**Exemplary Lesson Plan**

**B**. **Title** Scientific States of Matter, specifically liquids and solids infused with Agriculture

**C. Purpose** Students will investigate different liquids to develop a concept of the properties of liquids. This language is used as a springboard to develop precise vocabulary for properties of liquids in subsequent lesson(s). Infusion of how these simple products of agriculture become food for our table or plastic to hold the liquids.

**D.** **Grade Level** Second grade (also grades 9-12 when mentoring with PALS program)

**E.** **Time** 1 lesson of 45 minutes and a two hour lesson the following day which can be broken up over several consecutive days.

**F.** **Objective in the lessons** Students will understand the different properties of states of matter, especially liquids and how their properties relate to the dairy farming industry in our everyday lives. Students will also take simple household kitchen staples and create plastic that could even be consumed. Students will use these hands-on experiences to problem solve how this environmentally friendly plastic could be a step beyond recycling.

**G.** **Standards addressed**

* Physical Science 2.2.1.2.1- Observe, record, and recognize that liquid/water can be a solid, liquid, or a gas and change from one state to another and that the amount of liquid/water stays the same when it melts and freezes.
* AS.01.01.02.a Define major components of the animal industry.
* FPO.04.02.01.a. Identify & describe foods derived from meat, egg, poultry, fish, & dairy.
* PS.04.01.02.c. Create and implement designs by following established principles of art
* Language Arts 2.10.4.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases on grade two content.
* LA 2.10.5.5 Demonstrate understanding of word relationships in meanings to develop real life connections between words and their use. Distinguish shades of meaning among closely related adjectives (i.e. transparent vs. translucent).
* LA 2.2.10.10 Read informational texts with complexity for personal interest, enjoyment and academic tasks.

**H. Materials list**

* Liquids in bottles (7 different)
* Properties of liquids/tally sheet
* Solids and Liquids Big Book and student copies
* Properties of Liquids Memory (concentration) Card Game
* Solids, Liquids, and Gases Study Jam
* Recipes and study jam included in section K

**I. Vocabulary or key words**

states of matter, solid, liquid, gas, properties, texture, transparent, translucent, viscous, foamy, bubbly

**J.** **Instructor procedure**

Day 1

1. Read the non-fiction book of Solids and Liquids to the class. Discuss the different properties of liquids in bottles.
2. Encourage students to shake, tip, and roll each bottle.
3. Determine what properties each bottle contains based on the sheet provided. (see properties of liquids grid sheet in expanded section K)
4. Play the Properties of Liquids Memory Game having students draw a picture of what each property name looks like on their sheet prior to playing Memory.

\*\*\*Memory game cards and properties sheet attached to next page. There are 6 different properties and the cards have pictures of bottles on them to match with same pictures and they must be able to state what property is being shown in order to “win” the cards that turn.

1. Watch/Sing Study Jam on Scholastic.com to learn it and share with big pals the following day(s).

Day 2

1. Students meet with Big Pals to make ice cream, butter, and Bio-Plastic out of agriculture products from the kitchen. While making ice cream, they take the temperature of the snow before adding salt, after adding salt, and when the ice cream has become quite viscous.
2. The high school pals helped the second graders realize where these products came from, and why they used whole milk for ice cream and whipping cream for the butter. Discussed what cornstarch and corn oil are made from… that it didn’t originate on the grocery store shelf.
3. Students will demonstrate knowledge of vocabulary through conversation with Big Pals. Students will be able to describe the ice cream, butter, and bio-plastic as becoming viscous, non-translucent, foamy, and bubbly and offer reasons why these changes are taking place.

**\*Students will continue these agricultural lessons with the next 2 consecutive months of PALS visits include “little pals” learning about FFA since it’s FFA week. Big Pals cover competitions, cheese and milk tasting, along with creating Soil Sammy’s this visit. The local dairy farm tour is the following month where students see firsthand what they have been reading and learning about.**  See attached Brainerd Dispatch article about our trip in a blizzard. The farmers don’t get to reschedule their milking and we weren’t going to reschedule our trip either!

**K. Additional resources** The following non-fiction textsSolids and Liquids , Extra Cheese Please, by Cris Peterson and From Cow to Ice Cream

Additional Resources which enhance the lesson included on the next pages.

**L. Assessment**

1. What happens when temperature changes are imposed upon a liquid?
	1. How can you change a liquid into a solid?
	2. How can you change a solid into a liquid?
	3. Is there a point where it is hard to determine which state something is in?
2. Explain the meaning of the study jam line “states of matter changed by heat”.
3. What is the purpose of adding salt to the snow or ice cubes when making ice cream?
4. What are some possible uses for bio-plastic? Would this be an environmentally friendly form of plastic?
5. What would be the advantages/disadvantage of a plastic that eventually dissolves?

**Expanded Section K – Additional Resources**

**Recipes**

Make Ice Cream in a Plastic Bag

Sounds dangerous and the potential for messes seem highly likely, but you’ll be surprised at the good clean fun you’ll enjoy with students making ice cream. The lesson possibilities are nearly endless. Your class can explore the history of ice cream and dairy products, the chemistry of ice, salt and exothermic reactions, or use it as an exercise in the scientific method: What if you make this recipe without the salt?

This is enough for one student to make their own serving of ice cream.

*Materials/ingredients:*

* ½ c. whole milk
* ½ tsp. vanilla
* 1 T. sugar
* 4+c. crushed ice or snow
* 4 T. salt or rock salt
* 2qt sized zippered plastic bags
* 1 gallon sized zippered plastic bag
* gloves or a hand towel to keep fingers from freezing during processing

*Procedure*

1. Mix the milk, vanilla, and sugar together in one of the quart bags. Seal tightly, allowing as little air to remain in the bag as possible.
2. Place this bag inside the other quart sized bag, again leaving as little air as possible. Seal well.
3. Put these two bags inside the gallon sized bag which you have already filled with snow or ice and sprinkled salt over.
4. Wrap the bag in a towel or put gloves on… then shake or massage the bag, making sure the ice surrounds the bag of cream mixture. 5-8 minutes is adequate time for the mixture to freeze into ice cream. Add toppings as you wish. (From Teachernet.com)

Homemade Butter

Butter is made from cream, a component of milk. Cream is lighter than the rest of the milk and floats to the top, where it can be skimmed off and packaged separately. One lb. of butter is made from the cream found in 10 qts. of milk. The more butterfat milk contains, the more butter it will make. The Jersey breed of cattle produces milk with the highest percentage of butterfat. The Holstein breed gives the greatest quantity of milk, but the lowest percentage of butterfat.

Today, most people purchase butter at the supermarket. Years ago, however, most people made butter at home using a butter churn. A typical butter churn consisted of a container to hold cream, which was then stirred briskly using a stick or paddle. The cream thickened as it was stirred, resulting in butter and buttermilk (the remaining liquid). (From WI Ag in the Classroom)

*Materials/ingredients:*

* pint sized jar, glass or plastic with a secure lid
* heavy whipping cream, preferably at room temperature
* salt

*Procedure*

1. Fill jar ⅔ full with whipping cream. Firmly secure the lid, making sure to leave some air space in the jar.
2. Shake container briskly for 5-10 min. or until the butter is a solid lump in the jar. (The more cream in the container, the longer this process will take).
3. Once the butter has formed, pour off the liquid buttermilk---which makes great pancakes.
4. You may add salt to the lump of butter you’ve created and enjoy on crackers, bread, etc.

Make your own Bio-Plastic

*Materials/Ingredients*

* 1T. cornstarch
* 2 drops corn oil
* 1T. water
* food coloring
* zippered bag

After sealing the bag, mix the ingredients in the bag by rubbing the outside of bag with your fingers.

After mixing thoroughly without any lumps remaining, place the bag in microwave on high for 20-25 seconds. DO NOT SEAL THE BAG COMPLETELY IN MICROWAVE!

The bag will be hot upon removal so run under some cool water until the plastic is a comfortable temperature.

1. Form your plastic into a ball while it is still warm… describe what it does.

2. Is your plastic the same as the other students?

3. Compare/contrast biodegradable plastic with a plastic zippered bag.

(From Field Guide to Utah Ag. in the Classroom)

**Solids, Liquids, and Gases Study Jam Song**

Words to the song students sang … and they loved it!

Everything around us is made of matter, solid, liquid or gas. Matter can move from one state to another, sometimes really fast.

*Refrain*: Solid, liquid and gas you see are states of matter change by heat. Melting, boiling, and freezing points. Heat moves molecules where it wants.

Ice is a solid and then a liquid when temperatures increase. The heat keeps rising. Before you know it, it disappears into steam. *Refrain*

Water is a liquid that turns to vapor when exposed to heat. Add freezing temperatures you’ll see a solid as appears on the scene. *Refrain*

Vapor is a gas that turns to liquid when cooled to extremes. If the mercury keeps falling the liquid’s gonna form ice suddenly. *Refrain* (Study Jams from Scholastic.com)

