobs, more food can be produced at a lower cost.

Talking Points:

If the world's farmers would have continued to grow crops at 1961 productivity levels, they would need If the world's farmers would have continued to grow crops at 1961 productivity levels, they would need almost 2.5 billion acres of new farmland, which is more than the total land area of the United States!

It takes 15 minutes to milk a cow by hand and 5 minutes to milk a cow by robot.

Hands-On:

This lab from **Agriculture in the Classroom**, students discover technologies that are used on farms to increase efficiency and yields and decrease costs and environmental impact.

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DAIRY COUNCIL® OF AZ & NV

LESSONS FOR GRADES 9-12

Engineering: Methane Digesters

Mathematics: Agricultural Algebra

Science: Selective Breeding

Nutrition: Food Labels

9-12 DAIRY COUNCIL OF AZ & NV

Methane Digesters

Engineering

A methane digester is a system in which **methane gas from manure is captured and used to generate electricity.** The first step in turning cow poop into power is to put the manure through something called a **separator**, which separates the solid manure from the liquid. The solid manure is turned into compost, and the liquid is stored in a pond where bacteria produce methane gas from the organic liquid through a process called '**anaerobic digestion.**' It is then pumped into a combustion engine, like an engine in a car or truck. The engine fuels a generator, which produces electricity.

Talking Points:

Manure isn't the only organic material that can be used in anaerobic digestion. Food scraps, oil, and grease are other materials that can be processed.

Since animal waste and other organic materials are continually being produced, they are renewable energy sources.

Hands-On:

This exercise from the **California Academy of Sciences** includes an informational video, a vocabulary list, a library of resources, and discussion prompts to get older students thinking both critically and creatively about sources of renewable energy. Teachers are encouraged to use the additional resources to help expand class conversation.

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9-12 DAIRY COUNCIL OF AZ & NV

Mathematics

Agricultural Algebra

Many times, farmers need to know the overall area of their fields to calculate fertilizer rates and amounts of fertilizer to be applied. Farmers also use math every day to calculate feed rations and pasture grazing rates. Who knew farming required such strong physical AND mental muscles!

Talking Points:

- Fertilizer is a substance added to soil to help the growth of plants.
- A yield refers to the amount produced (ie: how much crop is grown).
- Feed rations are the predetermined portions of food given to farm animals.

Hands-On:

In this math exercise from **Oklahoma Cooperative Extension**, students will calculate the area of various farm plots and the yields of crops from those land areas. The activity fulfills Oklahoma schools' academic standards. However, teachers are encouraged to use this resources to compliment and/or inspire their curriculum in Arizona/Nevada.

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Selective Breeding

Science

The development of agriculture allowed people to settle in one place and form villages and cities. As **hunter-gatherers** became **farmers**, they learned to breed the animals that were best suited to meet people's needs. The first steps of **domestication** probably happened by accident, but soon farmers deliberately practiced **selective breeding** to develop crops and livestock more suited to their needs.

Talking Points:

- Animal husbandry refers to the science of breeding and caring for farm animals.
- Genetically modified crops are regulated by EPA, FDA, and USDA.
- Farmers practice selective breeding to develop cows more suited to their needs.

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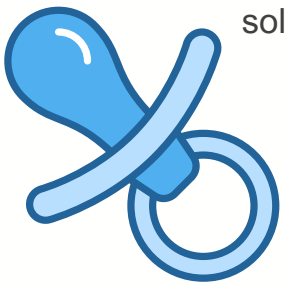
Hands-On:

In this lesson plan from **Agriculture in the Classroom**, students identify technologies that have changed the way humans affect the inheritance of desired traits in organisms, compare and contrast selective breeding methods to bioengineering techniques, and analyze data to determine the best solution for cultivating desired traits in organisms.



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Food Labels

Nutrition

Down every aisle and contained on every package of food in a grocery store, a consumer finds **labels** on their food. Some labels make claims about the **nutrition content** or the healthfulness of the food. Other labels indicate **production styles** practiced on the farm where the food was produced. Some labels are not regulated and are added by food companies as a **marketing tactic**.

Talking Points:

Organic is a term used to classify farming methods that limit the use of biotechnology along with various types of fertilizer or pesticide.

The word “natural” on a food label means that nothing artificial or synthetic (i.e., colors or dyes) has been included in or added to the food in processing.

Hands-On:

In this lesson plan from **Agriculture in the Classroom**, students evaluate food package labels, determine their meaning, and use the Claim, Evidence, and Reasoning model to determine the value of the label in relation to food production practices, nutrition, health, and food safety. Students will engage in critical thinking to recognize the impact of food package labels in relation to marketing, consumer perceptions of food, and farming practices.

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