



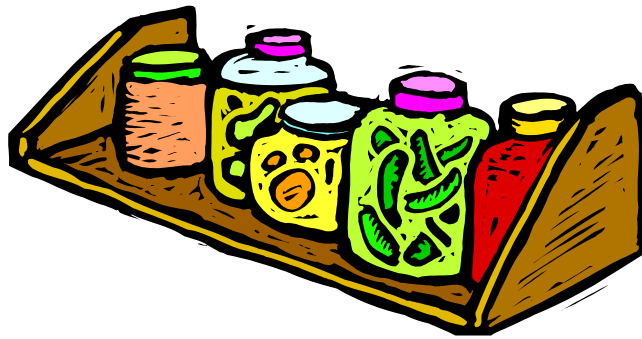
Name _____

Can My Vegetables



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! Can My Vegetables* contains:

- ◊ Beginning Activity: Can My Green Beans
- ◊ Advanced Activity: Can My Tomato Veggie Soup
- ◊ Additional Activities: Can My Vegetables



Name _____
Date _____
Teacher _____

Can My Green Beans



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, 2015

Slightly revised April 2015

Suggested citation: Christian, K. and Barefoot, S. (2015rev). Put It Up! Food Preservation for Youth. Athens, Georgia: National Center for Home Food Preservation. Retrieved from nchfp.uga.edu.

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.



Pressure Canning: A Preservation Exploration

Have you ever had canned green beans or veggie soup from the grocery store? Maybe you've tried green beans in a casserole during the holidays, or perhaps you've taken comfort in hot tomato soup on a cold winter day?

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

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

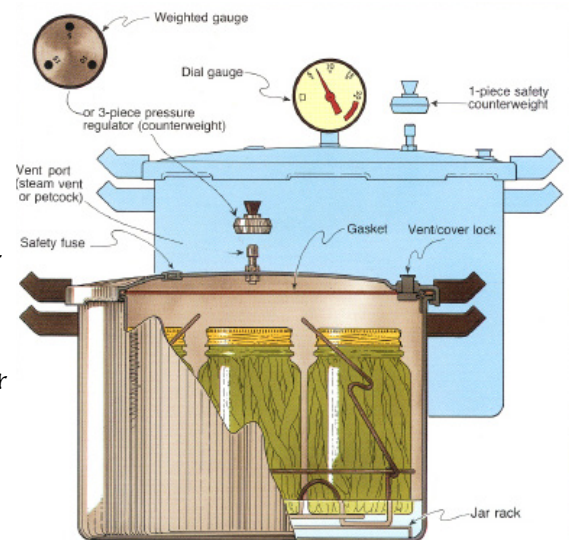
Preservation means to prevent decay, or in other words to stop a food from breaking down and spoiling. Rotten tomatoes, moldy bread, and stinky old milk are all examples of spoiled foods. Refrigeration and freezing are very common preservation methods used in modern households to extend the shelf-life of foods. Other home food preservation methods are canning, drying (or dehydrating), making jam, and pickling.

Canning is the process of closing jars of food in a canner and heating those jars inside the canner using the heat from a stovetop. **Pressure Canning** is when a device called a pressure canner is used for the canning process.

At first glance, a pressure canner might look similar to a large stockpot like you could make soup in. You'll see though that the lid is different. A pressure canner has a very special lid that secures tightly on top and does not let any air escape when fully closed. With its lid secured in place, and all openings closed off, a pressure canner is an example of a closed container.

When air temperature rises in a closed container, the pressure inside also rises. This is because heat causes molecules to move more quickly, bouncing off each other and into the walls of the container. All this movement creates more and more pressure inside the container.

You will put about 2 inches of water in the bottom of a pressure canner before turning a burner up to high heat underneath it. Once the water reaches a boil (212°F at sea level), it begins to evaporate into steam. Steam forms when liquid water molecules are moving so quickly that they become gaseous water vapor. Steam can hold more heat than normal air, so temperatures inside pressure canners rise to 240°F and higher, with pressure building up to 15 pounds.



The gauge on the pressure canner is used like a thermometer, except that instead of reading temperature it reads pounds of pressure. Use the gauge to determine the amount of pressure inside the canner.



Beginning Pressure Canning Activity: Green Beans

Time required:

1 hour for procedure + 1½ hours additional processing time
= 2½ hours (+ 12 hours minimum cooling time)

Ingredients:

For a canner load of about 9 pint jars

- 8-9 pounds green beans ($\frac{3}{4}$ -1 pound per pint)
- 9 cups water
- 4½ teaspoons canning salt (optional)
- Any additional ingredients from 'Want to Experiment?' (optional)

Select
Snap, Wax,
or Italian
green beans.

Equipment needed:

- Gas or electric stovetop range with four burners
- Pressure canner with rack
- Permanent marker
- Large stockpot
- Small paring knife (optional)
- Measuring cups
- Measuring spoons
- Large colander
- Large mixing bowl
- Ladle
- Slotted spoon (for hot pack method only)
- Spoon
- Paper towels
- Thermometer
- Timer (may be on oven)
- Towel or cake-cooling rack
- Pint canning jars, regular or wide mouth
- Ring bands, regular or wide mouth
- Two-piece metal canning lids and ring bands, regular or wide mouth
- Jar lifter
- Jar funnel
- Headspace tool
- Bubble freer or narrow spatula
- Oven mitts (recommended)

If range has a smooth cook-top, see canner and stove-top manufacturer's directions regarding the use of a pressure canner – it may not be recommended.

You can use regular or wide mouth jars and two-piece lids, but make sure you choose just one style so they fit together!

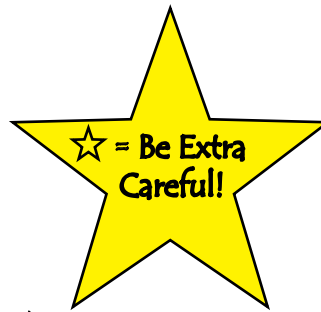


The Procedure:

Just Follow These Steps...

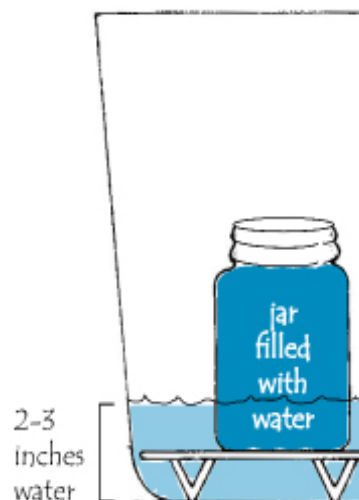
Part One: Preparing the Canner and Jars

1. Wash hands thoroughly with soap under running water for at least 20 seconds, rinse well, and dry.
2. Assemble equipment and ingredients.
3. ★ Place the rack into the canner and fill with 2-3 inches of water. Turn burner on medium-high to bring and keep water to 180°F (simmering) for a hot pack, or 140°F for a raw pack or if doing both.
4. ★ Fill a large stockpot with 9 cups water to be used to fill jars. Cover stockpot with lid and turn burner heat on high to bring to a boil.
5. Examine ring bands and discard any with rust or bends. Wash and dry as needed. Examine jars carefully. Discard any with cracks or chips in the rim.
6. ★ Wash jars in warm soapy water and rinse well. To keep jars warm until use, either fill jars with hot water and place upright in the canner or cover jars with hot water in a drain-plugged sink.
7. Use a permanent marker to label lids with your name, the name of the product, and the date. If you're feeling creative, make up a company name! Prepare lids according to manufacturer's recommendations.



Think About It: Vacuum Seals

Vacuum seals form as jars cool, keeping air out of jars so that the food inside is less likely to spoil. Could a vacuum seal keep air out if there were cracks and chips in the jar?



Part Two: Preparing the Beans and Filling the Jars

8. Use colander to rinse beans.
Discard any discolored or diseased bean pods.

9. Use your clean hands to snap the ends off the beans, then snap the beans into 1-inch pieces. Or, use a small knife to cut off ends and slice into 1-inch pieces.


Time to Decide:

Raw packs are the quickest way to go, but hot packs tend to have the best color and flavor. Choose one or try a few jars of each!

Raw Pack

10. ★ Remove jars from hot water using jar lifter and pour water out in sink (not in canner). Place jars upright on a towel-covered countertop or a rack.
11. Use funnel and clean fingers to push prepared beans tightly into jars, leaving 1-inch headspace.
12. Add $\frac{1}{2}$ teaspoon of salt to each jar, if desired.
13. ★ Using ladle, fill each jar with boiling hot liquid, leaving 1-inch headspace between the liquid and the lid.

Hot Pack

10. ★ Place beans into the boiling water for 5 minutes. Turn off heat. 
11. ★ Remove jars from water using jar lifter and pour water out in sink (not in canner). Place jars upright on a towel-covered countertop or a rack.
12. ★ Rest funnel in a jar and use slotted spoon to fill the jar with the heated beans, leaving 1-inch space from the top of the beans to the top of the jar. This gap is called headspace. Repeat to fill each jar.
13. ★ Add $\frac{1}{2}$ teaspoon of salt to each jar, if desired. Using ladle, fill each jar with the boiling hot cooking liquid, leaving 1-inch headspace.





14. Remove air bubbles by moving bubble freer or spatula gently in and out around the inside edge of the jar.

15. Carefully measure the headspace of each jar again, using a spoon to remove or add small amounts of liquid so that it is 1-inch.

16. Wipe rims of jars with a clean, damp paper towel. Apply lids according to manufacturer's directions. If using two-piece metal lids, turn bands onto jars until fingertip tight. Fingertip tight is when you meet firm resistance as you turn a band onto a jar using the tips of your thumb, index finger, and middle finger.

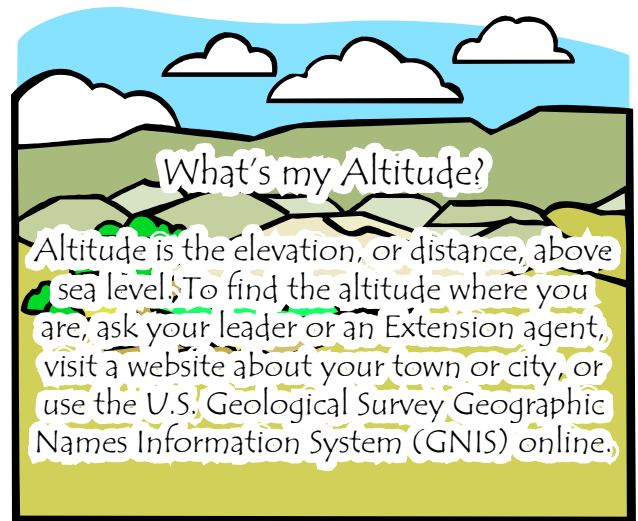
Part Three: Pressure Canning

17. ★ Use a thermometer to check the temperature of the water in the canner. Wait or adjust burner if needed to reach a temperature of 180°F for a hot pack and for a raw pack (also 140°F if processing both raw and hot packs).

18. ★ Use lifter to put each jar on the rack in the canner, keeping upright. Water level will rise, but should not cover jar tops. Remove water if needed.

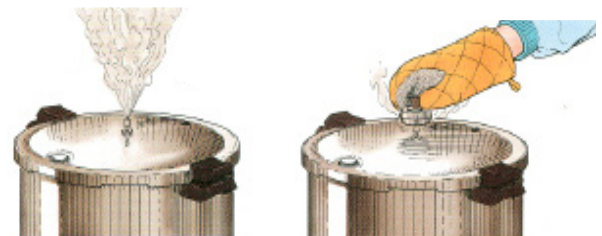
19. ★ Place lid on the canner and close tightly. Turn burner up to full heat. Wait until you see steam form a funnel as it comes out of the vent port, then set timer for 10 minutes. Use the table to the upper right to determine how many pounds of pressure are needed at your altitude. After steam has funneled out for 10 minutes, place weight(s) or close the vent port.

20. Wait until you can see and hear the weight steadily jiggling or the dial indicates the recommended pressure, and then set timer for 20 minutes.



Altitude Adjustments and Processing Times for Green Beans Raw or Hot Pack in Pint Jars:

	Altitude (in feet)	Pressure (in pounds)
Weighted Gauge	0-1,000	10
	above 1,000	15
Dial Gauge	0-2,000	11
	2,001-4,000	12
	4,001-6,000	13
	above 6,000	14



Note: Once recommended pressure is reached, you may lower the heat very slightly so that pressure does not rise too high, but be careful — if at any time the pressure drops below the recommended amount, you must bring the canner back to pressure and reset the timer to 20 minutes.

Altitude chart and canner and headspace illustrations from: USDA (2009). *Complete Guide to Home Canning*. Agriculture Information Bulletin No. 539. Washington, DC: USDA National Institute of Food and Agriculture.



21. ★ When timer sounds, turn off heat. Wait until canner pressure returns to 0 pounds (if the canner has a vent lock, look for it to drop) then wait two more minutes (or set a timer for 45 minutes if the canner gives no indication). Carefully check that the pressure is gone before removing the weight, then, remove weight or open the vent port and wait another 10 minutes for jars to settle.

Safety Tip: Don't rush depressurization! A rapid drop in pressure could cause leaking, poor sealing, or warping.

22. ★ Remove lid, lifting its underside away from you to direct the steam away from your face. Remove jars with jar lifter, one at a time, keeping upright. Place them on a towel-covered counter surface or a cake-cooling rack, at least 1 inch apart so they can cool evenly. Place away from drafts of moving air.

Do not disturb for 12-24 hours.

23. Test for a vacuum seal (see instructions to right). If jars do not seal or are taken home before cooling completely, keep in a refrigerator and eat the green beans within one week.

24. Remove ring bands from sealed jars and wipe jars. Store in a cool, dark, dry place.

Enjoy with family and friends within one year for best quality. Store in refrigerator after opening and eat within one week.



In the United States, green beans are typically in season from late summer to early fall.



Fun Facts!

Green beans help build strong bones by providing lots of Vitamin K. They also offer us vitamin C, vitamin A, and manganese.



Listen for lids to "pop!" as the vacuum pulls them down.

How to Test for a Vacuum Seal



Fun Facts from: USDA Food and Nutrition Service. *Green Beans*. www.fns.usda.gov/sites/default/files/greenbeans.doc



Time to Reflect...

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

What was your favorite part of canning green beans?

For you, what was the most challenging part of canning green beans?

What surprised you most in this activity?



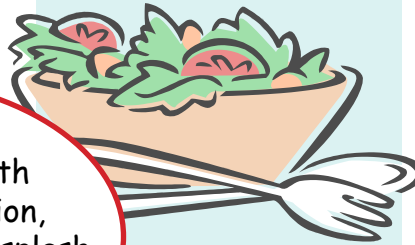
If you could do this activity again, what is one thing you would change?
Why?

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

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

Want to Experiment?

Make a salad:
mix green beans with
carrots, chopped onion,
chopped bell pepper, a splash
of vinegar, and a dash of
sugar, salt, and pepper.



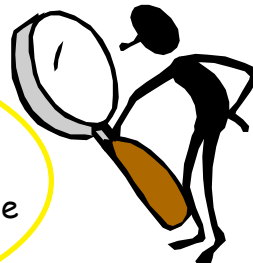
Add a small
amount of butter or
olive oil to warm green beans
and lightly sprinkle salt or
herbs on top. Or, try them
with dips like hummus or
ketchup.

Compare home-canned green beans
with store-bought green beans.
How do tastes, textures,
and appearances differ?
Do you prefer one more than the other?
Why?



Ask for help to follow directions
for another canning recipe, like *Mixed
Vegetables*. Guidelines are in *So Easy
To Preserve* and on the National Center
for Home Food Preservation website
(homefoodpreservation.com).

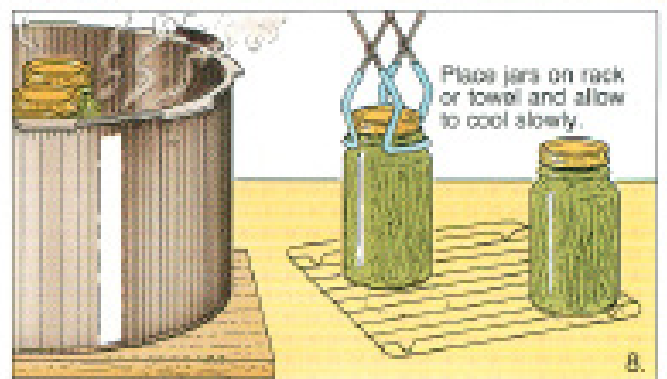
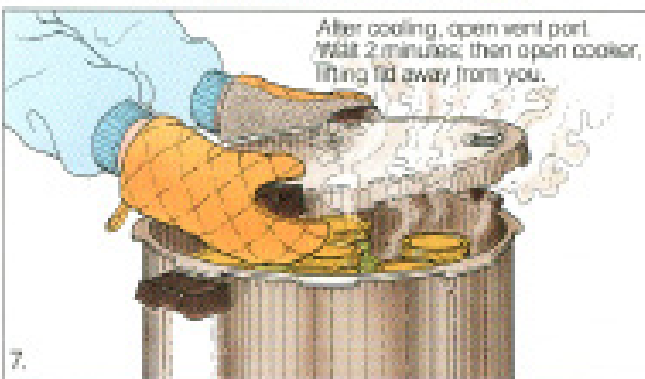
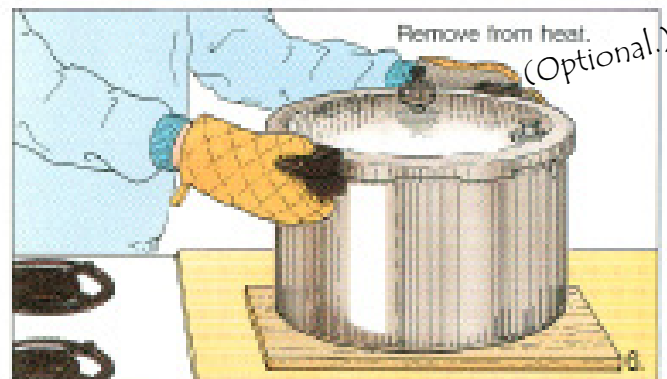
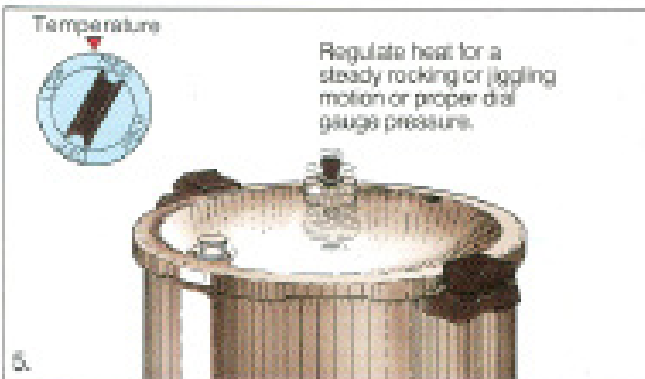
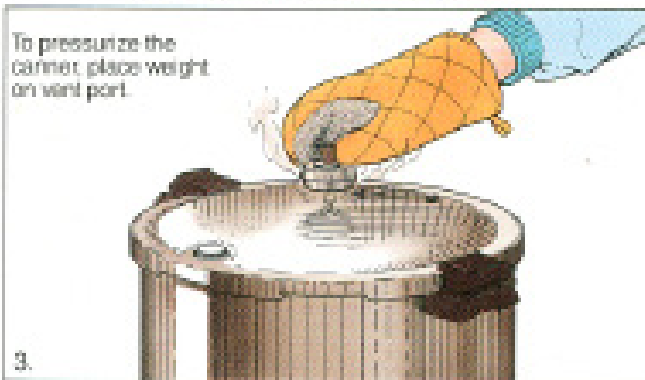
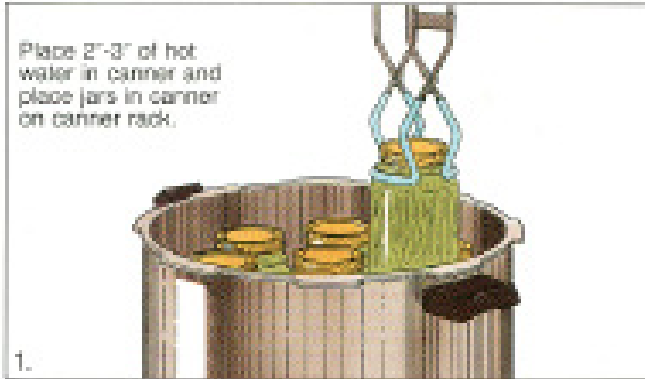
Make observations of
your jar of green beans now, then
again in 3 months, 6 months, and then
again in one year. Does their appearance
change over time?



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



Steps of the Pressure Canning Process



Illustrations adapted from: USDA (2009). *Complete Guide to Home Canning*. Agriculture Information Bulletin No. 539. Washington, DC: USDA National Institute of Food and Agriculture.



Name _____
Date _____
Teacher _____

Can My Tomato Veggie Soup



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, 2015

Slightly revised April 2015

Suggested citation: Christian, K. and Barefoot, S. (2014rev). Put It Up! Food Preservation for Youth. Athens, Georgia: National Center for Home Food Preservation. Retrieved from nchfp.uga.edu.

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.



Pressure Canning: A Preservation Exploration

Have you ever had canned green beans or veggie soup from the grocery store? Maybe you've tried green beans in a casserole during the holidays, or perhaps you've taken comfort in hot tomato soup on a cold winter day?

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

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

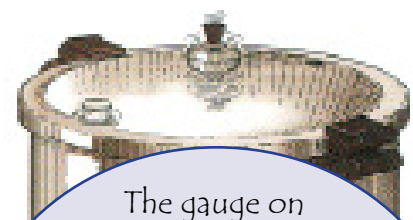
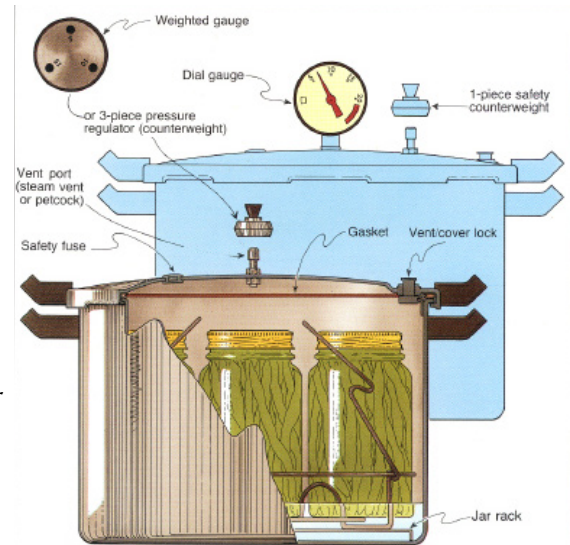
Preservation means to prevent decay, or in other words to stop a food from breaking down and spoiling. Rotten tomatoes, moldy bread, and stinky old milk are all examples of spoiled foods. Refrigeration and freezing are very common preservation methods used in modern households to extend the shelf-life of foods. Other home food preservation methods are canning, drying (or dehydrating), making jam, and pickling.

Canning is the process of closing jars of food in a canner and heating those jars inside the canner using the heat from a stovetop. **Pressure Canning** is when a device called a pressure canner is used for the canning process.

At first glance, a pressure canner might look similar to a large stockpot like you could make soup in. You'll see though that the lid is different. A pressure canner has a very special lid that secures tightly on top and does not let any air escape when fully closed. With its lid secured in place, and all openings closed off, a pressure canner is an example of a closed container.

When air temperature rises in a closed container, the pressure inside also rises. This is because heat causes molecules to move more quickly, bouncing off each other and into the walls of the container. All this movement creates more and more pressure inside the container.

You will put about 2 inches of water in the bottom of a pressure canner before turning a burner up to high heat underneath it. Once the water reaches a boil (212°F at sea level), it begins to evaporate into steam. Steam forms when liquid water molecules are moving so quickly that they become gaseous water vapor. Steam can hold more heat than normal air, so temperatures inside pressure canners rise to 240°F and higher, with pressure building up to 15 pounds.



The gauge on the pressure canner is used like a thermometer, except that instead of reading temperature it reads pounds of pressure. Use the gauge to determine the amount of pressure inside the canner.



Advanced Pressure Canning Activity: Tomato Veggie Soup

Time required:

1½ hours for procedure + 2½ hours additional processing time
= 4 hours (+ 12 hours minimum cooling time)

Ingredients:

For a canner load of about 9 pint jars

- 6 cups tomatoes (almost 5 pounds)
- 1 cup chopped onion (about 1/2 medium-sized)
- 2 cups sliced carrots (about one pound or 8 medium-sized)
- 2 cups chopped celery (about 1/2 bunch or 4 stalks)
- 2 cups corn kernels (about 3 fresh cobs, 16 oz. canned, or 2/3 lb. frozen)
- 2 cups chopped bell pepper (about 1 extra large, any color)
- 5 cups tomato juice (40 ounces)
- 3 cups water
- 1 teaspoon salt
- 1 teaspoon pepper
- Any additional ingredients from 'Want to Experiment?' (optional)

Equipment needed:

- Gas or electric stovetop range with four burners
- Pressure canner with rack
- Permanent marker
- Large stockpot
- Large colander
- 2 large mixing bowls
- Cutting board
- Paring knife
- Peeler
- Large chef's knife
- Can opener (only if using non pop-top canned corn)
- Slotted spoon
- Wet and dry measuring cups
- Measuring spoons
- Stirring spoon
- Ladle
- Spoon
- Towel or cake-cooling rack
- Paper towels
- Thermometer
- Timer (may be on oven)
- Ice (optional)
- Pint canning jars, regular or wide mouth
- Ring bands, regular or wide mouth
- Metal canning lids, regular or wide mouth
- Jar lifter
- Jar funnel
- Bubble freer or narrow spatula
- Headspace tool
- Oven mitts (recommended)

If range has a smooth cook-top, see canner and stove-top manufacturer's directions regarding the use of a pressure canner – it may not be recommended.



The Procedure:

Just Follow These Steps...

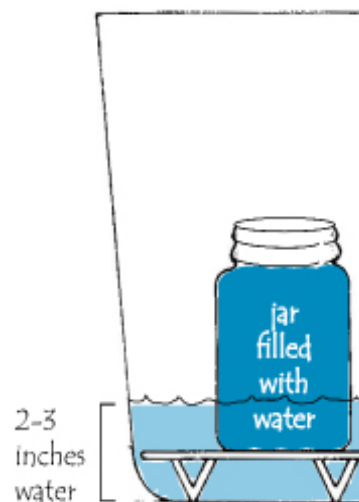
Part One: Preparing the Canner and Jars

1. Wash hands thoroughly with soap under running water for at least 20 seconds, rinse well, and dry.
2. Assemble equipment and ingredients.
3. ★ Place the rack into the canner and fill with 2-3 inches of water. Turn burner on medium-high to bring and keep water to just under a boil (180°F, simmering).
4. Examine ring bands and discard any with rust or bends. Wash and dry as needed. Examine jars carefully and discard any with cracks or chips.
5. ★ Wash jars in warm soapy water and rinse well. To keep jars warm until use, either fill jars with hot water and place upright in the canner or cover jars with hot water in a drain-plugged sink.
6. Use a permanent marker to label lids with your name, the name of the product, and the date. If you're feeling creative, make up a company name! Prepare lids according to manufacturer's recommendations.



Think About It: Vacuum Seals

Vacuum seals form as jars cool, keeping air out of jars so that the food inside is less likely to spoil. Could a vacuum seal keep air out if there were cracks and chips in the jar?





Part Two: Making the Soup

7. ★ Fill a large stockpot about $\frac{1}{4}$ full with water, cover with lid, and turn burner on high. Prepare vegetables while water comes to a boil.
8. Fill a large mixing bowl with ice if you have it, then add cold water.
9. ★ Use colander to rinse tomatoes. Use a paring knife to cut a small "x" in the non-stem end of each tomato.
10. ★ Rinse, peel, and slice carrots into $\frac{1}{4}$ inch rounds. Rinse and cut celery into $\frac{1}{4}$ inch slices. Peel the papery skins off the onion, then dice it into small pieces. Very carefully slice corn off the cob or open can of corn and drain liquid.
11. ★ Once water is boiling, place 2 to 3 tomatoes at a time in the boiling water and leave in for 30 to 60 seconds, until you see the skins split. Immediately remove tomatoes with a slotted spoon and place in the cold water bath. You might need to run cold water into the bowl or add ice to keep it cool. Peel off tomato skins and discard. Place all peeled tomatoes on a cutting board. Turn heat off and empty water into a sink. *Be careful — water is extremely hot!*
12. ★ Cut stems and firm cores out of tomatoes and discard. Chop the tomatoes into small chunks. Measure 6 c. of tomatoes into the emptied stockpot.
13. ★ Measure and add all other vegetables (1 c. onion, 2 c. carrots, 2 c. celery, 2 c. corn, 2 c. pepper) to stockpot, then measure and add 5 c. tomato juice, 3 c. water, 1 tsp. salt, and 1 tsp. pepper. Stir over high heat until boiling, then reduce heat to a simmer for 5 minutes. Turn off heat.

Leader demonstration: Knife skills

Grip the knife handle with dominant hand, wrapping fingertips behind knuckles for tight grip. Slice with a rocking motion, not a chopping down action. Always keep your hands out of the path of the blade.



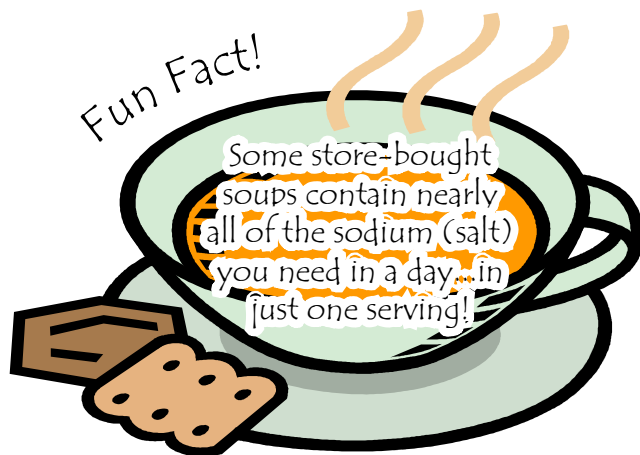
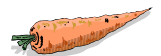
Leader demonstration: Peeling

Grip peeler same as knife. With other hand, hold the carrot at its top on a cutting board. Bring the blade of the peeler to just below your hold and push the peeler away from you to the tip of the carrot. Rotate the carrot and repeat until outer skin is removed.

*Caution!
Cut tomatoes become slippery! Always
direct knife blade away from your hands.*

Fun Fact!

When tomatoes were first transported to European countries, they were called "golden apples" and "apples of love".



Think About It: Wiping the Jar Rim

If a bit of tomato were left on the rim, could a tight seal form?

Think Again! Fingertip Tight

Why do you think it is important that lids are tightened just right?

Hint: If a band is too tight, could air escape? If a band is too loose, could liquid get out?

Headspace and canner illustrations from: USDA (2009). *Complete Guide to Home Canning*. Agriculture Information Bulletin No. 539. Washington, DC: USDA National Institute of Food and Agriculture.

Fun Facts from: Anderson, J. and Deskins, B. (1995). *The Nutrition Bible*. New York: William Morrow and Company, Inc.


Part Three: Filling the Jars


14. ★ Slowly remove jars from hot water using a jar lifter and empty water in a sink (not in canner). Place jars upright on a towel-covered counter or a rack.
15. ★ Rest a funnel in a jar and use a slotted spoon to fill the jar halfway with vegetables. Repeat to fill each jar halfway.
16. ★ Using a ladle, fill each jar with the hot liquid, leaving 1-inch of empty space between the liquid and the lid. This gap is called headspace.
17. Remove air bubbles by moving bubble freer or spatula gently in and out around the inside edge of the jar. Carefully measure again to check the 1-inch headspace, using a spoon to remove or add small amounts as needed.
18. Wipe jar rims with a clean, damp paper towel to remove food from sealing area. Apply lids according to manufacturer's directions. If using two-piece metal lids, turn bands onto jars until fingertip tight. Fingertip tight is when you meet firm resistance as you turn a band onto a jar using the tips of your thumb, index finger, and middle finger.
19. ★ Use a thermometer to check the temperature of the water in the canner. Wait a few minutes or adjust burner if needed to reach 180°F.




Part Four: Pressure Canning

20. ★ Use jar lifter to place jars on the rack in the canner, one at a time. Keep jars upright. Water level will rise, but should not cover over tops of jars. Remove water if needed.

21. ★ Place lid on the canner and close tightly. Turn burner up to full heat. Wait until you see steam form a funnel as it comes out of the vent port, then set timer for 10 minutes. Use the table to the lower right to determine how many pounds of pressure are needed at your altitude. After steam has funneled out for 10 minutes, place weight(s) or close the vent port. 

22. Wait until the dial indicates the recommended pressure or the weighted gauge is jiggling or rocking according to manufacturer's directions, then set timer for 60 minutes. 

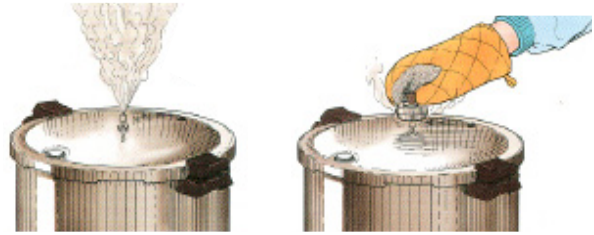
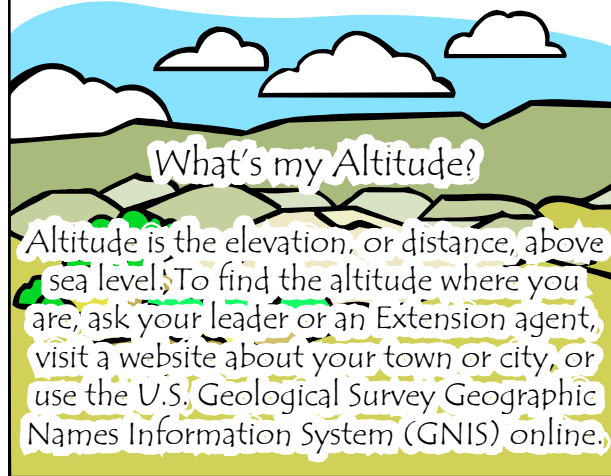
23. ★ When timer sounds, turn off heat. Wait until canner pressure returns to 0 pounds by looking for the vent lock to drop (or set a timer for 45 minutes if the canner gives no indication). Then, remove weight or open the vent port and wait another 10 minutes for jars to settle. 

24. ★ Remove lid, lifting its underside away from you to direct the steam away from your face. Remove jars with jar lifter, keeping upright. Place them on a towel-covered surface or rack at least 1 inch apart so that they can cool evenly to room temperature. Place away from drafts of moving air.

Do not disturb for 12-24 hours.

25. Check jars for vacuum seals. If jars do not seal or are taken home before cooling completely, keep in a refrigerator and eat the soup within one week.

26. Remove ring bands from sealed jars and wipe jars. Store in a cool, dark, dry place. Enjoy with family and friends within one year for best quality. After opening, store in refrigerator and eat within one week.



Note: Once recommended pressure is reached, you may lessen the heat very slightly so that pressure does not rise too high, but be careful — if at any time the pressure drops below the recommended amount, you must bring the canner back to pressure and reset the timer to 60 minutes.

Caution! Do not rush depressurization! A rapid drop in pressure could cause leaking, poor sealing, or warping.

Altitude Adjustments and Processing Times for Tomato Veggie Soup in Pint Jars:

	Altitude (in feet)	Pressure (in pounds)
Weighted Gauge	0-1,000	10
	above 1,000	15
Dial Gauge	0-2,000	11
	2,001-4,000	12
	4,001-6,000	13
	above 6,000	14

Chart from: National Center for Home Food Preservation, http://setp.uga.edu/spicy_tomato_vegetable_soup.html.



Time to Reflect...

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

What was your favorite part of canning tomato veggie soup?

For you, what was the most challenging part of canning soup?

What surprised you most in this activity?



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

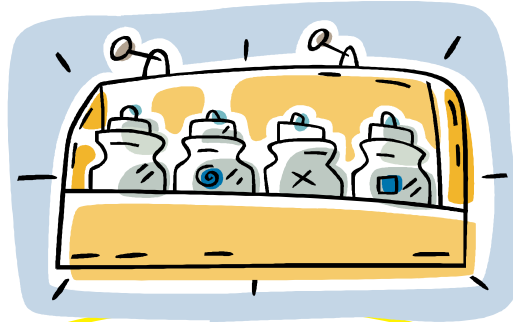
Do you think that canning vegetables is a useful skill?
Why or why not?

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

Want to Experiment?



Try growing fresh veggies in a garden! Ask for help, and make sure the plants have enough space, sunlight, and water.



Use different herbs and spices for extra flavor! If you like spicy hot, try 1/2 tsp. of cayenne or chili powder. Oregano and basil add Italian flair, or use rosemary for a taste of the Mediterranean. Curry brings in a warming touch from India, while bay leaves and thyme add traditional European-American flavor.



Ask for help to follow directions for another canning recipe, like *Mixed Vegetables*. Guidelines are in *So Easy To Preserve* and on the National Center for Home Food Preservation website (homefoodpreservation.com).



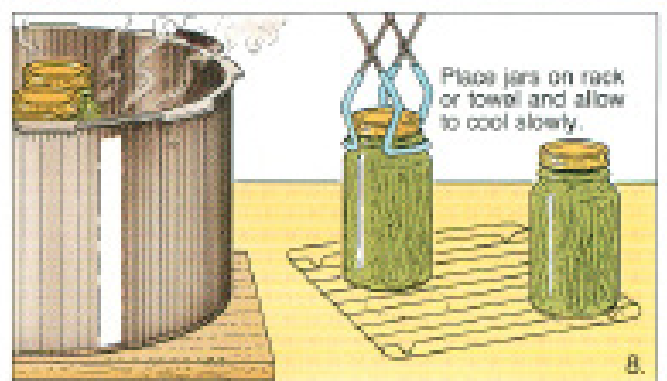
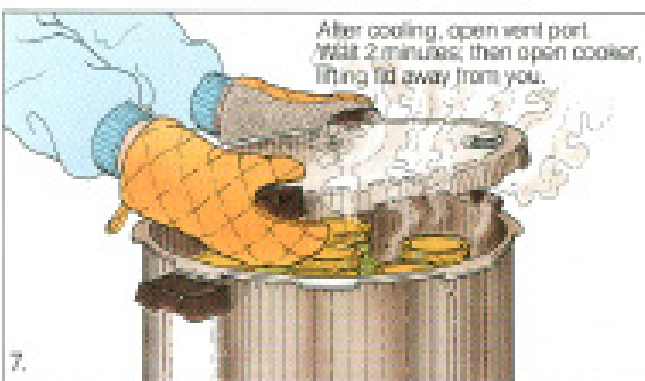
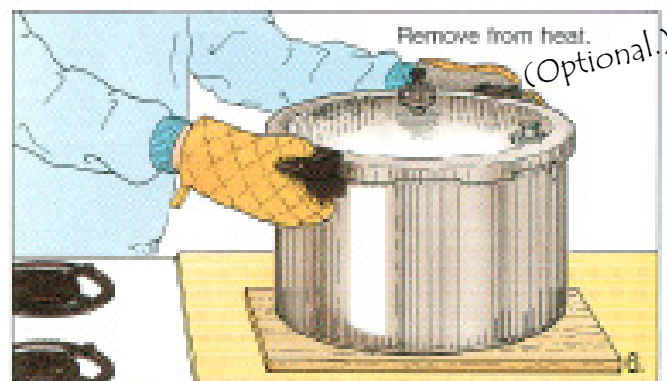
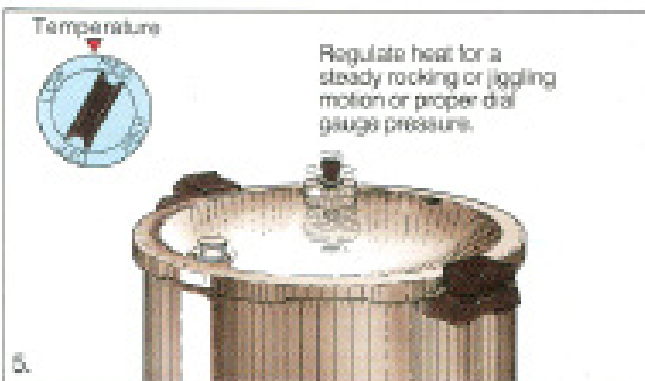
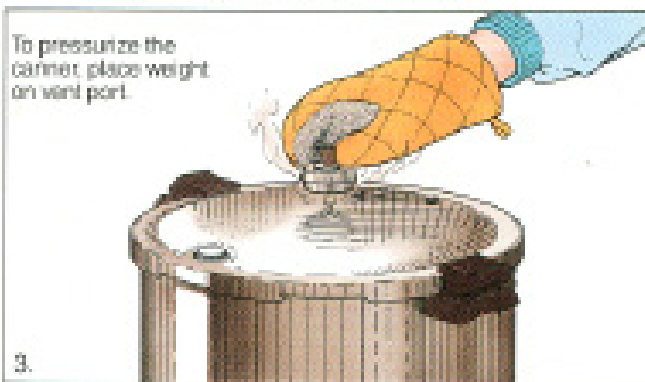
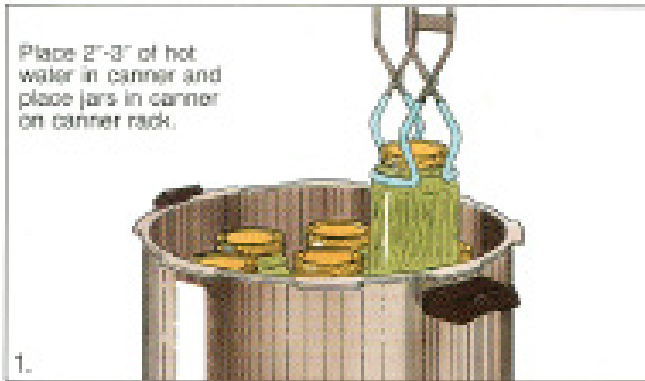
You might also like to try substituting chicken broth or vegetable broth for the tomato juice and/or water. Be sure to substitute amounts equal to the tomato juice and/or water — this is important for the safety of the canned soup.



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



Steps of the Pressure Canning Process



Illustrations adapted from: USDA (2009). *Complete Guide to Home Canning*. Agriculture Information Bulletin No. 539. Washington, DC: USDA National Institute of Food and Agriculture.



Name _____

Date _____

Teacher _____

Can My Vegetables



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, 2015

Slightly revised April 2015

Suggested citation: Christian, K. and Barefoot, S. (2015rev). Put It Up! Food Preservation for Youth. Athens, Georgia: National Center for Home Food Preservation. Retrieved from nchfp.uga.edu.

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.



All About Pressure Canning

	<u>Pages</u>
FUNdamentals of Pressure Canning.....	A.A.4
Pressure Canner Anatomy and Mason-Style Jar Anatomy.....	A.A.5
pH Power.....	A.A.6
What's the Story of Pressure Canning?.....	A.A.7
We're Still Waiting...What's Happening?.....	A.A.8
Glossary, Sources, and Resources.....	A.A.9
What Do You Know About Pressure Canning?.....	(A.A.10)



Pressure canning is a science, so there are important **facts and concepts** at play. These **FUNdamentals** will help you understand the steps of pressure canning.



FUNdamentals of Pressure Canning

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 raises the temperature so high that dangerous bacteria are destroyed by the heat.

_____ is measured by pH value.
Acid foods have a pH of 4.6 or lower, low-acid foods have a pH higher than 4.6.

Unless properly pressure canned, low-acid foods are at risk of causing the potentially deadly food poisoning called _____.

_____ does NOT heat hot enough to destroy the bacteria which cause botulism.

A _____ is created when air is pushed out and unable to re-enter a closed system (like a sealed jar).

_____ is a form of energy that travels through solid, liquid, and gas.

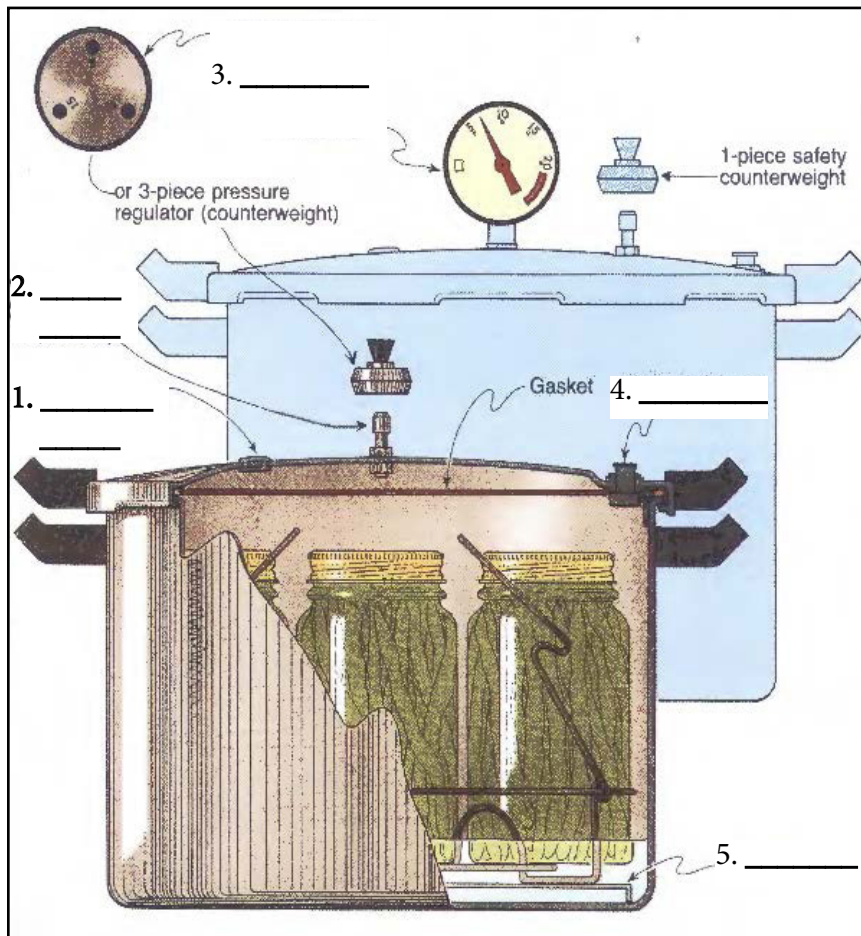
_____, Cooperative Extension, and the National Center for Home Food Preservation have science-based recipes for pressure canning, like the recommendations in the books *So Easy to Preserve* and *Complete Guide to Home Canning*.

Word bank: USDA, BOTULISM, PRESSURE CANNING, BOILING WATER CANNING, ACIDITY, HEAT, VACUUM



Pressure Canner Anatomy

Fill in each blank with the term to the right that describes that part of the pressure canner.



GAUGE (weighted or dial) determines the amount of pressure in the canner, which corresponds to the temperature inside.

VENT PORT lets air escape.

VENTCOVER LOCK prevents the lid from being taken off when the pressure inside is too great for the lid to be safely removed.

SAFETY FUSE releases excess pressure from the canner if it is too much.

RACK prevents jars from cracking from high heat of the burner and lets water circulate under the jars so that they heat evenly.

A _____ can be used again and again until cracked or chipped.

_____ on top of jar allow ring band to twist on tightly.

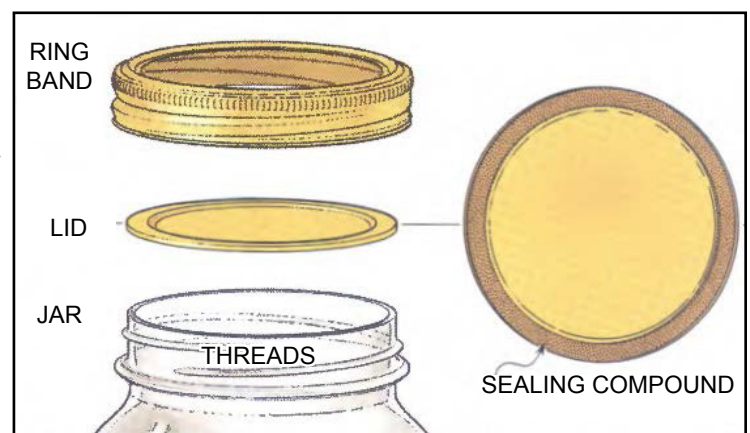
A _____ secures lid to jar, and can be reused if not bent or rusty.

A _____ has a springy center that dips down when pulled by a vacuum. After jars cool, gently rub the center of the lids with your fingertip; you have evidence of a vacuum if you feel an indent.

_____ is a soft plastic in the bottom-edge groove of lids that softens when heated and forms an airtight seal around the lid when cooled.

Mason-Style Jar Anatomy

Use the labels in the illustration below to correctly fill in the blanks of the descriptions to the left.



pH Power

Do you know what pH is?

pH is a measure of acidity, on a scale from 0 to 14. Foods are classified as Acid or Low-Acid according to their pH value.

Acid foods have a pH of 4.6 or less

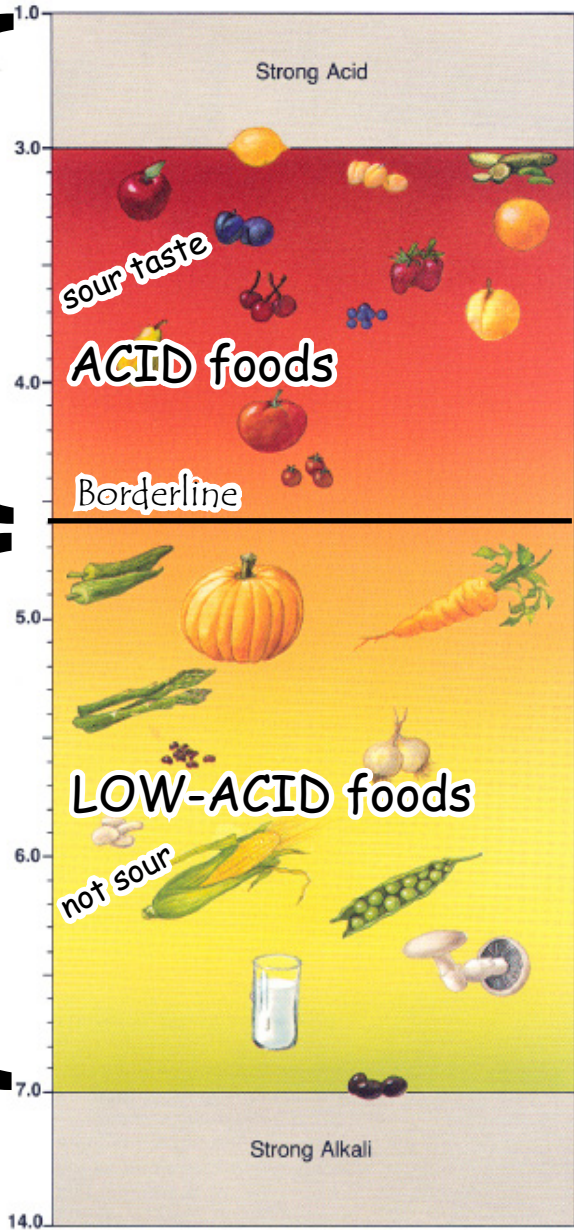
and can be boiling water canned because the acidity prevents dangerous bacteria from growing.

Low-acid foods have a pH above 4.6 and need to be

pressure canned because the higher temperature inside a pressure canner destroys dangerous bacteria.

use a boiling water canner

use a pressure canner



The table below shows pH values of several common foods. Under the "Acid or Low-Acid" column, write how that food is classified based on its pH. Then, decide and write whether that food needs to be pressure canned or if it can be safely canned in a boiling water canner.

Food	pH Value	Acid or Low-Acid?	Pressure Canner or Boiling Water Canner?
Lemon Juice	2.3		
Blueberries	3.7		
Tomatoes	4.2-4.9	Borderline	Add lemon juice for boiling water or pressure canner
Carrots	4.9-5.2		
Onions	5.3-5.8		
Beans	5.7-6.2		
Corn	6.0-7.5		



What's the Story of Pressure Canning?

Search the puzzle for the 15 UPPERCASE, underlined words from the history notes below!



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

- In 1679, French physicist Denis Papin invented the "Steam Digester" to cook foods faster than usual by PRESSURE cooking food in an AIRTIGHT container over high heat.
- In 1795, French Emperor Napoleon Bonaparte offered 12,000 francs to anyone who could develop a method to PRESERVE food for the French armed forces.
- In 1809, Nicholas Appert was awarded the prize money from Napoleon for his INVENTION of the basic canning process. His method protected foods from SPOILAGE by putting food inside a glass jar, sealing it with a cork, then heating it. The French Navy successfully tried Appert's method to preserve MEAT, VEGETABLES, FRUIT, and even MILK. Appert invested this money to open the first commercial CANNERY in the world.
- In 1854, Louis Pasteur studied the fermentation process. Three years later he presented evidence that living ORGANISMS were active in fermentation. He noticed that some microorganisms need oxygen to live (aerobic), but others can survive without oxygen (anaerobic).
- In 1863, Pasteur showed that heating wine before storing prevented CONTAMINATION — a technique that has since been applied to many other beverages and foods to prolong shelf-life.
- In the early 1900s, National Presto Industries manufactured small 10-gallon pressure canners for canning food products at HOME.
- In 1909, the United States Department of Agriculture (USDA) published its first recommendations for home canning, in Farmers' Bulletin 359. Even today, USDA remains a reliable source for scientifically-tested canning recommendations.
- In 1917, USDA declared that pressure canning was the only way to SAFELY preserve low-acid foods (like meats and most vegetables) without risking food poisoning.



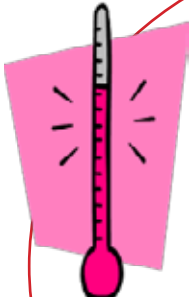
We're Still Waiting...What's Happening?

You can't see it with your bare eyes, but inside a pressure canner, enzymes and microorganisms are destroyed by the high heat. Both are microscopic, so you would need a microscope to look at them. **Enzymes** are actually a part of the basic structure of living things and are necessary for life and growth. Enzymes activate change in fruits and veggies that lead to ripeness, but over time they cause foods to over-ripen and spoil. High temperatures inactivate enzymes and stop them from spoiling foods. **Microorganisms** are tiny creatures that live everywhere on earth that there is water, including oceans, streams, and even in your body! Many of microorganisms are harmless and even necessary for life, but certain kinds cause food spoilage or food poisoning. Bacteria, yeast, and mold are the types of microorganisms that commonly cause food to spoil. You may have seen masses of mold as fuzzy spots on spoiled bread; pink shiny spots on spoiled cream cheese may be thousands of yeasts; slime on spoiled ground beef is caused by bacteria. Microorganisms that cause food poisoning are called pathogens.



Danger! Beware of *C. bot.*!

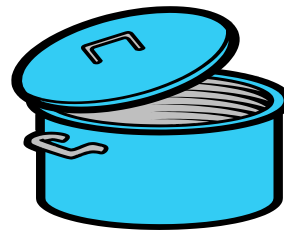
Pathogens can be very dangerous. For example, the bacteria called *Clostridium botulinum* (*C. bot.*) is deadly. This bacteria is harmless when in soil or water, but when it is sealed in a jar with moist, low-acid food at room temperature it can produce a toxin that causes botulism, a potentially deadly food poisoning. *C. bot.* is difficult to detect, like a secretive villain that leaves no sign of being there. That's why it's so important to use only tested canning recommendations and follow them exactly — to be sure that canned foods do not have any pathogens that would make you sick.



What does your body do when you get a "bug"?
(A "bug" is another term for a pathogen.)

You might get a **fever**!

Why? Because the increased body heat helps kill the pathogens making you feel sick. In the same way, the heat of steam in a pressure canner transfers into the food inside the jars and destroys pathogens living there.



Why don't we just use a boiling water canner?

C. bot.'s seed-like spores are only killed by temperatures well above boiling, so boiling water canning is not hot enough to prevent the risk of botulism. Pressure canners get much hotter inside than boiling water canners, so a pressure canner is needed to kill *C. bot.*



Glossary

Acid foods are foods with a pH value at or below 4.6.

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

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

Food preservation protects food from spoilage by microorganisms and enzymes.

Low-acid foods are foods with a pH value above 4.6.

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.

pH is a measure of acidity, on a scale from 0 to 14.

Pressure canning is the process of filling jars with a food product then processing the closed jars in a pressure canner for a long enough time to heat the product and destroy microorganisms.

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

Vacuum is empty space created when air is pushed out of a container and is unable to re-enter.

Sources and Resources

Andress, E, Kuhn, G. (1998). *Critical Review of Home Preservation Literature and Current Research*. Athens, GA: University of Georgia, Cooperative Extension Service.

Andress, E.L., Harrison, J.A., eds. (2014). *So Easy to Preserve*, 6th ed. Athens, GA: University of Georgia Cooperative Extension.

Center for Food Safety and Applied Nutrition (CFSAN) of the Food and Drug Administration (FDA), U.S. Department of Health and Human Services. (2012). *Bad Bug Book: Handbook of Foodborne Pathogenic Microorganisms and Natural Toxins*, second edition.

Clemson University Home and Garden Information Center factsheets about canning. HGIC 3020, HGIC 3025, HGIC 3030, HGIC 3040, HGIC 3050, HGIC 3051. http://www.clemson.edu/extension/hgic/food/food_safety/preservation/.

Encyclopaedia Britannica. *Louis Pasteur*. <http://www.britannica.com/EBchecked/topic/445964/Louis-Pasteur>.

National Center for Home Food Preservation, University of Georgia. <http://nchfp.uga.edu/>.

National Presto Industries, Inc. (2007). *The History of Pressure Cooking*...<http://discoverpressurecooking.com/history.html>.

Nummer, B.A. (2002). *Historical Origins of Food Preservation*. Athens, GA: University of Georgia, National Center for Home Food Processing and Preservation.

USDA (2009). *Complete Guide to Home Canning*. Agriculture Information Bulletin No. 539. Washington, DC: USDA National Institute of Food and Agriculture.

Name: _____

Date: _____

What Do You Know About Pressure Canning?

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

The pressure canning method is based on science. True False

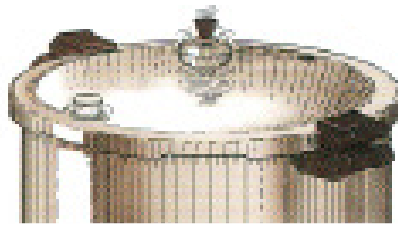
Vegetables last longer if pressure canned than if left at room temperature. True False

High temperatures (like inside a canner during processing) speed up enzyme activity and growth of microorganisms (like bacteria, molds, and yeasts). True False

Most microorganisms grow best in very acidic conditions. True False

It is not safe to can low-acid foods in a boiling water canner. True False

When filling jars for canning, it is a good idea to fill jars all the way up to the lid. 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 right or wrong 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 pressure can veggies (with the help of an adult). I agree I disagree

I can get everything I need to pressure can veggies at home. I agree I disagree

I will use pressure canning instructions from USDA or other science-based sources. I agree I disagree

Sometime when I am at home, I will try to pressure can veggies (with help from an adult). I agree I disagree