

Sugar Rush: The Science of Sweet

FRAMEWORK

- I. Scientific and Engineering Practices
- II. Cross-Cutting Concepts
- III. Physical Sciences

SKILLS/OBJECTIVES

- To observe the results of hands-on experiments and make inferences/draw conclusions
- To understand that sugar comes in different forms which affect the body in different ways. Not all sugar is “bad” for you.
- To use learned information to have a better understanding of the sugar in foods the children consume on a daily basis.

MATERIALS

- Clear beakers/containers
- Corn Syrup
- Red Food Coloring
- Measuring spoons (tea spoons)
- Sugar
- Flour
- Stirrers
- Timers
- Iodine Solution*
- Various apples (e.g. Red Delicious, Golden Delicious, Gala...etc)
- Knife (to be used by instructor only)
- Petri dishes
- Paper Plates
- Potato Chips
- Cheerios
- White Flour
- Sweet Potatoes
- Ripe bananas
- American cheese
- Butter
- Egg whites
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NOTES

- The iodine solution is to be prepared beforehand, material and instructions for preparation are found on the final page.
- Activity #1 is most appropriate for younger children.
- Activity #3: The knife should be handled only by the instructor.

BACKGROUND

- Ask children basic questions related to the topic: “What is sugar?” “What foods is it in?” “What does it do for our bodies?”
- Explain that sugar is one of the main ways that humans get energy (they need to eat it because they cannot make within themselves, like plants)
- Explain that sugar is in lots of things besides candy and soda, it is found in fruit, yogurt, bread, rice...However, it is often called by it’s scientific name “**carbohydrate**” (show nutrition label, if handy)
- Explain that these “carbohydrates” come in different forms; some are big long chains of molecules (polymers, polysaccharides, starch) which are found in bread and potatoes vs. other smaller molecules (fructose, sucrose...) which are found in fruit and table sugar.

Activity # 1	Absorbing Sugar
Materials	None
Worksheet	N

- Our body breaks big chains of sugar into smaller units of sugar (like the ones in fruit and candy) so that it can be digested
- Potatoes have long chains of sugar. We are going to act out how these chains broken down.
- Choose one child to be the enzyme amylase found in the mouth and another child to be the enzyme maltase found in the small intestine. Have the maltase stand on other side of the room.
- **Stand in a line and join hands.** Explain to the children they are a long chain of sugar (a polysaccharide).
- **Move towards the amylase. When you reach the amylase, split into pairs.** Tell them they are entering the mouth and the enzyme amylase is breaking them into maltose, which come in pairs.
- **In pairs, move towards the maltase on the other side of the room. When you reach the maltase, break your link with your partner.** Explain that they are passing down the throat, through the stomach until they reach the small intestine where they meet maltase. Maltase splits the pairs into individual sugars. Tell everyone that they are now glucose, the same sugar found in plants and a lot like the sugar they find in fruits, candy, juice...etc

Activity # 2	Absorbing Sugar Demonstration
Materials	<ul style="list-style-type: none"> ○ Two 500 mL beakers (or other clear container) ○ Corn Syrup ○ Red Food Coloring ○ Measuring spoons (tea spoons) ○ Sugar ○ Flour ○ Stirrers ○ Timers
Worksheet	No

- Explain that we will do an experiment to show how our bodies react differently to two kinds of sugar (starch vs. sucrose).
- **Fill two 500ml beakers half-way with corn syrup.**
- **Add a few drops of red food coloring to each beaker and stir to create the effect of artificial blood.**
- **Show one child how to use the timer.**
- **Place one teaspoon of sugar on top of the solution in one glass.**
- **Have the child record with the timer the rates at which the sugar is absorbed.**
- **Place one teaspoon of flour on top of the solution of the other glass.**
- **Have another child record with the timer the rate at which the flour is absorbed.**
- Have the children compare the rates at which the sugar vs. the flour was absorbed.
- The reason for the different rates is because of the length/complexity of the molecule → we can readily absorb refined sugar into our blood but complex starches take longer.
- Talk about the feeling of a “sugar rush” such as on Halloween → this happens because it’s the consumption of a lot of refined sugars

Activity # 3	Sweet Apples
Materials	<ul style="list-style-type: none"> ○ Iodine Solution* ○ Various apples (e.g. Red Delicious, Golden Delicious, Gala...etc) ○ Knife (to be used by instructor only) ○ Petri dishes ○ Paper Plates

Worksheet	No

- Now we will show that apples contain sugar (starch) through an iodine test and comparing the different distributions of starch in different types of apples.
- Present different types of apples that have been sliced and explain that apples have both starch (complex sugars) and simple sugars, and as they ripen more of the complex sugars become simple sugars
- **Try the different apples and predict which ones will have the most starch.**
- We can use iodine to see which apples have the most starch since iodine turns blue/black when it reacts with starch. So, iodine acts as a starch indicator.
- Pour iodine solution into petri dishes so that they are about 0.25 inches full
- Cut each apple in half and put the exposed surface face-down into the petri dish with the iodine solution.
- Let the apple sit for 1 minute.
- **Compare the different starch patterns represented by the black/blue pattern left on the different apples.**
- If no black/blue pattern is left, you can assume that all of the starch has been converted simple sugars.
- The apples with the most starch should be less sweet since more of the starch has not been converted to simple sugars, does this match the predictions the children made?
- *Extra: See what happens when apples are left to react in iodine longer. Also, you can test the difference between very ripe apples and rotting apples.

Activity # 4	Extra Starch Tests
Materials	<ul style="list-style-type: none"> ○ Potato Chips ○ Cheerios ○ White Flour ○ Sweet Potatoes ○ Ripe bananas ○ American cheese ○ Butter ○ Egg whites
Worksheet	No

- Present the children with a variety of foods and ask them which foods they think have starch in them (long chains of sugar) and which have refined sugars
- **Test it! Dip samples in petri- dishes containing the iodine solution or they can use pipettes.**
- Discuss why their predictions were right/ wrong (The no/low starch foods are composed of fats, protein or simple sugars). The kids may be surprised that sugar is found in salty foods like potato chips or foods that do not seem sweet like flour.

- *Extra: If there are foods left over from lunch/snacks the kids may test these foods too, for further exploration of sugar content in food. However, it is notable that once the food is tested, it may NOT be consumed.

Instructor Cheat Sheet:

Starch	No or Low Starch
Potato Chips	
Cheerios	
White Flour	Butter
Sweet Potatoes	Egg Whites
Ripe Banana	
American Cheese	

*Iodine Solution Preparation:

Materials:

- Potassium Iodide
- Water
- Iodine crystals
- Graduated Cylinder
- Large Bottle (capacity of about 1.5 Liters)
- Aluminum foil
- Beaker

Procedure:

- In the beaker dissolve 10 grams of potassium iodide in 10ml of water
- When it has dissolved, add 2.5 grams of iodine crystals
- Stir the mixture until the crystals have dissolved
- Pour the mixture into the bottle
- Dilute the mixture with 1.14 Liters of water
- Cover the bottle in aluminum foil for storage to minimize light exposure, and store in a dark space
- Make sure the solution is completely mixed by shaking the bottle everyday for several days

CONCLUSIONS

Closing powwow with group to reinforce the basic take home message or final discovery (in bold or otherwise easily observable) the lesson should help kids get to.

Any “continued investigations” projects should be sent home with them on paper in an easily follow-able for guardians. Should contain basic highlighting of the lesson name and big message for guardians as they not be able to get all that information out of the kids.