Dairy Australia

Primary Industries Education Foundation Australia

Paddock to Plate: Making Dairy Products

Learning Areas and Australian Curriculum Content

An educational resource for

Years 3–4

Discover Aussie Dairy

Learning Areas and Australian Curriculum Content

Teacher guide

Design and Technologies

Describe the ways of producing food and fibre. (AC9TDE4K03).

Examine design and technologies occupations and factors including sustainability that impact on the design of products, services and environments to meet community needs. (AC9TDE4K01).

Describe the ways food can be selected and prepared for healthy eating. (AC9TDE4K04).

Science

Explain the roles and interactions of consumers, producers and decomposers within a habitat and how food chains represent feeding relationships. (AC9S4U01).

Use provided scaffolds to plan and conduct investigations to answer questions or test predictions, including identifying the elements of fair tests, and considering the safe use of materials and equipment. (AC9S3I02, AC9S4I02).

Follow procedures to make and record observations, including making formal measurements using familiar scaled instruments and using digital tools as appropriate. (AC9S3I04, AC9S4I03).

English

Use interaction skills to contribute to conversations and discussions to share information and ideas. (AC9E3LY02).

Listen for key points and information to carry out tasks and contribute to discussions, acknowledging another opinion, linking a response to the topic, and sharing and extending ideas and information. (AC9E4LY02).

Plan, create, rehearse and deliver short oral and/or multimodal presentations to inform, express opinions or tell stories, using a clear structure, details to elaborate ideas, topic-specific and precise vocabulary, visual features, and appropriate tone, pace, pitch and volume. (AC9E3LY07).

Lesson Objective

Students will explore the world of dairy production and learn about dairy cows, the processes of milk production, and the steps that transform raw milk into consumable dairy products. Beginning with an understanding of dairy cows' features and the tools and systems used on dairy farms, students will then develop an understanding of the key milk processing technologies of pasteurisation and homogenisation. They will participate in a hands-on butter-making experiment. Building on this knowledge, students will work in pairs to plan, design, and create their own unique dairy product, considering ingredients, processing techniques, and desired textures or flavours. To conclude, each pair will present their dairy product design to the class, developing their communication skills and allowing for peer feedback. Through this integrated approach, students will gain a comprehensive understanding of dairy production from paddock to plate while engaging in collaborative, practical, and creative activities.

Lesson Overview

Activity 1 - How Do Cows Make Milk? (30 mins)

Activity 2 - How are Dairy Products Made? (60 mins)

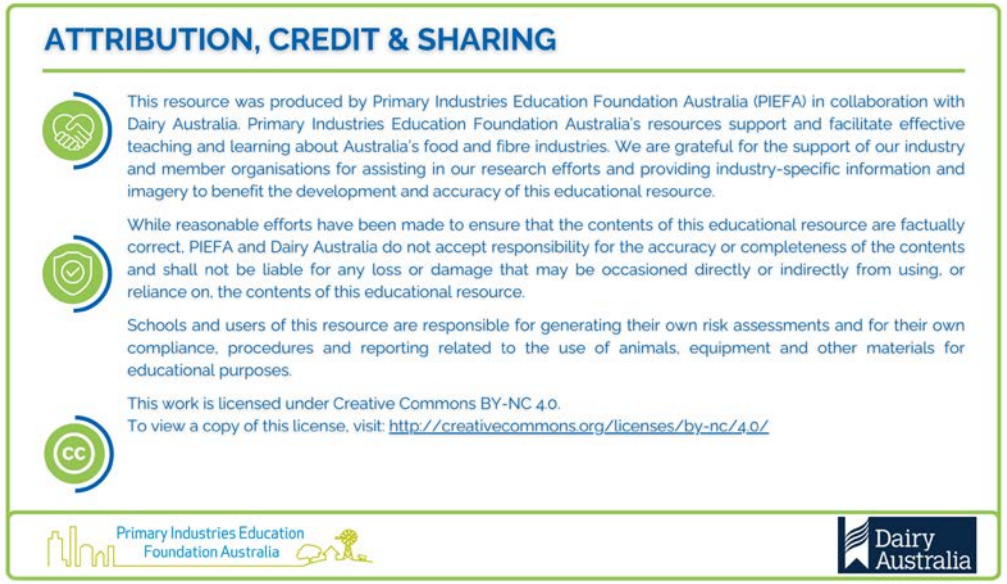
Activity 3 - Design a Dairy Product (40 mins)

Contents

Risk Assessments

Note: Schools are responsible for generating their own risk assessments for activities. Risk assessments should address the potential hazards associated with using dairy products in the classroom, including foodborne illnesses, allergies, slips/falls, and cross-contamination, and propose control measures such as allergy awareness, accident prevention, and hygiene practices to ensure a safe learning environment for students.

Teacher guide



ATTRIBUTION, CREDIT & SHARING

This resource was produced by Primary Industries Education Foundation Australia (PIEFA) in collaboration with Dairy Australia. Primary Industries Education Foundation Australia's resources support and facilitate effective teaching and learning about Australia's food and fibre industries. We are grateful for the support of our industry and member organisations for assisting in our research efforts and providing industry-specific information and imagery to benefit the development and accuracy of this educational resource.

While reasonable efforts have been made to ensure that the contents of this educational resource are factually correct, PIEFA and Dairy Australia do not accept responsibility for the accuracy or completeness of the contents and shall not be liable for any loss or damage that may be occasioned directly or indirectly from using, or reliance on, the contents of this educational resource.

Schools and users of this resource are responsible for generating their own risk assessments and for their own compliance, procedures and reporting related to the use of animals, equipment and other materials for educational purposes.

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Resources and Equipment

Teacher guide

Activity 1 - How Do Cows Make Milk?

Digital devices

Pop Quiz | Discover Dairy

When Do Cows Make Milk (1:03)

How Cows Make Milk (2:46)

How Do Dairy Cows Make Milk Animation

Worksheet 1a - How Do Dairy Cows Make Milk?

Scissors and glue

Activity 2 - How Are Dairy Products Made?

Digital devices

Milk Cycle Interactive

Discover How Milk Is Made (2:39)

Worksheet 2a - Dairy Word Study

How Cows Make Milk (2:46)

Discover How Cheese Is Made (3:10)

Discover How Other Dairy Products Are Made (3:07)

Worksheet 2b - How Are Dairy Products Made?

Worksheet 2c - Create Your Own Butter Experiment

- Measuring cup
- One cup of thickened cream
- A clean jar with a tight-fitting lid (e.g. a mason jar)
- Container for buttermilk

Activity 3 - Design a Dairy Product

A variety of empty and clean dairy products in packaging such as milk, cheese, yoghurt, butter, custard, cream etc. Multiples of each.

Worksheet 3a - Design Challenge: Design a Dairy Product

- A3 or butchers paper
- A4 paper
- Coloured pencils or markers
- Rulers
- Glue
- Scissors

Additional Resources

FodderTech

Encyclopedia Britannica | Britannica

Discover Dairy 360 Virtual Farm Tour (6:53)

Lesson Guide

Teacher guide

Activity 1 - How Do Cows Make Milk?

Students will learn about the features of dairy cows and how dairy cows produce milk. They will begin to explore the tools, equipment, procedures, and systems used to produce milk.

a Conduct a pre-test quiz with students using Pop Quiz | Discover Dairy to determine their existing level of knowledge.

b Present the following scenario to capture the students' interest and highlight the many different ways we can consume dairy products:
"This week you may have eaten a cheese sandwich or a tub of yoghurt, poured milk onto your cereal, enjoyed a babyccino at a local cafe, drank a milkshake or smoothie, eaten a piece of cheese as a snack, enjoyed a piece of quiche made with butter, cream and cheese, eaten an ice cream for dessert, eaten a serve of macaroni and cheese, some frittata with ricotta and feta cheese, or a piece of cheesecake."

c In a central area, write the three discussion topics for student reference:

- Dairy foods I eat
- The number of times per week I eat dairy foods
- My favourite dairy food.

Instruct students to follow the "Think, Pair, Share" format to talk with their partner about the dairy foods they eat, the number of times per week that dairy food is eaten, and their favourite dairy food. After the discussion, select pairs to share their partner's favourite dairy food with the class.

d Brainstorm with students what they already know about where their milk comes from and the processes dairy farmers use to produce dairy products. Use guiding questions such as:

- How do cows turn grass into milk?
- What tools, equipment, and procedures are used to produce milk?
- What are the ideal conditions for producing milk?
- What knowledge, understanding, and skills might dairy farmers need to produce milk?
- How does milk get from a dairy cow to us?
- What is pasteurisation?
- What processes are involved in making other dairy foods?

e View the video When Do Cows Make Milk (1:39) to give students an overview of milk production. Explain to students that a cow starts to produce milk after its first calf is born. This usually happens when a cow is around two years old.

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f Discuss the digestive system of a cow (an internal feature) with students. View the video How Cows Make Milk (2:46) to reinforce this process.

Explain that they have four stomach compartments or chambers (a chamber is a large room), each of which performs a particular function:

1 **Rumen** - chewed food is mixed with water and an enormous number of microorganisms which begin to break down the fibrous (tough) fibre of the pasture, hay, silage and grains. Cows regurgitate some roughage and re-chew it in the mouth to break it down further. This is regurgitated ball is called a cud. Bacteria ferment the hay, grass and grain and the fermentation acids are absorbed from the rumen.

2 **Reticulum** - this chamber has a honeycomb structure that traps large food particles, sending them back to the mouth for re-chewing, which helps break down tough plant material more efficiently.

3 **Omasam** - excess water is removed in this chamber.

4 **Abomasum** - the food is mixed with chemicals (acid, enzymes) that break down the food further and kill the microorganisms so that their nutrients can be digested too before it moves to the small intestine. The small intestine is where the nutrients from the digested food are absorbed into the blood stream. The nurients travel around the body where they are used for growth and repair. Some of the nutrient rich blood moves to the udder, where glands change the nutrients into milk. Milk is stored in the udder until the cow is milked. The large intestine is where the absorption of water, some nutrients and digestion of more microorganisms occurs before waste is excreted.

g Play the animation How Do Dairy Cows Make Milk Animation and complete **Worksheet 1a - How Do Dairy Cows Make Milk?** Once completed, review the answers with students. (Answers page 10).

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Activity 2 - How Are Dairy Products Made?

Students will learn about the processes that transform raw milk into dairy products. They will explore pasteurisation as a food technology used to extend milk's shelf life and provide for health and food safety. They will also explore homogenisation as a process used to create a smooth texture in milk. In a hands-on experiment, students will use and apply concepts and ideas about how milk is produced to create butter.

Note: Schools are responsible for carrying out risk assessments before this task.

a Display the Milk Cycle Interactive to students and read through each process to introduce them to the paddock to plate supply chain of milk.

b View the video Discover How Milk is Made (2:39) with students to show them the steps involved in producing milk.

c Explain that *pasteurisation* is the process of heating milk and milk products to destroy disease-producing microrganisms. Explain that the process of *homogenisation* is where milk is filtered under high pressure through tiny nozzles to create a smooth texture. This process breaks up the fattier globules in the cream of the milk to such a small size that they remain suspended in the milk, rather than separating out and floating to the surface.

d Distribute **Worksheet 2a - Dairy Word Study** and offer access to digital devices. Allow students to follow the instructions to complete the learning tasks. Review the How Cows Make Milk (2:46) video from Activity 1 if necessary.

e View the videos Discover How Cheese Is Made (3:10) and Discover How Other Dairy Products Are Made (3:07) to give students an understanding of the production process of cheese, butter, cream, and ice cream. Complete **Worksheet 2b - How Are Dairy Products Made?** (Answers page 10)

f Distribute **Worksheet 2c - Create Your Own Butter Experiment** and conduct an experiment with the class or in small groups where students create their own butter. Read through the method with students and encourage them to make a 'prediction' in the space provided before starting.

g Either distribute the equipment (measuring cup, one cup of thickened cream, a clean jar with a tight-fitting lid and container for pouring buttermilk into) to each group or prepare your own to demonstrate to the class.

h Allow students to take turns shaking the jar. After a few minutes, the cream will thicken and reach a whipped cream consistency. After enough agitation, the cream will separate into a solid mass (butter) and a liquid (buttermilk). The butter will form a lump, with liquid buttermilk remaining in the jar. Students will then carefully open the jar and pour out the liquid buttermilk into another container. This liquid is commonly used in baking (pancakes and muffins). The butter will remain in the jar as a solid.

Note: Allowing students to taste the buttermilk or butter is NOT advised.

i Assist students in drawing a diagram of the results, answering the discussion questions and writing a conclusion. (Answers page 10).

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Activity 3 - Design a Dairy Product

Students will work in pairs to plan, design, and create a dairy product. They will collaborate in pairs to develop their communication skills by presenting a description of their dairy product design to the class.

Note: Schools are responsible for carrying out risk assessments before this task.

a Display a number of empty and clean dairy product packaging examples for students to view and handle. Encourage students to discuss their observations. Use guiding questions such as:

- How do you know what is inside?
- How do you know they are food products?
- How do you know they are dairy products?
- What type of dairy product is it (milk, yoghurt, cheese)?
- What sort of information is written on them?
- What does the label look like? What colours and images are used?
- What kind of health benefits are advertised?

b Explain to students that they will be designing a new dairy product that will be sold in shops. The dairy product should be appealing to consumers because it looks delicious and healthy. Students may make their dairy product design on paper or use a tangible, clean, and empty dairy product package to attach their design to.

c Brainstorm with students what they think they will need to include and record their ideas in a central area. Remind them to consider the features of the dairy products they just viewed. Suggestions include:

- What type of dairy product will you create? (milk, yoghurt, or cheese)
- What fun or catchy name will you give it?
- What character or logo will you include to represent the product? (this could be a happy cow or a playful spoon etc.)
- How will your product help people stay healthy? (use descriptions such as "high in calcium," "for strong bones," "good source of protein")
- Will it come in different flavours or have unique ingredients? (e.g. strawberry yoghurt, chocolate milk, cheese with herbs)
- What type of container will you use? (carton, cup, bottle, tub)
- Who will this product appeal to the most? (children, adults, families, athletes)
- How much of the product is in the package? (e.g. 500ml for milk or 200g for cheese).
- What colours, images, or characters will make the product stand out?

d Allocate students into pairs and distribute **Worksheet 3a - Design Challenge: Design a Dairy Product**. Read the information as a class.

e Provide students with pencils and a piece of A3 or butchers paper to plan and draw a rough sketch of their product. Encourage the sharing of ideas between groups.

f Students collect design materials (e.g. paper, pencils, markers, glue, clean empty containers) and use their plan to begin designing their new dairy product.

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g Students present their completed designs to the class, discussing the following:

- The name and type of dairy product
- The health benefits
- The design choices they made and why they chose them
- Why they think the dairy product will appeal to shoppers and make them want to purchase it
- What do they think worked well, and if they would do anything differently next time.

Answers

Answer

Activity 1 - How Do Cows Make Milk?

Worksheet 1a - How Do Dairy Cows Make Milk?

1 Rumen

2 Reticulum

3 Omasum

4 Abomasum

5 Cud

6 25 L

Activity 2 - How are Dairy Products Made?

Worksheet 2a - Dairy Word Study

1 Cud, Udders, Birth, Four, Milking

2 **Ruminant:** A mammal that is a herbivore with a specialised stomach, usually with four chambers. They regurgitate their food back into their mouth and re-chew the cud.

Pasteurisation: A heat treatment process used to kill bacteria and other microorganisms in milk.

Homogenisation: A mechanical process to break down and evenly distribute fat molecules in milk. This process improves milk's texture, making it smoother and more consistent, and prevents the natural separation of fat that would otherwise occur.

Worksheet 2b - How Are Dairy Products Made?

1 B - Cheddar

2 D - Starter culture

3 C - 1 to 2 years

4 Butter

5 Centrifuge

6 -7

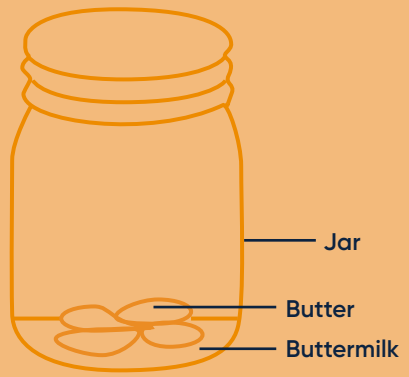
Worksheet 2c - Create Your Own Butter Experiment

Student responses may vary. Suggested responses include:

Prediction: When the cream is shaken, it will turn from a liquid into a solid. There will also be some liqid which is a different colour and thickness to the cream.

Results 1:

Student diagrams may vary. Suggested diagram below:



Answers

Answer

2 After shaking the jar of cream for three minutes, the cream became thicker. It remained white. With continued shaking, it separated into two parts: a solid (butter) whitish yellow in colour and a thin milky coloured liquid (buttermilk). The liquid was poured into another container.

Discussion questions:

1 As the cream is shaken, it first thickens and turns into a whipped cream-like texture. After more shaking, the cream separates into solid butter and liquid

2 The continuous shaking causes the fat molecules in the cream to clump together. This separates the fat from the liquid, resulting in solid butter and liquid buttermilk.

3 If the cream is shaken for a shorter time, it may only reach a whipped cream consistency and not separate fully into butter and buttermilk.

Conclusion: Shaking cream in a jar makes the fat clump together to form butter, while the liquid left behind becomes buttermilk. This shows how mixing can separate parts of a mixture.

Activity 3 - Design a Dairy Product

Student designs will vary.

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Worksheet 1a

How Do Dairy Cows Make Milk?

Activity

Play the How Do Dairy Cows Make Milk Animation. Cut out the terms below and paste them in the correct positions to complete the sentences.

	**1** The first chamber of a cows stomach is called the ⌜ _ _ _ ⌝ ⌞ _ _ _ ⌟
	**2** The second chamber of a cows stomach is called the ⌜ _ _ _ ⌝ ⌞ _ _ _ ⌟
	**3** The third chamber of a cows stomach is called the ⌜ _ _ _ ⌝ ⌞ _ _ _ ⌟
	**4** The fourth chamber of a cows stomach is called the ⌜ _ _ _ ⌝ ⌞ _ _ _ ⌟

	**5** The food pressed into a small ball and rechewed in the mouth of a cow is called a ⌜ _ _ _ ⌝ ⌞ _ _ _ ⌟
	**6** Dairy cows produce about ⌜ _ _ _ ⌝ ⌞ _ _ _ ⌟ liters of milk per day

omasum	cud	abomasum
rumen	25	reticulum

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Worksheet 2a

Dairy Word Study

Activity

1. Use the upside down word bank below to unscramble the following words:

MILKING, BIRTH, CUD, FOUR, UDDERS

DCU	DSEURD	RIBTH	RUFO	KINMLIG
___	______	_____	____	_______

2. Use your knowledge from the Discover How Milk is Made (2:39) and How Cows Make Milk (2:46) or an online dictionary to find the meaning of the following dairy words:

Ruminant

_____

_____

_____

Pasteurisation

_____

_____

_____

Homogenisation

_____

_____

_____

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Worksheet 2b

How Are Dairy Products Made?

Activity

Tick the correct answers after watching the Discover How Cheese is Made (3:10) video.

1 What is the most popular type of cheese in Australia?

	a Feta
	b Cheddar
	c Blue cheese
	d Swiss

2 What is the name of the special mix of microorganisms added to milk to make cheese?

	a Rennet
	b Mold
	c Yeast
	d Starter culture

3 How long is vintage cheddar cheese matured for?

	a 1 to 3 months
	b 6 to 12 months
	c 1 to 2 years
	d 2 to 4 years

Fill in the missing words after watching the Discover How Other Dairy Products Are Made (3:07) video.

4 To make butter, fresh milk is pasteurised and then agitated until the fat globules combine to become

_ _ _ _ _ _

5 The machine used to separate cream from fresh milk is called a

c _ _ t _ _ f _ _ e

6 After whipping and aerating ice cream, it is frozen at __ degrees Celsius before being packaged. It is then frozen at -25 degrees Celsius before transporting to shops for sale.

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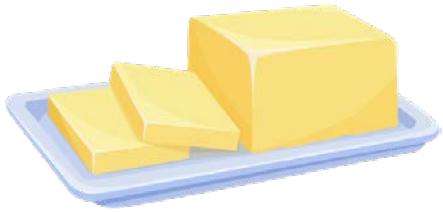
Worksheet 2c

Create Your Own Butter Experiment



Activity

As a class, read through the experiment below and fill in your answers on the lines provided.

Aim: To investigate the physical changes that occur in cream when it is shaken

Prediction: (what do you think will happen?):

_____

_____

_____

_____

_____

_____

Method:

1 Using a measuring cup, measure one cup of cream and pour it into a jar. Ensure that the jar is only half-full to allow space for the cream to move during shaking.

2 Seal the jar with a lid and shake vigorously for 5–10 minutes. Take turns with group members.

3 Observe any changes and continue shaking until separation occurs.

4 Carefully open the jar and pour out the liquid buttermilk into another container.

Results:

1 Draw a labelled diagram of the jar and its contents after shaking for 5 to 10 minutes.

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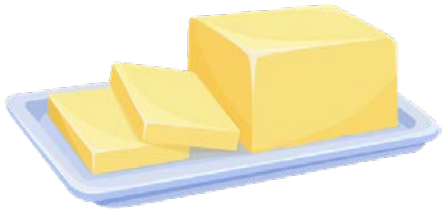
Worksheet 2c

Create Your Own Butter Experiment



Activity

Discussion questions:

1 What changes were seen in the cream's texture during shaking?

_____

_____

_____

2 Why does the cream eventually separate into butter and buttermilk?

_____

_____

_____

3 What might have happened if the cream was shaken for a shorter amount of time?

_____

_____

_____

Conclusion:

_____

_____

_____

2 Draw a labelled diagram of the jar and its contents after shaking for 5 to 10 minutes.

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Worksheet 3a

Design Challenge: Design a Dairy Product

Create a new dairy product such as milk, cheese, or yoghurt. The dairy product should make someone want to buy it because it looks delicious and healthy. The label you create for your dairy product will help people know what the product is and what it contains. Include important information about your dairy product and use your imagination.

Use the questions in the checklist to help you plan.

	What type of dairy product will you create? (milk, yoghurt, or cheese)
	What fun or catchy name will you give it?
	What character or logo will you include to represent the product? (this could be a happy cow or a playful spoon)
	How will your product help people stay healthy? (use descriptions such as "high in calcium," "for strong bones," "good source of protein")
	Will it come in different flavours or have unique ingredients? (e.g. strawberry yoghurt, chocolate milk, cheese with herbs)
	What type of container will you use? (carton, cup, bottle, tub)
	Who will this product appeal to the most? (children, adults, families, athletes)
	How much of the product is in the package? (e.g., 500ml for milk or 200g for cheese).
	What colours, images, or characters will make the product stand out?

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