

Cooking Chemistry

Activities 2 & 3—Butter in a Jar, Ice Cream in a Bag

Our next two activities are both fun and delicious. They also give us an opportunity to see a substance undergo physical changes. You may already know about physical and chemical changes, but here's a quick review before we start:

- A chemical change occurs at the molecular level when atomic bonds are broken or when new bonds are created, resulting in the creation of a new chemical structure. This kind of change cannot be reversed.
- A physical change, however, changes only the substance's form, or "state of matter." Its chemical structure remains the same. Physical changes can often be reversed, and the product can be returned to its original state. An obvious example is water/ice/steam!

Making Butter in a Jar

Materials Needed:

- heavy cream
- mason jar, or any container with a tight-fitting lid

What to Do:

1. Pour the heavy cream into the jar or container until it is half full.
2. Put the lid on, and make sure it's nice and tight.
3. Start shaking! It can take up to 15 minutes for the butter to form, so you might want to take turns! (The more cream you use, the longer it will take.)
4. Eventually, the cream will be gone, replaced by delicious butter! The thin liquid left in the jar is called buttermilk, and some people think it's very tasty as well.



Now let's look at what happened when you made your butter. Cream is made up of tiny globules of fat suspended in a watery solution. When you shook the jar, the tiny globules crashed into each other and stuck together, eventually forming a solid chunk of butter. The buttermilk is the liquid leftover after the fat has been removed.

Even though the butter looks very different from the cream, it is a physical change which means that the chemical composition is still the same. Do you remember when we said that most physical changes can be reversed? Well, if you melt the butter and whip it into the buttermilk with an electric mixer, it will eventually turn back into cream! Personally, I'd rather put the butter on some bread and eat it—but that's up to you!

Making Ice Cream in a Bag

Materials Needed:

- ½ cup of heavy cream or half-and-half
- 1 T. sugar
- ¼ tsp. vanilla
- 3 cups ice
- 1/3 cup kosher or rock salt
- Gallon size zip-top bag(s)
- Quart size zip-top bag(s)
- Optional: chocolate syrup, fruit, sprinkles



What to Do:

1. Place ice and salt in a gallon-sized bag; set aside
2. In a quart-sized bag, mix cream, vanilla, and sugar. Make sure bag is tightly sealed.
3. Place the quart-sized bag inside the gallon bag and shake.
4. As you shake the bag it will become very cold, so it's a good idea to have a pair of gloves handy—you may need them.
5. If the ice melts before the ice cream solidifies, you can add more ice.
6. After 5-10 minutes of shaking, you should have ice cream!
(Tip: To prevent salty ice cream, rinse or wipe any remaining salt from the outside of the smaller bag before you open it.)
7. Add any desired mix-ins or toppings—enjoy!

STEAM Connections

Making ice cream is a little more complicated than making butter because it requires more than one physical change to take place.

First, shaking the bag that contains the cream, sugar, and vanilla will cause the fat globules in the cream to bump into each other and eventually to begin sticking together. This is the same physical change that happens when you make butter.

The next physical change involves freezing the cream, sugar, and vanilla while they are being mixed together. The ice in the large bag absorbs the heat from the cream mixture, which causes the mixture to cool down and the ice to melt. The problem is that plain ice will melt too quickly, before the physical change can take place. Adding salt to the ice lowers its melting point, which gives the mixture time to freeze into the delicious treat we call ice cream. We hope your ice cream was fun to make, and even better to eat!

Are You Dairy-Free? Try this tasty, low-fat No-Cream Ice Cream!

Materials Needed:

- 4 very ripe bananas, peeled, broken into chunks, and frozen
- pinch of cinnamon
- ½ tsp. Vanilla

What to Do:

1. Put frozen bananas, cinnamon, and vanilla into blender and blend until smooth. It's easy and delicious!

The secret is to use bananas that are very ripe, but not over-ripe. Because the starch inside bananas converts to sugar as they ripen, those really ripe bananas are just sweet and creamy enough to make a delicious frozen dessert!