



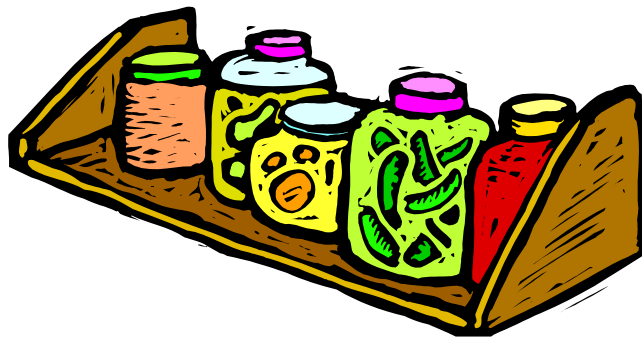
Name _____

Freeze My Fruits and Veggies



PUT IT UP!

The *PUT IT UP!* series of lessons in home food preservation includes six different food preservation methods: boiling water canning, making jam, pickling, freezing, drying, and pressure canning. Each method is divided into a beginning hands-on activity and an advanced hands-on activity. Activities may stand alone or be sequenced for cumulative learning. In addition to step-by-step procedures, reflection questions, and ideas for experimentation, each method also includes additional activities: a science-based fill-in-the blank challenge, a history-based word search, a glossary, a resource list, a knowledge test, and more.



On the following pages,
PUT IT UP! Freeze My Fruits and Veggies contains:

- ◊ Beginning Activity: Freeze My Berries
- ◊ Advanced Activity: Freeze My Corn-on-the Cob
- ◊ Additional Activities: Freeze My Fruits and Veggies



Name _____
Date _____
Teacher _____

Freeze My Berries



Credits and Acknowledgments

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Special thanks to:

Pilot Program Leaders (and youth participants!)

from Clemson Cooperative Extension

& University of Georgia Cooperative Extension

and Advisory Committee members



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Freezing: A Preservation Exploration

Have you ever had a fresh fruit popsicle or a chocolate covered banana on a hot summer day? Maybe you've tried frozen vegetables in stir-fry, or heated them up in a microwave as a side dish? Perhaps you liked to eat frozen peas when you were younger...or perhaps you still like them?!

In this food science exploration, you get to learn how to preserve your own frozen fruits and vegetables at home.

Let's start with some basics of food science and preservation:

Preservation means to prevent decay, or in other words to stop a food from breaking down and spoiling. Rotten tomatoes, moldy bread, and stinky old milk are all examples of spoiled foods.

Home food preservation methods include canning, making jam, pickling, and drying (or dehydrating). Two very common preservation methods used in modern households to extend the shelf-life of foods are refrigeration and freezing.

Freezing is when food is placed in freezing temperatures which cause the food itself to drop in temperature until it too is frozen. Fruits and vegetables contain a lot of water. As that liquid freezes, it becomes solid.

We freeze foods to prevent growth of microorganisms. Mold, yeast, and bacteria are the types of microorganisms most commonly found on food. Just like us, these tiny organisms also need water to live and grow. Freezing slows or even stops the growth of microorganisms by lowering temperature and by tying up water so that it can't be used.

Only a few microorganisms are actually killed by freezing, so we wash food very well before freezing to reduce their number. Microorganisms can grow again once frozen food is taken out of the freezer into warmer air, so we refrigerate thawed foods if they are not used immediately.



Have you ever made ice cream at home? Ice cream is really just a way to preserve milk by freezing it (with some extra deliciousness added)!

Beginning Freezing Activity: Berries

Time required:
1 to 2 hours procedure + 1 hour minimum additional freezing time
= 2 to 3 hours (+ freeze overnight for best results)

Ingredients:

- 3 pints berries (may be all the same type or different types; blueberries work well for making texture comparisons)
- $\frac{3}{8}$ cup sugar ($\frac{3}{8}$ cup = $\frac{1}{4}$ cup + 2 tablespoons)
- Any additional ingredients from 'Want to Experiment?' (optional)

Equipment needed:

- Freezer
- Pint freezer bags or plastic pint freezer containers with lids
- Permanent marker, or ink pen if writing on bags
- Colander(s)
- Paper towels (optional)
- Large bowl(s)
- Sheet pan(s)/cookie sheets
- Dry measuring cups
- Measuring spoons
- Large spoon for mixing
- Headspace tool
- Tape or other tool to use as divider if using just one sheet pan (see step 7)
- Freezer tape (optional; only if using freezer containers)
- Labels (optional)

Select fully ripe, firm, well-colored berries.

Set freezer temperature at -10°F or lower 24 hours in advance of activity.

What's in season? Are blueberries, blackberries, strawberries, or raspberries available at a local pick-your-own berry patch?

The Procedure

Just Follow These Steps...

Part One: Preparing the Containers

1. Wash hands thoroughly with soap under running water for at least 20 seconds, rinse well, and dry.
2. Assemble equipment and ingredients.
3. If using freezer containers, examine and discard any with cracks. Wash containers and lids thoroughly in warm soapy water, rinse well and dry.
4. Label three lids or freezer bags with the type(s) of berries. Then write "Not rinsed" on one container/bag, "Rinsed" on another container/bag, and "Sugar pack" on a third container/bag. Lastly, write the date and your name on each.



Feeling creative?
Make up a company name
for your products.



Fun Facts!

Raspberries
and blueberries
are high in
fiber, vitamin
C, and
potassium.

Frozen fruits
have nearly the
same nutrition
compared to
fresh fruits.



Part Two: Preparing the Berries

5. Remove leaves and stems. Discard under-ripe (hard), over-ripe (squishy), or spoiled (moldy) fruit.

FIRST, LET'S TRAY PACK SOME BERRIES, RINSED AND UNRINSED...

6. Rinse one pint of berries in cold water in a colander.

7. Spread out the pint of rinsed berries onto half of a sheet pan, and one pint of unrinsed but clean berries onto the other half of the pan. Place a piece of tape down the middle of the pan to separate the rinsed from the unrinsed, or use two pans. Use a piece of tape to label which is "rinsed" and "unrinsed".

8. Carefully place in the freezer, keeping the sheet pan flat so berries do not touch each other.

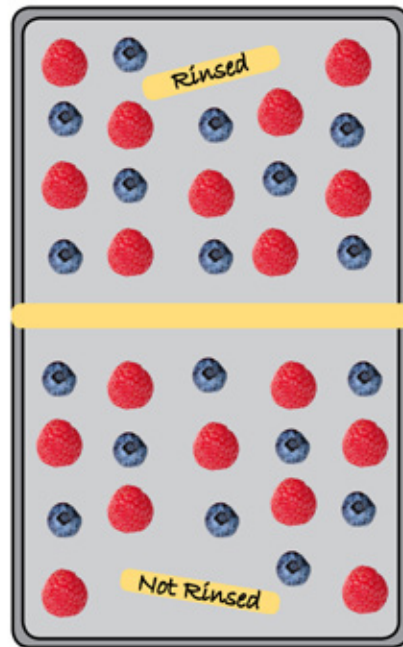
Freeze overnight, or for at least 1 hour.

MEANWHILE, LET'S PACK SOME WITH SUGAR...

9. Rinse another pint of berries as done in step 6. Gently mix this pint of washed berries with $\frac{3}{8}$ cup ($\frac{1}{4}$ cup + 2 tablespoons) sugar. Gently stir berries until the sugar is dispersed evenly.

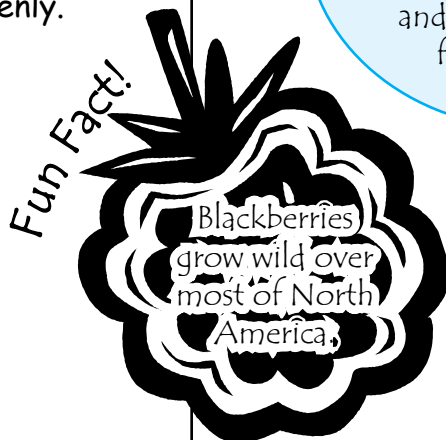
Think About It: Ice Crystals

How do you think water left on the berries will change the quality of the frozen berries?
Why?



Think Again! Added Sugar

How do you think adding sugar will affect the texture, flavor, and nutrition of the frozen berries?



Part Three: Packaging the Berries

10. Put sugared berries into containers/bags, leaving $\frac{1}{2}$ -inch headspace.

Headspace is the space between the top of the food and the sealing area of the container or bag it is in. Measure headspace with headspace tool; remove or add berries so that it is $\frac{1}{2}$ -inch. If using freezer bags, fill to $\frac{1}{2}$ -inch from top and gently press on bag (without squishing berries) to remove as much air as possible before closing. If using freezer containers, apply lids. If lids do not fit tightly, reinforce the seal by applying freezer tape where the lid touches the container.

11. Place containers/bags in the coldest part of the freezer: the back and sides. If there are shelves, place containers in contact with shelves to freeze quicker.

NOW, LET'S FINISH THE TRAY PACK WE STARTED WITH...

12. Check the berries on the sheet trays. Once the berries on the sheet trays are frozen, pack them into their correctly labeled containers or bags. Remember to leave $\frac{1}{2}$ -inch headspace, removing or adding berries so that it is $\frac{1}{2}$ -inch. Also remember to remove air from bags or add tape to sealing area of container if needed.

13. Place the bags/containers towards the back and sides of the freezer, placing them on shelves if available.

14. For best quality, keep freezer temperature at 0°F and enjoy with family and friends within 8 to 12 months.



Think About It: Phase Change and Headspace

What happens to water as it turns into ice? Does liquid water take up more or less space than frozen water? What could happen if there is not enough empty headspace in a container used for freezing food?

Learn that Term: Oxidation

Oxidation causes color, texture, and flavor changes when oxygen comes into contact with an exposed surface of food. What would happen to food in the freezer if too much headspace was left in its packaging?

Time to Reflect...

Write your responses to these questions.
Then, share your reflections with someone else.

What was your favorite part of freezing berries?

For you, what was the most challenging part of freezing berries?

What surprised you most in this activity?



If you could do this activity again, what is one thing you would change?
Why?

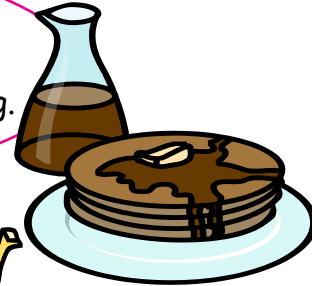
Do you think that freezing fruit is a useful skill? Why or why not?

How will you use what you have learned about freezing fruit?

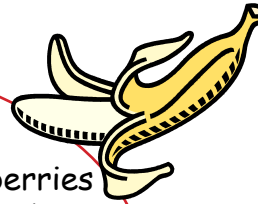
Want to Experiment?



Add frozen berries as a topping to ice cream, yogurt, oatmeal, or cereal. Add berries to pancake batter before cooking.



Make a berry smoothie by blending berries with a splash of orange juice and sherbet or vanilla frozen yogurt. Or, make a banana-berry smoothie by blending 1 ripe banana with about 1 cup frozen berries and 1 cup yogurt or milk until smooth.

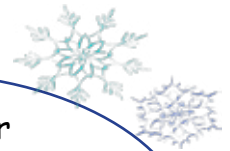


Make berry milkshakes: blend 1 pint vanilla ice cream, 1/2 cup unsweetened frozen berries and 1 cup milk.

Do a sensory comparison — taste the three different types of packs of berries (rinsed, unrinsed, and sugared) and observe similarities and differences between their textures and flavors.



Compare your frozen berries to store-bought frozen berries and/or fresh berries. How are they different? What do you think causes the differences?



Try freezing other types of fruits. Some fruits such as apples and peaches must be treated with ascorbic acid to prevent browning. Instructions are in *So Easy to Preserve*.



Did you really like freezing berries? Brainstorm, research, or just ask your leader about careers in which you get to play with food, like food science, cooking, or catering.



Name _____

Date _____

Teacher _____

Freeze My Corn-on-the-Cob



Credits and Acknowledgments

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Freezing is when food is placed in freezing temperatures which cause the food itself to drop in temperature until it too is frozen. Fruits and vegetables contain a lot of water. As that liquid freezes, it becomes solid.

We freeze foods to prevent growth of microorganisms. Mold, yeast, and bacteria are the types of microorganisms most commonly found on food. Just like us, these tiny organisms also need water to live and grow. Freezing slows or even stops the growth of microorganisms by lowering temperature and by tying up water so that it can't be used.

Only a few microorganisms are actually killed by freezing, so we wash food very well before freezing to reduce their number. Microorganisms can grow again once frozen food is taken out of the freezer into warmer air, so we refrigerate thawed foods if they are not used immediately.



Have you ever made ice cream at home? Ice cream is really just a way to preserve milk by freezing it (with some extra deliciousness added)!

Advanced Freezing Activity: Corn-on-the-Cob

Time required:
2 to 3 hours procedure + additional freezing overnight

Ingredients:

- 8 equal-sized ears of corn
- 5 pounds ice
- Any additional ingredients from 'Want to Experiment?' (optional)

Equipment needed:

- Gas or electric stovetop range
- Freezer
- Quart-size freezer bags
- Permanent marker or ink pen
- Blancher with basket and cover (or a large pot with lid and wire basket)
- Vegetable brush
- Colander(s)
- Large bowl(s)
- Paper towels (optional)
- Headspace tool
- Large stockpot
- Timer (may be on oven)
- Tongs

Select tender, freshly gathered milk-stage corn. When punctured, kernels of milk-stage corn ooze milky white liquid.

Set freezer temperature at -10°F or lower 24 hours in advance of activity.

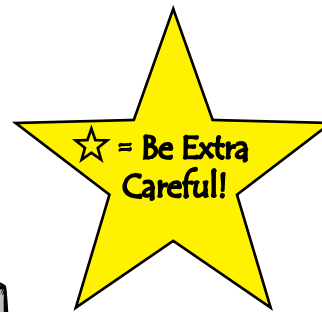


The Procedure

Just Follow These Steps...

Part One: Preparing the Bags and Equipment

1. Wash hands well with soap and running water for 20 seconds, rinse, and dry.
2. Assemble equipment and ingredients.
3. Use a permanent marker or pen to label freezer bags with your name, the name of the product and the date.
4. ★ Fill the blancher about $\frac{1}{2}$ full of hot water then place it on a burner and turn heat on high to bring the water to a boil.
5. Fill a large bowl with ice and water.



Feeling creative?

Make up a company name
for your products.

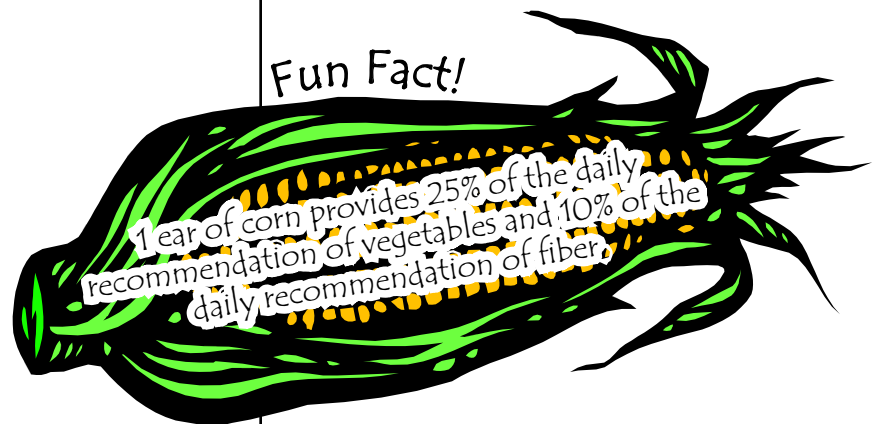


Learn that Term: Blanching

To blanch means to quickly dip into boiling water or steam from boiling water. Blanching before freezing vegetables helps slow the breakdown of color, flavor and texture without cooking it completely. Blanching also helps clean, slow the loss of vitamins, and makes some veggies easier to pack.


Fun Fact!

1 ear of corn provides 25% of the daily recommendation of vegetables and 10% of the daily recommendation of fiber.



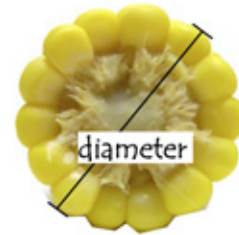


Part Two: Preparing the Corn

6. Use your hands to remove the husks (outer leaves) from the ears of corn. Remove silks by gently rubbing ears of corn with a vegetable brush.
7. If corn is over 8 inches in length, grip the ends of the corn firmly and break into halves to form two smaller cobs.
8. Rinse the corn in cold water in a colander.
9. Use headspace tool to measure diameter of the ears across their widest section and sort according to size (see diagram and table to the right).
10. ★ Check the water in the blancher to make sure it is boiling vigorously.
11. ★ Put four of the same size ears of corn in the blanching basket and lower into the boiling water. Place lid on the blancher. The water should return to boiling within 1 minute, or you are putting in too much for the amount of boiling water. When the water returns to a boil, set timer using the appropriate time on the table to the right. 
12. Cool the ears immediately by plunging the blanching basket containing the corn into a large bowl of ice cold water. Leave the corn in ice water for about the same amount of time as blanching, then feel with clean hands to make sure the cobs are cool. Once cool, drain corn in a colander. Blot ears dry with paper towels (optional).
13. Repeat steps 11-12 as needed for the remaining ears of corn.

Think About It: Blanching Times

What would happen if the corn was blanched for too long? What would happen if the corn was not blanched long enough?



Blanching Times for Small, Medium or Large Ears of Corn

Size of Ear	Blanching Time
Small ($\leq 1\frac{1}{4}$ in. diameter)	7 minutes
Medium ($1\frac{1}{4}$ - $1\frac{1}{2}$ in. diameter)	9 minutes
Large ($>1\frac{1}{2}$ in. diameter)	11 minutes

Blanching information from: *So Easy To Preserve.*

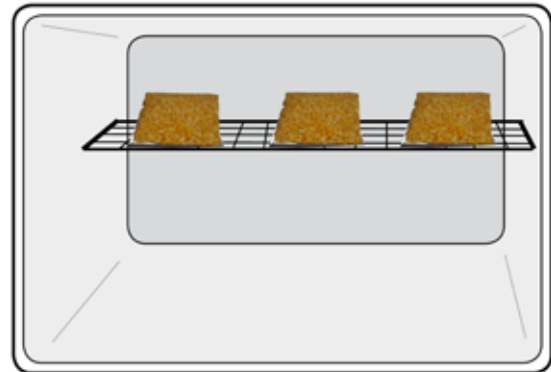
Think Again! Ice Crystals

What will happen to the water droplets still on the corn when it goes into the freezer? How might this affect the quality of the corn?

Part Three: Packaging and Freezing the Corn

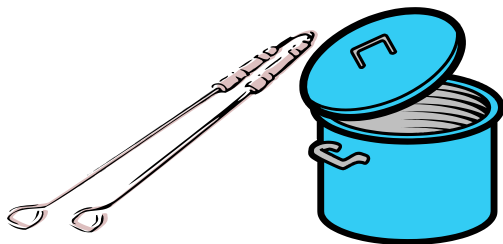
14. Pack cooled ears of corn into freezer bags. Press as much air as possible out of the bag. Measure headspace (space between the corn and the sealing area of the bag) with a headspace tool; remove or add corn so that headspace is $\frac{1}{2}$ -inch.

15. Place bags of corn in the coldest part of the freezer — the back and sides. If there are shelves, place packages in contact with shelves to allow for quicker freezing.



Freeze overnight, or longer.

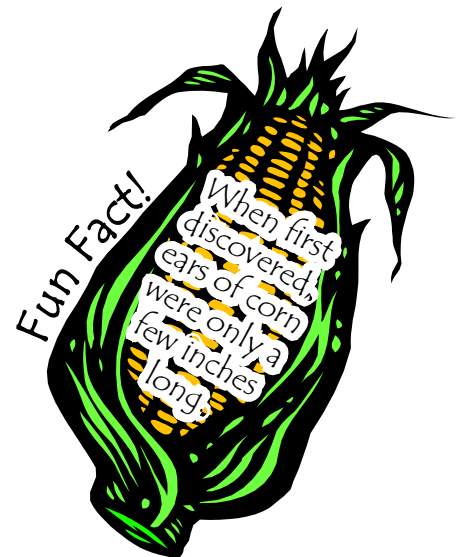
16. For best quality, keep freezer temperature at 0°F and enjoy with family and friends within 8 to 12 months.



Bonus! Part Four: Cooking the Corn

★ Put the desired number of frozen ears of corn in a large pot. Fill the pot with enough water to completely cover the ears. Place the pot on the stove and bring the water to a boil. Allow the corn to boil for 9 to 10 minutes.

Remove the corn from the boiling water with tongs and drain well before serving.



Fun Facts from:

Iowa Corn Promotion Board. (2013). *FAQ*. Iowa Corn Growers Association.

USDA. (2009). *Household Commodity Fact Sheet: Corn, Fresh*. USDA.

Time to Reflect...

Write your responses to these questions.
Then, share your reflections with someone else.

What was your favorite part of freezing corn-on-the-cob?

For you, what was the most challenging part of freezing corn-on-the-cob?

What surprised you most in this activity?



If you could do this activity again, what is one thing you would change?
Why?

Do you think that freezing vegetables is a useful skill?
Why or why not?

How will you use what you have learned about freezing vegetables?

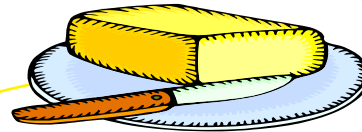
Want to Experiment?



For a zesty snack, squeeze a fresh lime wedge over cooked corn. Very lightly, sprinkle paprika or cayenne. Be careful - it could get very spicy!



Cook corn-on-the-cob a variety of ways: on a grill, in an oven and in a microwave. How do these different heating methods change the flavor and texture of the corn?



For a sweet treat, rub a small pad of butter evenly over cooked corn then sprinkle $\frac{1}{2}$ teaspoon of a cinnamon sugar mix to cover evenly. Or, lightly drizzle honey onto the corn.



To freeze corn kernels off the cob, first blanch corn-on-the-cob for 4 minutes, then cool, drain, and cut the kernels off the cob. Fill, seal, and freeze a freezer bag or container, leaving $\frac{1}{2}$ inch headspace. Use the corn kernels in recipes such as cornbread, pancakes, and soups.



Try freezing cream style corn or other types of vegetables. Look in *So Easy to Preserve* for recommendations.

Evaluate the quality of finished frozen products. Use a scale of excellent to poor for the following categories: headspace, color, texture, product labels, and lack of ice crystals (also called freezer burn).



Do some research to find which vegetables (or other foods) do not freeze well. Why do some foods freeze better than others?



Did you really like freezing corn? Brainstorm, research, or just ask your leader about careers in which you get to play with food, like food science, cooking, or catering.



Name _____
Date _____
Teacher _____

Freeze My Fruits and Veggies



Brought to you by the
National Center for Home Food Processing and Preservation,
University of Georgia Cooperative Extension and Clemson Cooperative Extension

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All About Freezing

FUNdamentals of Freezing.....	A.A.4
What's the Story of Freezing?.....	A.A.5
Why So Cold?.....	A.A.6
Glossary, Sources, and Resources.....	A.A.7
What Do You Know About Freezing?.....	(A.A.8)



Freezing is a science, so there are important facts and concepts at play. These FUNdamentals will help you understand the steps of the freezing procedure.



FUNdamentals of Freezing

Use the word bank at the bottom of the page to correctly fill in the blanks. (Hint: The answers can be found in the pages of this activity book.)

_____ is a method of food preservation that uses low temperatures to preserve foods for weeks, months, even up to a year.

Microorganisms (bacteria, molds, and yeasts) sometimes cause food to _____.

Cold temperatures slow or stop the growth of _____, but do not destroy them.

When water freezes, it changes from a liquid to a solid.
Water _____ and increases in size as it freezes into ice.

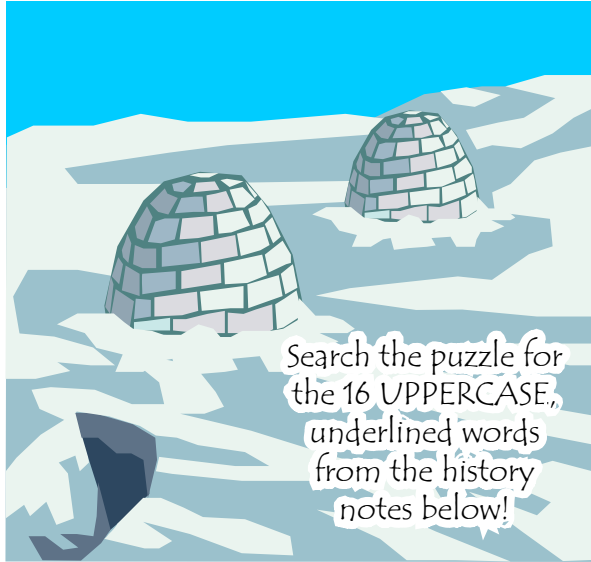
Ice crystals can break the cell walls of food and make it mushy. Freezing food _____ in a very cold freezer (-10°F) reduces mushiness because ice crystals are smaller the faster they form.

When _____ comes into contact with an exposed surface of food, it will eventually oxidize that part of the food, causing color, texture, and/or flavor changes.

_____, Cooperative Extension, and the National Center for Home Food Preservation have science-based recipes for freezing, like the recommendations in the book *So Easy to Preserve*.

Word bank: USDA, OXYGEN, FREEZING, EXPANDS, MICROORGANISMS, SPOIL, QUICKLY

What's the Story of Freezing?



S	E	U	B	Y	J	G	V	N	P	Z	A	Z	F	V
J	R	W	Z	R	Q	C	E	O	I	B	Y	N	L	S
U	O	E	M	K	B	X	S	I	K	E	E	S	U	R
K	Q	S	T	B	T	O	K	T	J	Z	F	C	I	A
I	W	U	R	N	M	I	Y	A	O	O	R	K	D	L
B	C	X	A	I	I	U	P	R	E	Y	B	I	I	L
L	Y	U	K	L	M	W	F	E	O	V	X	B	Z	E
A	O	S	G	E	I	K	A	G	K	Q	I	R	E	C
S	E	K	S	B	C	T	E	I	L	A	E	M	D	G
T	U	N	O	I	M	N	Y	R	P	D	W	Z	C	W
A	O	O	U	N	I	K	F	F	P	O	F	L	J	D
W	A	Q	R	C	O	N	V	E	N	I	E	N	C	E
Y	X	J	Q	E	D	H	R	R	C	C	L	D	W	N
Y	R	T	S	U	D	N	I	L	Y	I	N	S	W	U
P	R	R	P	V	I	V	Y	R	A	P	I	D	L	Y

- In early recorded history, people in China used ice cellars to preserve foods through WINTERS.
- Ancient Romans stored food with packed SNOW in insulated CELLARS.
- A process for freezing food in an ICE and salt water solution was patented in Britain in 1842.
- Mechanical REFRIGERATION was invented in the 1800's.
- In the 1910's, Clarence Birdseye was inspired by Inuit ESKIMOS in Labrador, Canada. Eskimos froze excellent quality fish and meat at low Arctic temperatures. Back in the U.S., Birdseye patented a quick freezing system to RAPIDLY freeze individual food items.
- Have you ever eaten a frozen dinner from the grocery store? The first QUICK-FROZEN, ready-to-eat MEAL was sold in 1953.
- In the 1960's, frozen CONVENIENCE meals were widely available in the UK and America, made popular because they were so quick and easy to serve: simply heat them up and enjoy the meal!
- The commercial frozen food INDUSTRY uses several methods of freezing, including:
 - "BLAST freezing" (food is frozen by a blast of very cold air),
 - "Individual quick freezing" (IQF) (small foods are frozen by an upward blast of cold air), and
 - "CRYOGENIC freezing" (food is frozen by direct contact with liquid nitrogen or liquid carbon dioxide).
- Fruits and vegetables that are frozen and kept at -18°C (0°F) will keep good QUALITY for 12 months or longer.

Why So Cold?

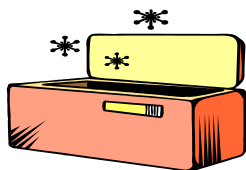


Have you ever been so cold that the only way to feel warm was to move your body, like by jumping up and down? Well, food can't do jumping jacks, so the water inside it becomes **so cold and still that it actually stops moving.**

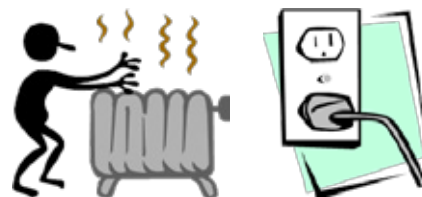
Just like your body, fresh food contains a lot of water. As a food loses heat to the cold air surrounding it, the water inside that food also cools. **Water molecules slow down as they lose heat.** To freeze, the water must get so cold that its molecules become still. In other words, the liquid water becomes a solid, also known as ice. When water turns from liquid to solid it is called a *phase change*.

In nature, **heat travels from hot to cold,** causing cold things to become warmer.

A home freezer is a technology created to reverse this energy flow – heat is removed from a freezer in order to lower temperature.



Have you ever stood beside a refrigerator or freezer and felt warm air coming out of it? That's because hot air is being pushed out in order to keep it cold inside! That work is done by electrical power.



As the water in food freezes, it forms ice crystals. If temperature drops slowly and food freezes slowly, then large ice crystals form. Large crystals break the cell walls of fruits and veggies, causing them to be soft and mushy when they thaw. Faster freezing at extremely cold temperatures causes smaller ice crystals that don't damage food as much.



Glossary

Bacteria are a type of microorganism that often grow on food and can cause spoilage or sickness.

Enzymes are natural proteins that speed up the rate of reactions necessary for life.

Evaporation is the phase change from a liquid to a gas.

Food preservation protects food from spoilage by microorganisms and enzymes.

Freezing is the phase change from a liquid to a solid.

Headspace is the empty space between the top of a product and the top of the container or bag.

Microorganisms are living creatures so small that you need to use a microscope to see them.

Mold and **Yeast** are types of microorganisms that often grow on food and can cause spoilage.

Molecules are the smallest part of a substance which still has all parts needed to identify it.

Oxidation is a chemical and physical change caused by oxygen interacting with a substance.

Phase Change is a physical change from one state to another without a chemical change.

USDA is an acronym for the United States Department of Agriculture; a reliable source for scientifically tested home food preservation recommendations, including freezing.

Sources and Resources

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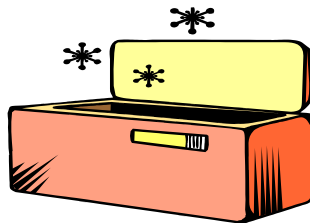
Name: _____

Date: _____

What Do You Know About Freezing?

If you think the statement is true then circle "True",
and if you think the statement is not true then circle "False".

- | | | |
|--|------|-------|
| Freezing food is based on science. | True | False |
| Food lasts longer if it is frozen than if it is left at room temperature. | True | False |
| Low temperatures (like in a freezer) speed up the growth of microorganisms (like mold) and cause food to spoil faster. | True | False |
| The best quality frozen foods are frozen very slowly so that large ice crystals form. | True | False |
| Cold temperatures cause water molecules to move slower. | True | False |
| Microorganisms are killed by the cold temperature inside a freezer. | True | False |



If you agree with a statement below then circle "I agree",
and if you don't agree with the statement then circle "I disagree".
There are no correct answers, just answer honestly with what is true for **you**.

- | | | |
|--|---------|------------|
| I like to make my own snacks and other foods at home. | I agree | I disagree |
| It's fun to prepare and preserve food. | I agree | I disagree |
| I know how to freeze food (with the help of an adult). | I agree | I disagree |
| I can get everything I need to freeze food at home. | I agree | I disagree |
| I will use freezing instructions from USDA or other science-based sources. | I agree | I disagree |
| Sometime when I am at home, I will try to freeze food (with the help of an adult). | I agree | I disagree |