

How Fruits Store Energy: Science and Cooking Experiments

Grade(s): All grades for applesauce, 4 – 8 for sugar and starch experiments	Topic: Fruit, Food Origins, Energy, Plant Life Cycle, Plant Parts We Eat	Season: Any, but especially appropriate at harvest and Thanksgiving time
Timing: 60 minutes, including 5 minutes RPK, 10 minute introduction, 10 minute applesauce starting, 25 minute indoor sugar and starch experiments, and 10 minute applesauce eating and conclusion		
Objectives: <ul style="list-style-type: none">• Students can list ways that energy is vital to the survival of plants and animals, including people. They can distinguish between the way plants get their energy (from their leaves using photosynthesis) and how people get their energy (from eating plants or from eating animals products from animals who ate plants).• Students can explain that energy is stored in plants as in the forms of sugars and starches, and that the forms are not absolute and can change over time.• By creating applesauce, students demonstrate how humans have developed ways to store fruits over time to last over the winter or seasons when they cannot harvested in the wild• Students can distinguish between the role of a fruit from the perspective of a plant (reproduction) and from the perspective of a consumer (source of sugar and energy)		
Materials: <u>Applesauce Ingredients:</u> <ul style="list-style-type: none">• 7 to 8 apples peeled, cored and quartered• 1 lemon• 3 – 4 cinnamon sticks/pieces of cinnamon bark or ½ teaspoons cinnamon powder• ½ cup brown sugar (white is ok to use, too)• 1 cup water• Small rice cooker or crockpot you can plug in in your classroom• Small cups to divvy out finished applesauce• Potato masher (optional)• ½ teaspoon nutmeg (optional)• Pinch of Salt (optional) <u>Sugar and Starch Experiment Materials:</u> <ul style="list-style-type: none">• Knife• Cutting board• Iodine (can be purchased at any pharmacy; might stain hands and desks)• Plates or containers, one for each group of students• 1 green banana, cut into pieces• 1 ripe banana• Unsalted saltine crackers or bread, enough for each student to have 1 or 1 piece• Napkins or paper towels, one piece for each student		

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Prep Needed:

- Pre-peel, cut, and core the apples into small pieces (1/2 inch to 1 inch) beforehand (they will turn slightly brown but this is ok)
- Can cut bananas, but make sure it is right before class

Degree of need for extra teacher or parent helper? Medium

Journal Prompt: List the things you need energy for every day. Include the things you do, but also the things that go on inside your body that require energy.

Lesson Sequence:

Reactivate Prior Knowledge (5 minutes)

Tell the students what you ate so far today. Did it come from plants or animals? Tell them you're sure glad you ate breakfast because today you need energy. Have students make a list of everything you use energy for, including the active things they can see you do (teaching) and the less obvious things going on inside your body (digesting).

Introduction (5 minutes)

Next, have the students make a list of what plants need energy for (growing, developing defenses, making fruit, etc). What is different about the way that people get their energy versus plants (plants get energy from the sun, using their leaves to do photosynthesis; we get our energy from plants, either by directly eating them, or by eating meat or dairy products from animals that eat plants)? What do we do if we have extra energy or eat too much food (use it up by being active, gain weight, etc)? How do plants use up the extra energy that they make (new growth, such as growing fruits on the plant, or storing their energy as sugar or starch)?

Applesauce Part 1 (10 minutes)

Ask students what happens to an apple if you leave it for too long? Will it still be good to eat? What will start happening to it? How do humans deal with the problem of food going bad? Kids will probably want to talk about just going to the grocery store to buy more food if you run out or if the food you have goes bad.

Have them close their eyes, and push them to imagine a world WITHOUT groceries, having them imagine that they are the first pilgrims and live hundreds of years ago before refrigeration and grocery stores were available. They are getting off a boat in the New World and the weather is getting cold. They brought some apples on the boat but some of them are already going bad after the long journey. What can they do to survive the winter?

Applesauce and jams are a way to STORE (fruit) food for winter that we can't get otherwise. Making something like applesauce allows us to use all the apples that would otherwise go bad and preserve them to eat at a time when we can't find them naturally. It is a way for us to hold on to the nutrients an apple gives us for a longer time.

With the students' help if you wish, apples should be put into a rice cooker or crockpot with other ingredients and left to simmer for as long as possible while moving on to the other experiments. Make sure kids realize the pot is hot and they should avoid it and the cord.

Sugar vs. Starch Experiments (25 minutes)

Reiterate that plants give us energy when we eat them. That energy is stored in 2 different ways inside plants: sugars and starches. Sugars taste sweeter to us, while starches are not

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as sweet. Pick a few plant parts and have students guess which part of the plant it is and whether it is more sugary or starchy. (Roots are more starchy, fruits are sugary, leaves are somewhere in between the two, usually).

With older students, talk kids through the basics of carbohydrates, explaining that sugars are energy stored that can be used right away, while starches are for storing energy for a long time, which are long chains of sugar (glucose specifically) which are easier to store (much less reactive, insoluble, longer chains).

When we eat something that is mostly starch (like a potato) it is a longer-term storage organ, not like a blackberry, which is a short-term way of having energy. Push kids to think this through, doesn't that make sense a bit? A potato is energy for the plant for the **WHOLE WINTER** so it has to be able to store well, but a blackberry just needs to be out for just a short amount of time to attract a bird to eat it and carry the seeds, so it doesn't last through the winter. When people are about to run a marathon or have a big football game coming up they eat lots of pasta (starch!) so they will have energy through the **WHOLE GAME**, not just at the start. If we eat a ton of Halloween candy, we have a ton of energy for awhile, and then feel sick and have low energy for a long time.

For each experiment have the class come up with a hypothesis (or multiple hypotheses if there is not consensus) and record these on the board or a large piece of paper.

Experiment 1: Cracker Taste Test

Give each student an unsalted cracker/piece of bread and tell them to chew it **SLOWLY** and as they chew pay attention to any differences in the taste they might notice. Remind them to be very slow and deliberate. Students should hopefully notice that as they eat the cracker/piece of bread begins to taste sweeter... why is this happening? (Their saliva is breaking down the starches in it into sweet-tasting sugars.) The goal of this experiment to solidify the idea that sugars and starches are made up of the same things.

Experiment 2: As the Banana Ripens

Take an unripe, green and an over ripe, brown banana and have the kids spend a minute making observations about them. Encourage them to think about how each smells, feels, tastes, etc. Explain that iodine turns blue/black when it touches a starch and stays brown when it touches a sugar. For each table, set out slices of each banana and have the kids put a few drops of iodine onto the slices. What color does the banana turn? Which one is more sugar and which one is more starchy? What does this mean about what happens when bananas ripen?

What differences do you notice between the two bananas? Explain to the kids that the bananas are still made of the same things (carbohydrates) but in the unripe banana the carbohydrates are still in their "storage" phase as starches, which are not as sweet, and are more stable (better for storing), whereas in the overripe banana the carbohydrates have all separated into sugars which are available energy **RIGHT NOW**.

If the kids are interested, you can also test other classroom items, such as paper, or other fruits or vegetables, to see if they are sugars or starches.

Applesauce, Part 2 and Conclusion (10 minutes)

Now get the students back to thinking about how WE store food. We eat starches (rice, potatoes, pasta, cereals etc.) and sugars every day that are made from plant parts that come from all over the world and are processed in many different ways. Without grocery stores and being able to import food, we would only be able to eat what is in season where we are, and in the winter that's not very much! Humans are clever though, and we figure out ways of holding on to food and the nutrients in them for a while. We make tomato sauce to have tomatoes in the winter, jam to have berries in the fall, and APPLESAUCE to satisfy our apple cravings any time! Have the kids start thinking about what it means to eat something when it isn't in season. What do we have to do in order to be able to get it to where we are? What impact does that have on the environment? On culture?

Pull out the cinnamon and lemon peel and mash the applesauce with a potato masher. Give each kid a small cup of it and enjoy!

Vocabulary

Carbohydrate
Digest
Hypothesis
Preserve
Starch
Storage
Sugar

Vocabulario

Almacenaje
Azúcar
Digerir
Fécula
Hidrato de carbono
Hipótesis
Preservar

Extensions / Homework Ideas:

- Can you think of other fruits or vegetables besides bananas that get sweeter as they ripen? Get another kind of fruit unripe from the store and test it as it ripens.
- Have students look in their home pantries and identify foods containing fruits that have been stored to be preserved over time. Also have them identify sweet foods containing sugar, and starchy foods such as pastas and grains. For a math experiment, have them count how many sugars and starches they eat every day and add them as a class, finding averages and trends. You can also do this with favorite sugary/starchy foods.