Freeze My Fruits and Veggies

Method 4: Freezing

Name _____________________________

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

Freeze My Berries
Credits and Acknowledgments

Written by:
Kasey A. Christian, M.Ed., Project Assistant, National Center for Home Food Processing and Preservation (NCHFP), University of Georgia
Susan Barefoot, Ph.D., Extension Food Safety and Nutrition Program Team Leader, Clemson University

Edited by:
Elizabeth L. Andress, Ph.D., Director, NCHFP and Extension Food Safety Specialist, University of Georgia
Judy A. Harrison, Ph.D., Extension Foods Specialist, University of Georgia

Designed by:
Kasey A. Christian, M.Ed., Project Assistant, NCHFP, University of Georgia

Special thanks to:
Pilot Program Leaders (and youth participants!)
   from Clemson Cooperative Extension
   & University of Georgia Cooperative Extension
and Advisory Committee members

© 2014
Released July 2014

This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under Agreement No. 2011-51110-30995.

The University of Georgia College of Agriculture & Environmental Sciences and College of Family & Consumer Sciences (working cooperatively with Fort Valley State University, the U.S. Department of Agriculture, and the counties of Georgia) offer their educational programs, assistance, and materials to all people regardless of race, sex, color, ethnicity or national origin, religion, age, disability, genetic information, sexual orientation, or veteran status. The University of Georgia is committed to principles of equal opportunity and affirmative action.

Clemson University Cooperative Extension Service offers its programs to people of all ages, regardless of race, color, sex, religion, national origin, disability, political beliefs, sexual orientation, marital or family status and is an equal opportunity employer.

The use of trade, firm, or corporation names in this curriculum and links to information on outside, commercial websites is for the educational information and convenience of the reader. Such use does not constitute an official endorsement or approval of any product or service to the exclusion of others that may be suitable.
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.
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, but using blueberries works best 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 or ruler
- Tape or other tool to use as divider if using just one sheet pan (see step 7)
- Freezer tape (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?

Note: If working as individuals or in small groups of 2 to 4, then distribute or share equipment so that each person or group has access to what is needed. Ingredients may be multiplied or divided such that each person or small group has equal amounts of berries and sugar. Remember to convert amounts throughout procedure if you do alter the amount.
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 washed” on one container/bag, “Washed” on another container/bag, and “Sugar pack” on a third container/bag. Lastly, write the date and your name on each.

Frozen fruits have nearly the same nutrition compared to fresh fruits. For best flavor and nutritional value, freeze fruits within 24 hours of harvest.

Feeling creative? Make up a company name for your products.
Part Two: Preparing the Berries

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

6. Wash one pint of berries in cold water in a colander. Drain washed berries in a colander or on paper towels.

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

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.

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

Fun Facts!

Blackberries grow wild over most of North America.

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

Think About It: Ice Crystals

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

Step #6 will allow you to observe how washing affects the texture of the frozen berries.

Step #9 will allow you to observe how adding sugar affects the flavor of the frozen berries.
Part Three: Packaging the Berries

10. Put sugared berries into containers/bags, leaving ½-inch headspace. Headspace is the space between the top of the food and the top of the container or bag it is in. Measure headspace with ruler or headspace tool; remove or add berries so that it is ½-inch. If using freezer bags, fill to ½-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.

12. Once the berries on the sheet trays are frozen, pack them into their correctly labeled containers or bags. Remember to leave ½-inch headspace, removing or adding berries so that it is ½-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 one or two others.

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?
______________________________________________________________________________
______________________________________________________________________________

Now think about how you will apply what you have learned today.
Again, share your ideas.

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?
______________________________________________________________________________
______________________________________________________________________________

Beg.8
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.*

**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.

Do a sensory comparison — taste the three different types of packs of berries (washed, unwashed, 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?

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.
PUT IT UP!

Freeze My Corn-on-the-Cob

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

Written by:
Kasey A. Christian, M.Ed., Project Assistant, National Center for Home Food Processing and Preservation (NCHFP), University of Georgia
Susan Barefoot, Ph.D., Extension Food Safety and Nutrition Program Team Leader, Clemson University

Edited by:
Elizabeth L. Andress, Ph.D., Director, NCHFP and Extension Food Safety Specialist, University of Georgia
Judy A. Harrison, Ph.D., Extension Foods Specialist, University of Georgia

Designed by:
Kasey A. Christian, M.Ed., Project Assistant, NCHFP, University of Georgia

Special thanks to:
Pilot Program Leaders (and youth participants!)
from Clemson Cooperative Extension & University of Georgia Cooperative Extension
and Advisory Committee members

©2014
Released July 2014

This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under Agreement No. 2011-51110-30995.

The University of Georgia College of Agriculture & Environmental Sciences and College of Family & Consumer Sciences (working cooperatively with Fort Valley State University, the U.S. Department of Agriculture, and the counties of Georgia) offer their educational programs, assistance, and materials to all people regardless of race, sex, color, ethnicity or national origin, religion, age, disability, genetic information, sexual orientation, or veteran status. The University of Georgia is committed to principles of equal opportunity and affirmative action.

Clemson University Cooperative Extension Service offers its programs to people of all ages, regardless of race, color, sex, religion, national origin, disability, political beliefs, sexual orientation, marital or family status and is an equal opportunity employer.

The use of trade, firm, or corporation names in this curriculum and links to information on outside, commercial websites is for the educational information and convenience of the reader. Such use does not constitute an official endorsement or approval of any product or service to the exclusion of others that may be suitable.
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)!
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 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 or ruler
- 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.

Note: If working as individuals or in small groups of 2 to 4, then distribute or share equipment so that each person or group has access to what is needed. Divide as needed so that each person or group has an equal amount of corn.

Fun Fact:
When first discovered, ears of corn were only a few inches long.
Part One: Preparing the Bags and Equipment

1. Wash hands thoroughly with soap under running water for at least 20 seconds, rinse well, 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 ½ full of hot water. Place the blancher on a large eye of the stovetop, turn heat on high, and bring the water to a boil.

5. Fill a large bowl with ice and cold water.

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.
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. Wash the corn in cold water in a colander.

9. Use heads pace tool or ruler to measure diameter of the ears across their largest section and sort according to size (see table to 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?

<table>
<thead>
<tr>
<th>Size of Ear</th>
<th>Blanching Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small (≤1 1/4 inches in diameter)</td>
<td>7 minutes</td>
</tr>
<tr>
<td>Medium (1 1/4 to 1 1/2 inches in diameter)</td>
<td>9 minutes</td>
</tr>
<tr>
<td>Large (&gt; 1 1/2 inches in diameter)</td>
<td>11 minutes</td>
</tr>
</tbody>
</table>

**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?

Blanching information from: So Easy To Preserve.
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 ruler or headspace tool; remove or add corn so that headspace is ½-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

17. * 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.

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

Fun Facts from:
USDA. (2009). Household Commodity Fact Sheet: Corn, Fresh. USDA.
Time to Reflect...

Write your responses to these questions. Then, share your reflections with one or two others.

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?

________________________________________________________________________

________________________________________________________________________

Now think about how you will apply what you have learned today. Again, share your ideas.

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?

________________________________________________________________________

________________________________________________________________________
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 ½ inch headspace. Use the corn kernels in recipes such as cornbread, pancakes, and soups.

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!

For a sweet treat, rub a small pad of butter evenly over cooked corn then sprinkle ¼ teaspoon of a cinnamon sugar mix to cover evenly. Or, lightly drizzle honey onto the corn.

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?

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

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

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).

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.
PUT IT UP!

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
Freezing

Credits and Acknowledgments

Written by:
Kasey A. Christian, M.Ed., Project Assistant, National Center for Home Food Processing and Preservation (NCHFP), University of Georgia
Susan Barefoot, Ph.D., Extension Food Safety and Nutrition Program Team Leader, Clemson University

Edited by:
Elizabeth L. Andress, Ph.D., Director, NCHFP and Extension Food Safety Specialist, University of Georgia
Judy A. Harrison, Ph.D., Extension Foods Specialist, University of Georgia

Designed by:
Kasey A. Christian, M.Ed., Project Assistant, NCHFP, University of Georgia

Special thanks to:
Pilot Program Leaders (and youth participants!)
from Clemson Cooperative Extension
& University of Georgia Cooperative Extension
and Advisory Committee members

© 2014
Released July 2014

This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under Agreement No. 2011-51110-30995.

The University of Georgia College of Agriculture & Environmental Sciences and College of Family & Consumer Sciences (working cooperatively with Fort Valley State University, the U.S. Department of Agriculture, and the counties of Georgia) offer their educational programs, assistance, and materials to all people regardless of race, sex, color, ethnicity or national origin, religion, age, disability, genetic information, sexual orientation, or veteran status. The University of Georgia is committed to principles of equal opportunity and affirmative action.

Clemson University Cooperative Extension Service offers its programs to people of all ages, regardless of race, color, sex, religion, national origin, disability, political beliefs, sexual orientation, marital or family status and is an equal opportunity employer.

The use of trade, firm, or corporation names in this curriculum and links to information on outside, commercial websites is for the educational information and convenience of the reader. Such use does not constitute an official endorsement or approval of any product or service to the exclusion of others that may be suitable.
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 books *So Easy to Preserve* and *Complete Guide to Home Canning*.

**Word bank:** USDA, OXYGEN, FREEZING, EXPANDS, MICROORGANISMS, SPOIL, QUICKLY
What’s the Story of Freezing?

- 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.
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**


Clemson University Home and Garden Information Center factsheets about freezing: HGIC 3024, HGIC 3060, HGIC 3063, HGIC 3064, HGIC 3065, HGIC 3067. [http://www.clemson.edu/extension/hgic/food/food_safety/preservation/](http://www.clemson.edu/extension/hgic/food/food_safety/preservation/).


National Center for Home Food Preservation, University of Georgia. [http://nchfp.uga.edu](http://nchfp.uga.edu).


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