



SOUTH DAKOTA STATE  
UNIVERSITY EXTENSION

# Adopt-A-Cow: Dairy

## LESSON 6: DAIRY CAREERS & PRODUCTS



### KEY TERMS

Protein, Fat, Lactose, Emulsion

### EDUCATION STANDARDS

*English Language Arts*

- SL.1, SL.2, SL.3, W.8

*Educational Technology*

- ET.EL.2

### TIME NEEDED

**Lesson:** 5 min

**Ice Cream Video:** 11 min

**Making Ice Cream:** 20 min

**Butter Video:** 3 min

**Making Butter:** 10 min

**Valley Queen Video:** 7 min

### MATERIAL LIST

*Materials for the whole class:*

- Computer/Projector/TV/  
Promethean board
- PowerPoint
- Variety of ice cream toppings

*Materials for the individual students*

- Ingredients and materials for making: Ice Cream OR Butter  
(See Activity Preparation)



### EXPECTED LEARNER OUTCOMES

**OBJECTIVE 1** – Youth will see two different ways of making ice cream and observe how the engineering design process is used in their development.

**OBJECTIVE 2** – Youth will experience chemistry in action as they make their own ice cream (or churn their own butter).

**OBJECTIVE 3** – Youth will learn about a variety of careers that are involved with getting their milk to the grocery store.

### BACKGROUND

Milk not only serves as a nutritious drink, but it also is the basis of many other foods that are in our diets. Milk is made up of water, lactose (sugar), fat, protein, vitamins, and minerals. Lactose plays a key role in producing yogurt while the protein and fat are utilized in cheese making. The fat which is the cream found in the milk also plays a key role in the creation of butter and ice cream.

In heavy cream, protein allows the fat molecules to be suspended in the water found in the cream. When agitated the cream becomes an emulsion – or a substance where a small amount of water is suspended in fat. This process is important in both the creation of butter and ice cream.

In addition to creating an emulsion, during the ice cream process chemistry is also present as the cream moves from a solid to a liquid.

## VOCABULARY

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**Protein** – A nutrient that the body uses to build and repair muscles as well as for energy.

**Fat** – A nutrient that provides calories for the body as well as aids in carrying vitamins to our cells.

**Lactose** – A sugar present in milk.

**Emulsion** – A dispersion of small droplets of one liquid in another liquid in which it is not soluble.

## ACTIVITY PREPARATION

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You may decide to make either the ice cream or butter for this lesson. Another option would be to have the class make ice cream and the other make butter.

For the ice cream you will need the following for each individual student:

- 1 gallon zipper-style bag (heavy duty freezer bag)
- 1 quarter zipper-style bag
- 4 cups of ice
- 1 cup of ice cream salt or table salt
- ½ tablespoon sugar
- ½ cup whipping cream
- 1 teaspoon vanilla extract
- cups
- spoons

You may also choose to gather a variety of toppings so that youth can engineer their own ice cream flavor.

To keep little hands warmer and to keep condensation from dripping everywhere you may want to wrap the bags in a towel before youth begin churning their ice cream.

You can make larger ice cream batches by increasing your bag sizes or utilizing containers that nest inside one another. Just be certain there is adequate space between containers for the salt and ice. This allows them to work as a group to mix the ice cream and reduces cold hands.

You may also choose to provide towels or oven mitts to keep their hands warm while mixing.

If appropriate for your youth, there is an ice cream observation sheet that you can print for each student.

For the butter you will need the following for each individual student:

- approximately 1 oz Heavy whipping cream
- 1 small container (2 oz plastic portion cups with lids work well for this)

You will want to provide something for the youth to taste their butter with. A salted cracker of some sort works best. Additionally, if you would like, you can provide some different herbs for them to mix in their butters to engineer different flavors.

If appropriate for your youth, there is a butter observation sheet that you can print for each student.



## ACTIVITY INSTRUCTIONS

### I. Review Lesson 5 (Slide 2)

In lesson 5 we discussed how milk gets from the farm to our tables. Milk starts at the

- a. Cow and then goes to the
- b. Milking Parlor. We were even able to see what it might be like to milk a cow by hand. Milk then is transported via
- c. Truck to a
- d. Processing Facility where it is turned into cheese, ice cream and several other items. It then comes to our
- e. Stores where we purchase it and it can then be served on
- f. Your table.

Along the way the milk is tested numerous times to ensure its safety. We simulated testing our milk with food coloring and dish soap. What do you remember about this.

### II. What's in your milk? (Slide 3)

Milk is a mixture of different things. It is made up of

- a. Water
- b. A sugar called lactose.
- c. Cream which is the milk fat
- d. Protein and
- e. Minerals

### III. What makes butter, cheese, yogurt, and ice cream? (Slide 4)

Each of the things we make from milk uses different components of the milk.

- a. Butter is made from cream or milk fat.
- b. Cheese is made from proteins and cream (fat).
- c. Yogurt is made from the sugars of milk.
- d. Ice Cream is made from the cream or fat of milk.

### Option I: Making Ice Cream

*\*This video is a bit longer. Depending on your audience, you may choose to watch the video while youth eat their ice cream.*

#### I. Video\*: Designing ice cream (11 minutes) (Slide 5)

Making Ice Cream is a science that has changed and developed over the years. Food Scientists and Engineers work to create a variety of different types of ice cream. Let's watch this video to learn more.

#### II. Designing your own ice cream (Slide 6)

Ask youth to reflect on what they saw in the video. What did they notice about both processes that made ice cream? (Both used cream and cold temperatures)

Explain to youth that they are going to make their own ice cream starting with cream, sugar, and vanilla which they will place into a small Ziplock bag. They are then going to place that in a larger bag with ice and salt (the cold) and mix it to allow it to freeze into ice cream. This may take up to 10 minutes.

Once the ice cream is made, youth can add toppings to design their own ice cream creations.

#### III. As they are mixing their ice cream, youth can watch the Dairy Tour Video ([vimeo.com/867339436](https://vimeo.com/867339436)) (Slide 9).

As an alternative, you may have them listen to the shake break song to encourage them to shake their ice cream.

### Option II: Butter

#### I. Video: Making Butter (Slide 7)

Ask youth to reflect on what they saw in the video.

Did they notice that they tested the cream – like talked about in lesson 4?

#### II. Churning your own butter (Slide 8)

We are starting with cream because cream comes from milk. When whole milk sits the milk separates and the cream floats to the top. This is because milk is made of water and fat among other things. Water and fats (oils) don't mix and over time



will separate. However, the proteins in the cream allow them to be suspended in one another – this is called an emulsion.

As the cream is shaken (churned) the fat molecules begin to stick together. This creates a different type of emulsion – one in which the water is suspended in fat. Not all the water can be suspended and so you end up with a solid (butter) and liquid (butter milk).

Have youth examine their substance as they shake (churn) it. It will gradually turn from a liquid to a thick whipping cream. Then after about 10 min the cream in the canister should be easier to shake and the sound will change to be much quieter. This means the buttermilk has been squeezed out of the butter. Butter goes from the liquid state of cream to the solid state of BUTTER!

- III. As they are churning their butter, youth can watch the Dairy Tour Video ([vimeo.com/867339436](https://vimeo.com/867339436)) (Slide 9).  
As an alternative, you may have them listen to the shake break song to encourage them to churn their butter.





# Ice Cream Observations



## Ingredients:

- 4 cups of ice
- 1 cup of ice cream salt or table salt
- ½ tablespoon sugar
- ½ cup whipping cream
- 1 teaspoon vanilla extract

## Directions:

1. Pour the cream, vanilla extract, and sugar into the small zipper bag. Squeeze carefully as much air out as possible, mix well, and seal the bag.
2. Place the small zipper-style bag into the large bag. Cover with ice and salt. Seal the large bag tightly.
3. Shake, toss and flip the “ice cream machine” for 5 to 10 minutes. If the bag gets too cold to handle, wrap it with a towel or pass it from person to person. If the mixture hasn’t frozen after 10 minutes, add more salt and ice.
4. Open the larger bag and remove the smaller bag. Wipe the smaller bag thoroughly before opening it so the salty water does not contaminate the ice cream. The ice cream should be the consistency of soft serve ice cream. Eat right out of the bag or serve in small cups.



**What state of matter does the ice cream start as?**

\_\_\_\_\_

**What state of matter does the ice cream end as?**

\_\_\_\_\_

Draw a picture of what is in the small bag at the beginning.	Draw a picture of what is in the small bag after 5 minutes.	Draw a picture of what is in the small bag at the beginning after 10 minutes.



# Butter Observations

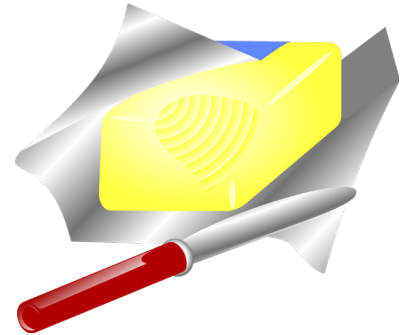


## Ingredients:

- Heavy Whipping Cream

## Directions:

1. Fill your container halfway with Heavy Whipping Cream
2. Make the first observation using the observation sheet.
3. Secure the lid (WELL!)
4. Shake the container vigorously.
5. Listen to the cream as you shake. When you no longer hear liquid sloshing around carefully open the lid and observe the cream.
6. Make observations.
7. Replace the lid and continue shaking until you hear sloshing around and see a clump in the container.
8. Open the lid on the container and observe what has happened. What do you see?
9. Make observations on the sheet.
10. Pour your buttermilk into a glass.
11. Spread butter on crackers and enjoy!



Time	Observations
Before shaking	
2 minutes	
4 minutes	
6 minutes	
8 minutes	
10 minutes	

## EXTENDED LEARNING

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**Tour the South Dakota State University (SDSU) Dairy Processing Facility (15 min):** Look at the SDSU Dairy Plant. You will see how they make ice cream and cheese as well as get an idea of what large-scale dairy processing facilities might look like. ([youtu.be/FGth8SgB9aI](https://youtu.be/FGth8SgB9aI)).

## LESSON FEEDBACK

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In an effort to continuously improve the content provided, we have developed a brief feedback form for educators to utilize. Scan this QR code and take the survey to let us know what you think of this lesson.



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