Name: _____ Date: _____ CP: ____

Butter Lab

Materials: heavy cream, small container with a lid

Instructions:

1. Work in groups of 2
2. Put 3 tablespoons heavy cream into a jar with a lid.
3. Tightly secure the lid
4. Follow the directions given in the data collection section and answer all questions in complete sentences.

Data Collection:

1. Take turns shaking the container vigorously and constantly for 10 minutes. Record the time when you begin shaking the container. Every minute, stop shaking the container and hold it up to the light. Record your observations in the chart below.

Time (minutes)	Observation
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

2. After 10 minutes of shaking, you should have a lump of "butter" surrounded by liquid inside the container. Describe both the butter and the liquid in detail.

3. Let the container sit for about 10 minutes. Observe the butter and liquid again, and record your observations making notes of any changes you observe.

4. Write a hypothesis explaining why you think the butter globule changed during the 10 minutes in question 3.

5. Technology: Use your own device to figure out why letting the butter sit at room temperature for 10 minutes helped in the butter making processes.

6. What state of matter is the globule that formed during the shaking process? List 2 characteristics of this state of matter to support your answer. (Hint: use your notes)

7. Draw the molecule arrangement and explain the amount of energy for the globule's state of matter.

8. What state of matter is the left over substance that separated out from globule during the mixing process? List 2 characteristics of this state of matter to support your answer. (Hint: use your notes)

9. Draw the molecule arrangement and explain the amount of energy for the left over substance that separated out from globule during the mixing process.

10. What type of energy was used to form the butter? Explain your reasoning. (Use your own device for help if needed)

Helpful Information

The cream has little globs of fat and protein. When you shake the jar, you get the fat and the protein that are moving around in the cream to stick together. The glob is butter! The liquid that's leftover is buttermilk.

If you have never made butter, these instructions may sound strange, but trust me, it works wonderfully. The first thing to do is to let the cream sit on the counter, at room temperature, for about 12 hours. I put it out on the counter after supper, and I had freshly made butter on my toast the next morning.

After letting the cream sit, pour it into the glass jar. Don't worry if it has a slightly sour smell. Put the lid on the jar. Now we have to shake the jar, but we don't want to just start shaking it wildly. We want to watch what is happening. Give it one good hard shake about once every second. Watch carefully. For the first few minutes, not much will happen. Then suddenly, you will feel something solid hit the jar when you shake it. Look inside and you will see a large lump of butter. Give it a few more hard jolts and your butter should be ready.

Open the jar and look carefully. Around the butter is a thin, white liquid, which is commonly known as buttermilk. If you have ever had buttermilk biscuits, this is what they are made with. Pour off the buttermilk and add some cold water to the jar. Swirl it around a bit and then pour it off. Repeat this a few times, until the water remains clear. Drain all the water and put the lump of butter into a small bowl.

At this point, you have sweet cream butter, which is wonderful on hot bread or fresh biscuits. If you prefer salted butter, simply sprinkle some salt into the butter and stir it in. At this point, treat the butter just as you would the butter you get from the store.

That was quite yummy, but how and why did it work? First, we have to know a bit about milk. If you have ever been lucky enough to have milk fresh from the cow, you know that if you let it sit for a while, the cream floats to the top. That is because milk contains lots of tiny globules of milk fat, each surrounded by a thin membrane. Imagine tiny balloons filled with butter instead of air. Because the milk fat (butter) is lighter than the liquid, they tend to float. The cream that rises to the top is really a very high concentration of these fat globules floating on the milk. The milk from the grocery does not do this because it has been homogenized, a process that makes the fat globules small enough to keep them mixed evenly in the milk.

We left the cream out of the refrigerator overnight for two reasons. First, it helps the fat in the globules to form crystals. These crystals will help to break the membrane when we shake the cream. Imagine a water balloon with shards of glass inside. One jolt would cause the glass to slice through the balloon. That is what we want to happen.

Letting the cream sit at room temperature does something else. It allows lactic acid bacteria to grow. We think of bacteria as a bad thing, but many of them are quite useful. These bacteria make the cream more acidic, which prevents the growth of harmful bacteria. They also produce chemicals that give the butter a stronger and richer flavor.

When you shake the cream, some of the globules slam into the glass and break open. Soon, the cream is filled with tiny globs of butter. As these tiny bits of butter bump into each other, they stick together. The lumps of butter get larger and larger, as more and more globules are ripped open. Very quickly, you have one large lump of butter and a small amount of liquid buttermilk. I was amazed at how little liquid was left once the butter formed.

You will probably notice that the color of your butter is more pale that the stuff you buy at the store. That is because the manufacturer adds color to it, to make it look more like what people expect butter to look like. I suppose you could color your butter if you wanted to, but I like it just as it is.

A quick trip to the bakery and I had some fresh, hot French bread to give my fresh butter a real test.

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