

GRADE 5 COOKING & FOOD

First edition

8 units

32 lessons · one school year

A video for every lesson

FIRST EDITION

COURSE GUIDE

This course follows eight strands of cooking and food through one school year: kitchen and food safety, the food groups and the balanced meal, taste and smell, heat and cold, food chemistry, cravings and a balanced way of eating, fire and spice, and meal planning for the family table. Each unit is built around real people and real moments: Ignaz Semmelweis setting a basin of wash water at the door of his clinic, Louis Pasteur boiling broth in swan-necked flasks, Kikunae Ikeda tasting his kombu broth and naming umami, Count Rumford building a stove that wasted less fuel, Nicolas Appert sealing food in glass jars, Clarence Birdseye watching fish freeze on the Labrador ice, and Fannie Farmer teaching America to level the cup.

Every lesson follows the same path. First comes **the story**. Then **how they figured it out**: the question they faced, what they tried, what they saw and what they learned. Then **the kitchen science**, explained for a fifth grader. Last, **let's cook**: the student makes a real recipe for the family, with an adult beside, and records it in a cook's notebook, tasting, rating and improving it the next time. Food is treated as God's good gift, received with thanks and shared with others. We talk about food in terms of skill, safety, nourishment, thankfulness and hospitality, never in terms of body size or appearance.

The year ends with a family feast: the student plans a balanced menu, shops with a parent, cooks several dishes learned during the year, sets the table, welcomes the family and gives thanks. The old Latin saying *Fabricando fit faber*, “by making, one becomes a maker,” fits the kitchen as well as the workshop: by cooking, one becomes a cook.

Most videos come from trusted public and teaching sources: the CDC and the USDA, Penn State Extension and other public-media channels, America's Test Kitchen Kids, Learn Bright, SciShow and SciShow Kids, BBC science channels, and careful cooking teachers chosen lesson by lesson. Every video was previewed for content, accuracy and modest dress. Some videos are short; a few run longer

and are best watched together. Some channels end with an invitation to subscribe or a short message about their other videos; you can stop the video when the teaching ends. Pause whenever the lesson's note asks the student to predict what will happen next.

Start with Lesson 1.1 →

WHO IT IS FOR

Written for students in grade 5 (about ages 10–11) who read independently, can measure with cups and spoons, read a thermometer and work with simple fractions. A parent or responsible adult reads along, stands beside the student for every knife and stove step, and handles the grill. Nothing needs to be bought beyond an ordinary kitchen and ordinary groceries; an instant-read food thermometer is the one inexpensive tool we strongly recommend.

HOW TO USE THIS COURSE

1. **The weekly rhythm.** The year has 32 lessons, one a week, in two sessions. Session 1 (about 45–60 minutes) is the warm-up, the video, the teaching and the picture study. Session 2 (about 45–60 minutes) is the kitchen project: cook the recipe, run the little experiment inside it, clean up, and write in the cook's notebook. In the last week of each unit, add a third session for the unit review and the unit challenge.
2. **An adult supervises all cooking.** A parent or responsible adult is present for every kitchen project in this course. Before cooking, check every recipe and every taste test against your own family's food allergies; each recipe card names the major allergens it contains and offers swaps where they are easy.
3. **The grade 5 safety ladder.** Fifth graders use a small serrated knife or paring knife only with an adult right beside them, on a cutting board that cannot slide (a damp towel underneath), using the “claw” and “bridge” grips taught in Lesson 1.2. They use the stove and oven with an adult beside them, pot handles turned in, oven mitts on, and never reach over steam. The microwave is used with an adult nearby. There is no frying in more than a thin film of oil. At the grill, the student preps and watches from 3 feet back while an adult does the grilling.
4. **Story, then science, then cooking.** The core ideas are written to be read aloud or read by the student. The paragraphs marked *The story* and *How they figured it out*

tell what happened; *The kitchen science* explains what is happening to the food; *Let's cook* names the recipe and the one skill to do well and safely. After each paragraph, ask the student to tell it back in his or her own words.

5. **Picture study.** Each lesson has one painting or historic photograph of a kitchen, a harvest, a market or a table. Look at it quietly for two minutes. Then put it away and have the student tell everything he or she remembers. Bring it back and work through the “look for” items and questions, which point to the food, the heat, the tools and the people in the picture.
6. **The cook's notebook.** Use one notebook for the whole year. For every recipe, write the date, copy the recipe in your own words, record what you measured and observed, make a quick sketch of the finished dish, collect a family rating, and write one thing you would change next time. Then, when you can, cook it again and make that change. Cook it, record it, improve it.
7. **How we talk about food and bodies.** This course never discusses weight or how bodies look. We call foods “everyday foods” and “sometimes foods,” never “good” or “bad.” Treats and feasts are good gifts in their place. Grades rest on effort, care, safety, cleanliness and improvement.
8. **Groceries.** The recipes use ordinary grocery-store ingredients and feed a family of four to six. Most weeks the kitchen project can be the family's lunch, snack or supper, so the course adds little to the grocery bill beyond what the family already buys. Read the recipe card a few days ahead and add its ingredients to the shopping list.
9. **Optional books and tools.** Some units list free charts, guides, cookbooks and simple tools. They are extras. Every recipe can be made without them.
10. **Unit review and unit challenge.** Each unit ends with a short review (50 points) and a unit challenge: something real cooked, served and recorded, such as a family kitchen safety inspection, three balanced packed lunches, a family blind taste test, or one potato cooked four ways. Keep the challenge pages and photographs in a folder for the year.
11. **The family feast.** In the last week the student plans, shops for and cooks a balanced meal for the family with an adult beside, using dishes from several units, sets the table, and leads or joins in giving thanks.

SCOPE AND SEQUENCE

UNIT 1 • WEEKS 1–4

Kitchen & Food Safety

Semmelweis and clean hands; knife skills with the claw and the bridge in Escoffier's orderly kitchen; Pasteur, germs that grow and the 40–140 °F danger zone; and Clean, Separate, Cook, Chill, with a thermometer-checked chicken quesadilla.

- 1.1 Ignaz Semmelweis and Clean Hands
- 1.2 Knife Skills: The Claw and the Bridge
- 1.3 Louis Pasteur and the Germs That Grow
- 1.4 Clean, Separate, Cook, Chill

UNIT 3 • WEEKS 9–12

Taste, Smell & Your Taste Buds

Kikunae Ikeda and umami, the fifth taste; smell and flavor and the tongue-map myth; why bitter vegetables taste better as taste buds change and you keep trying them; and crunchy, creamy and chewy textures in a batch of homemade granola.

- 3.1 Kikunae Ikeda and the Fifth Taste
- 3.2 Your Nose Knows: Smell, Flavor and the Tongue-Map Myth
- 3.3 Taste Buds Change: Why Broccoli Gets Better
- 3.4 Crunchy, Creamy, Chewy: Texture

UNIT 2 • WEEKS 5–8

Food Groups & the Balanced Meal

Food guides from the 1943 Basic Seven to MyPlate; whole and refined grains and the roller mill; protein and dairy, from Gail Borden's condensed milk to Ezekiel's bread of grains and beans; and packing a balanced lunch, from the miner's dinner pail to the lunch box.

- 2.1 From the Basic Seven to MyPlate
- 2.2 Grains: Whole and Refined
- 2.3 Protein and Dairy: Gail Borden's Milk and Ezekiel's Bread
- 2.4 Packing a Balanced Lunch

UNIT 4 • WEEKS 13–16

Heat & Cold

Count Rumford's stove and conduction, convection and radiation on a pancake griddle; Papin's steam digester, boiling and simmering; Nicolas Appert's sealed jars and quick pickles; and Clarence Birdseye's fast freezing.

- 4.1 Count Rumford's Kitchen
- 4.2 Boiling, Simmering and Steaming
- 4.3 Nicolas Appert and the Sealed Jar
- 4.4 Clarence Birdseye and Fast Freezing

UNIT 5 • WEEKS 17–20

Food Chemistry

- 5.1 Starch: The Thickener
- 5.2 Oil and Water: Emulsions
- 5.3 Protein: Eggs, Browning and Louis-Camille Maillard
- 5.4 Yeast: Pasteur and the Living Leaven

UNIT 6 • WEEKS 21–24

Cravings, Reward & a Balanced Diet

- 6.1 Your Brain's Reward System
- 6.2 Sugar, Salt and Fat: The Bliss Point
- 6.3 Reading the Label for Added Sugar
- 6.4 Treats in Their Place

UNIT 7 • WEEKS 25–28

Fire, the Grill & Spice

- 7.1 Fire Safety and the Grill
- 7.2 A Fire of Coals by the Sea
- 7.3 The Spice Trade
- 7.4 Flavors That Go Together

UNIT 8 • WEEKS 29–32

Meal Planning & the Family Table

- 8.1 Fannie Farmer and the Level Cup
- 8.2 Joseph Plans for the Famine
- 8.3 At the Grocery Store
- 8.4 The Family Feast

WEEKLY PACING CALENDAR

WEEK	PLAN
1	• Session 1: Lesson 1.1 Ignaz Semmelweis and Clean Hands: warm-up, video, teaching and picture study • Session 2: Lesson 1.1 kitchen project (cook the recipe) and cook's notebook <i>Two sessions a week is the usual rhythm: one to learn, one to cook. Younger children can split a long session in two. Cook the week's recipe again at home whenever you can.</i>
2	• Session 1: Lesson 1.2 Knife Skills: The Claw and the Bridge: warm-up, video, teaching and picture study • Session 2: Lesson 1.2 kitchen project (cook the recipe) and cook's notebook
3	• Session 1: Lesson 1.3 Louis Pasteur and the Germs That Grow: warm-up, video, teaching and picture study • Session 2: Lesson 1.3 kitchen project (cook the recipe) and cook's notebook

WEEK	PLAN
4	• Session 1: Lesson 1.4 Clean, Separate, Cook, Chill: warm-up, video, teaching and picture study • Session 2: Lesson 1.4 kitchen project (cook the recipe) and cook's notebook • Session 3: Unit 1 review and unit challenge
5	• Session 1: Lesson 2.1 From the Basic Seven to MyPlate: warm-up, video, teaching and picture study • Session 2: Lesson 2.1 kitchen project (cook the recipe) and cook's notebook
6	• Session 1: Lesson 2.2 Grains: Whole and Refined: warm-up, video, teaching and picture study • Session 2: Lesson 2.2 kitchen project (cook the recipe) and cook's notebook
7	• Session 1: Lesson 2.3 Protein and Dairy: Gail Borden's Milk and Ezekiel's Bread: warm-up, video, teaching and picture study • Session 2: Lesson 2.3 kitchen project (cook the recipe) and cook's notebook
8	• Session 1: Lesson 2.4 Packing a Balanced Lunch: warm-up, video, teaching and picture study • Session 2: Lesson 2.4 kitchen project (cook the recipe) and cook's notebook • Session 3: Unit 2 review and unit challenge
9	• Session 1: Lesson 3.1 Kikunae Ikeda and the Fifth Taste: warm-up, video, teaching and picture study • Session 2: Lesson 3.1 kitchen project (cook the recipe) and cook's notebook
10	• Session 1: Lesson 3.2 Your Nose Knows: Smell, Flavor and the Tongue-Map Myth: warm-up, video, teaching and picture study • Session 2: Lesson 3.2 kitchen project (cook the recipe) and cook's notebook
11	• Session 1: Lesson 3.3 Taste Buds Change: Why Broccoli Gets Better: warm-up, video, teaching and picture study • Session 2: Lesson 3.3 kitchen project (cook the recipe) and cook's notebook
12	• Session 1: Lesson 3.4 Crunchy, Creamy, Chewy: Texture: warm-up, video, teaching and picture study • Session 2: Lesson 3.4 kitchen project (cook the recipe) and cook's notebook • Session 3: Unit 3 review and unit challenge

WEEK	PLAN
13	• Session 1: Lesson 4.1 Count Rumford's Kitchen: warm-up, video, teaching and picture study • Session 2: Lesson 4.1 kitchen project (cook the recipe) and cook's notebook
14	• Session 1: Lesson 4.2 Boiling, Simmering and Steaming: warm-up, video, teaching and picture study • Session 2: Lesson 4.2 kitchen project (cook the recipe) and cook's notebook
15	• Session 1: Lesson 4.3 Nicolas Appert and the Sealed Jar: warm-up, video, teaching and picture study • Session 2: Lesson 4.3 kitchen project (cook the recipe) and cook's notebook
16	• Session 1: Lesson 4.4 Clarence Birdseye and Fast Freezing: warm-up, video, teaching and picture study • Session 2: Lesson 4.4 kitchen project (cook the recipe) and cook's notebook • Session 3: Unit 4 review and unit challenge
17	• Session 1: Lesson 5.1 Starch: The Thickener: warm-up, video, teaching and picture study • Session 2: Lesson 5.1 kitchen project (cook the recipe) and cook's notebook
18	• Session 1: Lesson 5.2 Oil and Water: Emulsions: warm-up, video, teaching and picture study • Session 2: Lesson 5.2 kitchen project (cook the recipe) and cook's notebook
19	• Session 1: Lesson 5.3 Protein: Eggs, Browning and Louis-Camille Maillard: warm-up, video, teaching and picture study • Session 2: Lesson 5.3 kitchen project (cook the recipe) and cook's notebook
20	• Session 1: Lesson 5.4 Yeast: Pasteur and the Living Leaven: warm-up, video, teaching and picture study • Session 2: Lesson 5.4 kitchen project (cook the recipe) and cook's notebook • Session 3: Unit 5 review and unit challenge
21	• Session 1: Lesson 6.1 Your Brain's Reward System: warm-up, video, teaching and picture study • Session 2: Lesson 6.1 kitchen project (cook the recipe) and cook's notebook

WEEK	PLAN
22	- Session 1: Lesson 6.2 Sugar, Salt and Fat: The Bliss Point: warm-up, video, teaching and picture study - Session 2: Lesson 6.2 kitchen project (cook the recipe) and cook's notebook
23	- Session 1: Lesson 6.3 Reading the Label for Added Sugar: warm-up, video, teaching and picture study - Session 2: Lesson 6.3 kitchen project (cook the recipe) and cook's notebook
24	- Session 1: Lesson 6.4 Treats in Their Place: warm-up, video, teaching and picture study - Session 2: Lesson 6.4 kitchen project (cook the recipe) and cook's notebook - Session 3: Unit 6 review and unit challenge
25	- Session 1: Lesson 7.1 Fire Safety and the Grill: warm-up, video, teaching and picture study - Session 2: Lesson 7.1 kitchen project (cook the recipe) and cook's notebook
26	- Session 1: Lesson 7.2 A Fire of Coals by the Sea: warm-up, video, teaching and picture study - Session 2: Lesson 7.2 kitchen project (cook the recipe) and cook's notebook
27	- Session 1: Lesson 7.3 The Spice Trade: warm-up, video, teaching and picture study - Session 2: Lesson 7.3 kitchen project (cook the recipe) and cook's notebook
28	- Session 1: Lesson 7.4 Flavors That Go Together: warm-up, video, teaching and picture study - Session 2: Lesson 7.4 kitchen project (cook the recipe) and cook's notebook - Session 3: Unit 7 review and unit challenge
29	- Session 1: Lesson 8.1 Fannie Farmer and the Level Cup: warm-up, video, teaching and picture study - Session 2: Lesson 8.1 kitchen project (cook the recipe) and cook's notebook
30	- Session 1: Lesson 8.2 Joseph Plans for the Famine: warm-up, video, teaching and picture study - Session 2: Lesson 8.2 kitchen project (cook the recipe) and cook's notebook
31	- Session 1: Lesson 8.3 At the Grocery Store: warm-up, video, teaching and picture study - Session 2: Lesson 8.3 kitchen project (cook the recipe) and cook's notebook

WEEK	PLAN
32	• Session 1: Lesson 8.4 The Family Feast: warm-up, video, teaching and picture study • Session 2: Lesson 8.4 kitchen project (cook the recipe) and cook's notebook • Session 3: Unit 8 review and unit challenge <i>Last week. Hold a family feast: the student plans the menu, shops with a parent, cooks a balanced meal with a dish from several units, sets the table, says grace with the family and shows the cook's notebook.</i>

MATERIALS

Cook's notebook (any notebook)

One for the whole year: recipes in your own words, observations, taste charts, sketches, family ratings and “what I would change next time.”

An instant-read food thermometer

The one tool we strongly recommend. Used from Lesson 1.3 on to check the refrigerator, cooked chicken, eggs and leftovers.

A refrigerator thermometer

Optional and inexpensive. Leave it in the fridge to check that it stays at or below 40 °F (4 °C).

Measuring cups (dry and liquid) and measuring spoons

Used in every recipe. A kitchen scale that reads in grams is helpful but not required.

A small serrated knife or paring knife, a vegetable peeler and a cutting board

Used only with an adult right beside the student. Put a damp towel under the board so it cannot slide. Two boards are best: one for raw meat and one for ready-to-eat foods.

A large skillet or griddle, a medium and a large pot with lids, a baking sheet and oven mitts

Ordinary kitchen equipment for the stovetop and oven recipes.

Mixing bowls, a whisk, a wooden spoon, a spatula, a colander and clean jars with lids

For mixing, draining, pickling and storing.

Clean dish towels, dish soap and paper towels

Cleanup is part of every recipe.

A timer and a camera or phone

For timing cooking and experiments and photographing finished dishes and unit challenges.

GRADING

Grades come mostly from the kitchen projects and the cook's notebook, because cooking is learned by doing, recording and trying again. A dish that flops but is honestly recorded and then made again with one improvement earns full credit.

PART	%
Kitchen projects (effort, safety, cleanliness and the improve round)	40
Cook's notebook (recipes in your own words, observations, taste charts, sketches)	20
Unit reviews	15
Unit challenges	25

Scale: A 90–100, B 80–89, C 70–79, D 60–69. Below 60: cook the recipe or redo the review again with help.

- Grade the cook, not the dish. Did the student wash up first, follow the safety steps, measure carefully, observe and record honestly, clean up, and try an improvement?
- A notebook page earns full marks when it has a date, the recipe in the student's own words, at least one observation or measurement, a sketch or photo, a family rating and one sentence about what to change.
- A dish that flops but is honestly recorded and tried again earns full credit. Burnt pancakes and runny pickles teach as much as perfect ones.
- Unit reviews may be done orally for a student who writes slowly; the parent writes down the answers.
- Never grade or comment on anyone's body, size or how much they ate. Grades rest on effort, care, safety, cleanliness and improvement.

A NOTE TO PARENTS

You do not need to be a chef to teach this course. Read the story aloud together, watch the video, and then be the student's kitchen partner: stand beside the stove and the cutting board, hand over the thermometer, and ask "What do you think will happen?" and "Why do you think it happened?" Those two questions are most of what a good cooking teacher does. Let the student do as much of the work as the safety ladder allows, including the cleanup.

Expect some flops. Pancakes will burn, pasta will go soft, granola will stick. Cooks learn by tasting, noticing and trying again, and the course is built so that a recorded mistake and a second try earn full credit. *Fabricando fit faber*: by making, one becomes a maker.

Food in this course is a good gift to be received with thanks and shared. We keep the conversation on skill, nourishment, thankfulness and hospitality, never on weight or appearance, and we name foods neutrally as "everyday foods" and "sometimes foods." Food allergies and any special medical needs belong to your family and your doctor: please read each recipe card's allergen note and make the swaps your family needs.

KITCHEN & FOOD SAFETY

Every good cook is first a safe cook. Before you make a single dish this year, you will learn the habits that keep a family well: clean hands, clean food and clean tools; a knife held the right way; and cold food kept cold and hot food cooked hot. You will meet Ignaz Semmelweis, the doctor who asked his students to wash their hands in 1847, and Auguste Escoffier, the French chef who organized his kitchen so that every cook knew his station and every tool had its place.

Then you will follow Louis Pasteur as he proved that the tiny living things that spoil food come from other tiny living things, and you will learn the four steps that food scientists teach every family today: Clean, Separate, Cook, Chill. Along the way you will make a rainbow fruit salad, vegetable sticks with a yogurt dip, egg-salad sandwiches and chicken quesadillas checked with a thermometer. Safety is not a list of rules to be afraid of. It is a way of loving the people you feed.

PREREQUISITES

- Can read a simple recipe aloud and follow numbered steps with an adult
- Can read the numbers on a dial or digital thermometer
- Knows to ask an adult before using a knife, the stove, the oven or the microwave

MASTERY CHECKLIST

- ☐ I can wash my hands the right way for at least 20 seconds and tell when cooks must wash.
- ☐ I can use a small knife with the claw and bridge grips, with an adult beside me, on a board that does not slide.
- ☐ I can explain the temperature danger zone (40–140 °F) and the 2-hour rule.
- ☐ I can name the four steps, Clean, Separate, Cook, Chill, and show each one in my own kitchen.
- ☐ I can use a food thermometer to check that chicken reached 165 °F and that the refrigerator is at or below 40 °F.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **Fight BAC! (Partnership for Food Safety Education):** Free. Printable Clean, Separate, Cook, Chill posters, games and family activity sheets. Good for the unit challenge poster.
- **FoodSafety.gov: Safe Minimum Internal Temperatures chart:** Free. Search “FoodSafety.gov safe minimum internal temperatures” and print the chart to tape inside a cupboard door for Lessons 1.3–1.4 and the rest of the year.
- **An instant-read food thermometer and a refrigerator thermometer:** Inexpensive tools sold in most grocery and hardware stores. A digital instant-read thermometer is the easiest to read.
- **America’s Test Kitchen Kids:** Free recipes, kitchen-skills videos and experiments for young cooks from the America’s Test Kitchen team, and their cookbook *The Complete Cookbook for Young Chefs*.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

1.1 Ignaz Semmelweis and Clean Hands	2 sessions of 45–60 minutes
1.2 Knife Skills: The Claw and the Bridge	2 sessions of 45–60 minutes
1.3 Louis Pasteur and the Germs That Grow	2 sessions of 45–60 minutes
1.4 Clean, Separate, Cook, Chill	2 sessions of 45–60 minutes

UNIT 1 REVIEW

Answer each question in complete sentences unless it asks for a number or a list. The review is worth 50 points.

1. **5 pts**

What did Ignaz Semmelweis notice about the two clinics in his hospital, and what did he do about it in 1847?

2. (5 pts)

List the five handwashing steps and tell how long to scrub.

3. (5 pts)

Explain the claw grip and the bridge grip. Which would you use to cut a bell pepper in half, and which to cut it into strips?

4. (5 pts)

Why is a dull knife more dangerous than a sharp one?

5. (5 pts)

Describe Pasteur's swan-necked flask experiment and what it proved.

6. (5 pts)

What is the temperature danger zone, and what is the 2-hour rule?

7. (5 pts)

Predict: you leave one bowl of egg salad on the counter for 4 hours and keep another in the refrigerator. Will they look and smell different? Which one is safe to eat, and why?

8. (5 pts)

Name the four steps of food safety and give one example of each.

9. (5 pts)

Give the safe minimum internal temperature for each: chicken, ground beef, a pork chop or salmon fillet, and reheated leftovers.

10. (5 pts)

Why should you never wash raw chicken in the sink?

ANSWER KEY

1. Far more mothers became sick in the clinic where doctors came straight from the laboratory without washing than in the midwives' clinic. He made every doctor and student scrub their hands in chlorinated lime (bleach water) before examining a mother, and far fewer mothers became sick.
2. Wet, lather with soap, scrub, rinse, dry. Scrub for at least 20 seconds, including the backs of the hands, between fingers, thumbs and under nails.
3. Claw: fingertips curled under, the side of the knife against the knuckles. Bridge: hand arched over the food, cutting down through the arch. Use the bridge to cut the pepper in half and the claw to cut it into strips.
4. A dull knife needs more force, so it is more likely to slip off the food and cut the cook.
5. He boiled broth in flasks with long S-shaped necks. Air could get in, but dust and microbes were trapped in the bend, and the broth stayed clear. When the neck was broken off, the broth soon spoiled. Microbes come from other microbes, not from nothing.
6. 40–140 °F (4–60 °C), where bacteria grow fastest. Perishable food must go back in the refrigerator within 2 hours, or within 1 hour if it is above 90 °F.
7. They will probably look and smell the same, but only the refrigerated one is safe. Bacteria could have multiplied in the bowl left in the danger zone, and the bacteria that make people sick usually do not change the smell or look of food.
8. Clean (wash hands and boards), Separate (raw meat on its own board and on the bottom shelf), Cook (chicken to 165 °F checked with a thermometer), Chill (leftovers in the refrigerator within 2 hours). Other good examples accepted.
9. Chicken 165 °F; ground beef 160 °F; pork chop or fish 145 °F (the pork with a 3-minute rest); leftovers 165 °F.
10. Splashing water spreads germs from the chicken onto the sink, counter, hands and nearby foods. Cooking the chicken to 165 °F is what destroys the germs.

UNIT CHALLENGE: FAMILY KITCHEN SAFETY INSPECTION

Inspect your family's kitchen like a health inspector, with an adult as your partner. Make a checklist with at least three items for each of the four steps (for example: soap and a clean towel by the sink; a separate board for raw meat; a food thermometer in the drawer; raw meat on the bottom shelf; the refrigerator at or below 40 °F).

Measure and record the refrigerator and freezer temperatures with a thermometer. Mark each checklist item as “yes” or “needs work,” and fix at least one “needs work” item with your family. Finish with a colorful hand-washing poster showing the five steps and the 20-second rule, and hang it by the kitchen sink.

LOOK FOR	WHAT IT MEANS
Complete checklist	At least three items for each of Clean, Separate, Cook and Chill, each marked honestly.
Thermometer readings	Refrigerator and freezer temperatures measured correctly, recorded with the date, and compared with 40 °F and 0 °F.
One fix	At least one problem found and fixed with the family, with a sentence about what changed.
Hand-washing poster	Shows all five steps and the 20-second rule clearly enough for a younger child to follow.
Effort and care	Neat, careful work, done with a helpful attitude toward the family.

1.1 IGNAZ SEMMELWEIS AND CLEAN HANDS

OBJECTIVES

- Tell how Ignaz Semmelweis discovered that washing hands keeps sickness from spreading.
- Explain how soap, scrubbing and running water remove germs, and wash your hands correctly for at least 20 seconds.
- Wash fruit under running water and cut soft fruit with a small serrated knife, with an adult right beside you.

Warm-up. Make a list of everything your hands have touched since you got up this morning: doorknobs, a pet, a phone, a pencil, your face, a ball. Count the items. Then ask: if your hands could carry something invisible from each of those places, where would it go next if you started cooking right now without washing?

WATCH

Fight Germs. Wash Your Hands!

Centers for Disease Control and Prevention (CDC) • 3:00

<https://www.youtube.com/watch?v=eZw4Ga3jg3E>

WHEN TO WATCH

After the story of Semmelweis and before the cinnamon germ test. Watch the glowing-hands demonstration closely: where did the germs hide?

Note: From the U.S. Centers for Disease Control and Prevention.

KEY TERMS

germs

Living things too small to see without a microscope, such as some bacteria and viruses, that can make people sick.

bacteria

Tiny one-celled living things. Most are harmless or even helpful, but a few kinds cause sickness or spoil food.

soap

A cleaner whose tiny particles grab grease and dirt on one end and water on the other, so that scrubbing and rinsing carry germs away.

produce

Fresh fruits and vegetables.

claw grip

Holding food with your fingertips curled under, like a claw, so the knife meets your knuckles and never your fingertips.

CORE IDEAS

The story. In 1846 a young Hungarian doctor named Ignaz Semmelweis went to work in the great General Hospital of Vienna, Austria. The hospital had two clinics where mothers came to have their babies. In the first clinic, where doctors and medical students worked, many mothers became very sick with a fever after their babies were born. In the second clinic, where midwives worked, far fewer did. The difference was so well known that some mothers begged not to be sent to the first clinic. Semmelweis could not rest until he knew why.

How he figured it out. Semmelweis compared the two clinics carefully. They were in the same building and cared for the same kinds of mothers. One difference stood out: the doctors and students often came to the mothers' beds straight from the hospital's laboratory, where they studied sickness, without washing their hands. The midwives did not work in the laboratory. When a fellow doctor was cut by a student's knife in the laboratory and became sick with the very same kind of fever, Semmelweis guessed that something too small to see was traveling on the doctors' hands. In May 1847 he set a basin of chlorinated lime, a kind of bleach water, at the door and required every doctor and student to scrub their hands in it before examining a mother. Within months, far fewer mothers in his clinic became sick, about as few as in the midwives' clinic.

Think it through. Many doctors refused to believe Semmelweis. Nobody had yet seen germs cause sickness, and some doctors did not like being told that their own hands were the problem. About twenty years later, Louis Pasteur (whom you will meet in Lesson 1.3) and the surgeon Joseph Lister showed that tiny living things do cause

sickness and spoil food, and Semmelweis was proved right. Today every hospital, restaurant and home kitchen depends on the idea he tested.

The kitchen science. Water alone does not clean hands well, because germs cling to the natural oils on your skin. Soap is made of tiny particles with two ends: one end holds on to oil and grease, and the other end holds on to water. When you lather and scrub, soap pulls the oily dirt and the germs off your skin, and running water carries them down the drain. Scrubbing matters as much as soap. The CDC teaches five steps: wet your hands with clean running water, lather with soap, scrub for at least 20 seconds (hum “Happy Birthday” twice), rinse, and dry with a clean towel. Don’t forget the backs of your hands, between your fingers, your thumbs and under your nails. Wash before you cook, after touching raw meat, poultry, fish or eggs, after using the bathroom, after blowing your nose or touching a pet or the trash.

Let’s cook. Fruits and vegetables need washing too, even ones with a peel you will not eat, like melons and oranges, because a knife can carry germs from the outside to the inside. Rinse produce under cool running water while you rub it with your hands; use a clean brush on firm produce. Do not use soap on food. Today you will make a rainbow fruit salad with a honey-lime dressing. Your one skill to do well: cut soft fruit with a small serrated knife using the claw grip, with an adult right beside you.

PICTURE STUDY



The Scullery Maid, Jean-Siméon Chardin, about 1738 · Oil on canvas · National Gallery of Art, Washington, D.C.

Image: [Wikimedia Commons](#), public domain

Jean-Siméon Chardin was a French painter who loved quiet, ordinary work in the kitchen. Here a young scullery maid, the servant whose job was washing pots and dishes, bends over a wooden washtub. Chardin painted her with the same care that other painters gave to kings.

Look closely

- Find the wooden tub. What is she doing with her hands inside it?
- Find the big copper pot on the floor. Why would a cook want a pot to be scrubbed clean before the next meal?
- Look at her apron and cap. Why might kitchen workers wear clean aprons and cover their hair?
- Find the long-handled ladle and the shallow dish. Which other tools are waiting to be washed?

Talk about it

1. This maid had no running water from a tap. Where do you think her washing water came from, and how might she have heated it?
2. Chardin painted a person doing a humble job very carefully. Why is cleaning an important part of cooking for a family?

3. If you painted your own kitchen after cooking, what would be waiting to be washed?

Safety first. A parent or responsible adult supervises all cooking in this course, and every family checks each recipe against its own food allergies before cooking. Use the small serrated knife only with an adult right beside you, on a cutting board with a damp towel underneath so it cannot slide. Honey is never given to babies under one year old.

KITCHEN PROJECT

The Cinnamon Germ Test and a Rainbow Fruit Salad

First you will see for yourself why 20 seconds of scrubbing with soap matters, using cinnamon as pretend “germs.” Then, with clean hands and clean fruit, you will make a rainbow fruit salad for the family, practicing the claw grip with a small serrated knife.

You will need

- Cooking oil and ground cinnamon (or fine craft glitter) for the germ test
- Soap, a sink with running water, a clean towel and a timer
- A colander, a cutting board, a damp towel to go under the board, a small serrated knife and a vegetable peeler
- A fine grater or zester, a small bowl, a whisk or fork, a large serving bowl and a big spoon

RAINBOW FRUIT SALAD WITH HONEY-LIME DRESSING

Serves 6 · Prep 25 min

Ingredients

- 2 cups (about 300 g) strawberries
- 1 can (11 ounces / 312 g) mandarin oranges, drained, or 2 clementines, peeled and pulled into sections
- 1 can (20 ounces / 567 g) pineapple chunks in juice, drained
- 2 kiwis
- 1 cup (about 150 g) seedless green grapes
- 1 cup (about 150 g) blueberries
- 1 lime
- 2 tablespoons honey (or maple syrup)

Method

1. Wash your hands with soap for at least 20 seconds. Wipe the counter with a clean, soapy cloth.

2. Rinse the strawberries, grapes and blueberries in a colander under cool running water, gently rubbing them with your fingers. Rinse and rub the kiwis and the lime too. Pat everything dry with a clean towel.
3. Put a damp towel under your cutting board. With an adult right beside you, pull or cut the green tops off the strawberries. Lay each berry on its flat side, hold it with the claw grip, and cut it into quarters with the small serrated knife.
4. Peel the kiwis with a vegetable peeler, always peeling away from your body. Lay each kiwi down and cut it into rounds, then cut each round in half.
5. With an adult beside you, rub the lime gently over a fine grater to scrape off ½ teaspoon of the green zest (stop before the white part). Cut the lime in half and squeeze out 1 tablespoon of juice.
6. In a small bowl, whisk the honey, lime juice and lime zest until smooth.
7. Arrange the fruit in rainbow stripes in a large bowl: red strawberries, orange mandarins, yellow pineapple, green kiwi and grapes, and blue blueberries. Show the family, then pour the dressing over the top and stir gently.
8. Serve right away, or cover and refrigerate. Put any leftovers back in the refrigerator within 2 hours and eat them within 2 days.

Allergy check: Contains none of the nine major allergens. Contains honey, which must never be given to a baby under one year old; use maple syrup instead if a baby will share the salad.

Steps

1. **Germ test, round 1.** Rub ½ teaspoon of cooking oil all over your hands, then sprinkle ½ teaspoon of cinnamon over them and rub it in. The cinnamon stands for germs. Rinse with plain water for 5 seconds, no soap. Look closely and write down where the “germs” are still stuck.
2. **Germ test, round 2.** Coat your hands again with oil and cinnamon. This time wet them, lather with soap and scrub for a full 20 seconds by the timer, covering palms, backs, between fingers, thumbs and under nails. Rinse and dry. Where is cinnamon still hiding? Most people miss their thumbs and fingernails.

3. Make the rainbow fruit salad, following the recipe card. Before you start, say out loud the four times a cook must always wash: before cooking, after raw meat or eggs, after the bathroom, and after touching a pet, your face or the trash.
4. When the salad is served, set a timer for 2 hours. When it rings, make sure any leftovers are back in the refrigerator.
5. Clean up: wash the knife, board, grater and bowls in hot, soapy water (never leave a knife hidden in a sink of soapy water), dry them, wipe the counter and put everything away.
6. **Improve it.** Teach a younger brother, sister or friend the 20-second hand wash using the cinnamon test, and watch to see whether they miss the same spots you did.

Tips

- Hold the strawberry by its flat cut side down so it cannot roll. Round food that rolls is the most common cause of knife slips.
- A serrated knife works by sawing gently back and forth. Let the teeth do the work instead of pressing hard.
- If the pineapple and mandarins are packed in syrup instead of juice, drain and rinse them, and you may need less honey.

Check your work

- ☐ I can wash my hands for at least 20 seconds and name the spots most people miss.
- ☐ I can explain how Semmelweis found that washing hands stopped sickness from spreading.
- ☐ I washed every fruit under running water before cutting it, and I used the claw grip with an adult beside me.

COOK'S NOTEBOOK

1. Draw two hands, front and back, and shade every spot where cinnamon stayed after the 5-second rinse. Use a second color to show where it stayed after the 20-second scrub.
2. Copy the fruit-salad recipe in your own words and draw the rainbow bowl. Ask three family members to rate it from 1 to 5 stars.

3. Write the story of Semmelweis in five sentences, as if you were explaining it to a friend who has never heard of germs.

From history. Semmelweis published his findings in a book in 1861, but most doctors of his day still did not accept them. In 1867 Joseph Lister, an English surgeon who had read Pasteur's work, began cleaning wounds and surgical tools with carbolic acid and saw far fewer infections. Today Semmelweis is honored in Hungary as the "savior of mothers," and a university in Budapest bears his name.

COMMON MISTAKES

- Washing for only a few seconds, or rinsing without soap. Germs cling to oily skin; it takes soap and at least 20 seconds of scrubbing.
- Washing fruit with dish soap. Use only cool running water and your hands or a clean brush.
- Skipping the wash for fruits with a peel. A knife can carry germs from an unwashed melon or orange peel into the part you eat.
- Wiping wet hands on your clothes. Dry them on a clean towel or paper towel.

Make it a game · Twenty-Second Scrub. Tell the story of Ignaz Semmelweis in three sentences to your parent, who plays a doctor who doubts you. Then wash hands at the sink, singing or counting a full twenty seconds while your parent watches the clock. Afterward, name the three things that remove germs: soap, scrubbing and running water. Switch, and let your parent try the story.

Scripture. "He that hath clean hands, and a pure heart" (Psalm 24:4, KJV)

Clean hands matter in the kitchen, where they protect the people we feed. The psalm reminds us that God cares even more about clean hearts.

1.2 KNIFE SKILLS: THE CLAW AND THE BRIDGE

OBJECTIVES

- Tell how Auguste Escoffier organized the kitchen brigade and the habit of mise en place, “everything in its place.”
- Use the claw grip and the bridge grip with a small knife, with an adult right beside you, on a board that cannot slide.
- Make a round vegetable safe to cut by first giving it a flat side, and prepare a platter of vegetable sticks.

Warm-up. Go to the kitchen with an adult and set out every tool you would need to make a sandwich, in the order you would use it, before you open a single jar. Then put a dull butter knife next to a small sharp knife. Which do you think is safer to cut a tomato with? Write down your guess; you will find out the answer in the lesson.

WATCH

How to Teach Kids to Use a Knife Safely | Kids Cook Real Food.

Katie Kimball · 10:09

<https://www.youtube.com/watch?v=wTVaAlOpJgQ>

WHEN TO WATCH

Before your first knife practice. Watch it all the way through, then practice the grips with your adult before you cut anything.

Note: Katie Kimball of Kids Cook Real Food teaches several age levels; follow this course’s grade 5 rule of a small knife with an adult right beside you.

BACKUP VIDEO

Good Food Skills: First level - Bridge and Claw

Education Scotland · 3:48

<https://www.youtube.com/watch?v=PmYdU68jpGA>

KEY TERMS

claw grip

Holding food with your fingertips curled under, like a claw, so the side of the knife rests against your knuckles and never meets your fingertips.

bridge grip

Making an arch over the food with your thumb on one side and your fingers on the other, then cutting down through the middle of the arch, under your hand.

mise en place

French for “put in place”: getting every ingredient measured and cut and every tool set out before you start to cook.

brigade

A team of cooks in which each person has one station and one job, all led by a head chef.

serrated knife

A knife with a saw-toothed edge that cuts soft or slippery foods, like tomatoes and bread, with gentle back-and-forth strokes.

CORE IDEAS

The story. Auguste Escoffier was born in 1846 in a village in the south of France and started work in his uncle’s restaurant kitchen at the age of thirteen. In those days many restaurant kitchens were hot, crowded and disorderly, with cooks shouting and getting in each other’s way. Escoffier became one of the most famous chefs in the world, cooking at the Savoy Hotel in London from 1890 and later at the Ritz and Carlton hotels. He made the kitchen a place of order: clean white jackets, a calm voice, clean tools and every cook in his place.

How he figured it out. Escoffier organized his cooks into a *brigade*, like a well-run army. One cook made the sauces, another roasted the meats, another cooked the vegetables, another made the pastry, and the head chef led them all. Each station had its own tools and its own work, and each cook prepared everything ahead of time, the habit cooks call *mise en place*, “everything in its place.” Cooks who were not scrambling to find a knife or chop an onion at the last second made fewer mistakes, cut themselves less often and served better food. In 1903 he wrote down thousands of recipes and methods in a great book, *Le Guide Culinaire*, which chefs still study.

The kitchen science. Most knife accidents happen when food slips, the board slides or the cook rushes. A sharp knife is actually safer than a dull one: a dull blade needs more pushing, so it skids off the food and into fingers. A board that cannot move is safer too, so put a damp towel under it. Round foods roll, so the first cut should always give the food a **flat side**; lay that side down, and the food stays still. Use the **bridge grip** to cut something in half: make an arch over the food with your thumb on one side and fingers on the other, and cut down through the middle of the arch. Use the **claw grip** to slice: curl your fingertips under, rest the side of the blade against your knuckles, and move your claw back a little after each cut.

Think it through. A few knife rules keep everyone safe. Carry a knife with the point down and the blade at your side, and say “knife behind” if someone is near. Never try to catch a falling knife; step back and let it fall. Lay a knife down flat on the board, away from the edge of the counter, never hidden under food or in a sink full of soapy water. Keep your eyes on the blade while you cut, and stop cutting if you need to look up.

Let’s cook. You will set out your mise en place like one of Escoffier’s cooks and make a platter of carrot, cucumber, celery and bell-pepper sticks with a yogurt-herb dip. Your one skill: the bridge to cut each vegetable in half, the claw to cut it into sticks, always with an adult right beside you.

PICTURE STUDY



The Kitchen Maid, Jean-Siméon Chardin, 1738 • Oil on canvas • National Gallery of Art, Washington, D.C.

Image: [Wikimedia Commons](#), public domain

Chardin painted this young kitchen maid in the middle of peeling turnips for the family's soup. She has paused for a moment and is looking away, thinking. Everything she needs is close at hand, just as a good cook sets out her *mise en place*.

Look closely

- Find the knife and the turnip in her hands. Which way does the knife point while she rests?
- Find the bowl of water at her feet. What do you think she is putting into it, and why?
- Find the chopping block with the cleaver stuck in it. Where is it placed so that no one bumps into the blade?
- Find the pile of unpeeled vegetables and the copper pan. What do you think will happen to them next?

Talk about it

1. She has stopped to think, but her knife is still in her hand. What would a careful cook do with a knife when she stops working?
2. How is her work set out like *mise en place*? What is close at hand and what is put away?

3. Turnips are hard and round. How would you give a turnip a flat side so it would not roll on your board?

Safety first. Use a knife only with an adult right beside you, on a cutting board with a damp towel underneath. Cut round foods in half first and lay them flat side down, keep your fingertips curled in the claw, and never try to catch a falling knife.

Mise en Place: A Vegetable-Stick Platter

You will set up your station the way Escoffier's cooks did, then practice the bridge and the claw on four different vegetables, each a little harder than the one before. The finished platter becomes the family's snack or a side dish for supper.

You will need

- A cutting board and a damp towel to put under it
- A small serrated or paring knife and a vegetable peeler
- A ruler, a medium bowl, a whisk or fork, measuring cups and spoons, a fine grater (optional)
- A large platter and a clean towel

VEGETABLE STICKS WITH YOGURT-HERB DIP

Serves 6 • Prep 35 min • Chill 15 min

Ingredients

- 3 medium carrots
- 1 medium cucumber
- 3 stalks celery
- 2 bell peppers (red, yellow or orange)
- For the dip: 1 cup (about 240 g) plain Greek yogurt
- 1 tablespoon lemon juice
- 2 tablespoons chopped fresh dill or chives (or 2 teaspoons dried dill)
- 1 small clove garlic, finely grated (optional)
- ¼ teaspoon salt and a pinch of black pepper

Method

1. Wash your hands and wipe the counter. Rinse all the vegetables under cool running water, rubbing them with your hands, and pat them dry.
2. Make the dip first so it can chill: stir the yogurt, lemon juice, herbs, garlic, salt and pepper together in a bowl. Cover and refrigerate.

3. Carrots: peel them, peeling away from your body. With an adult right beside you, cut each carrot crosswise into pieces about 3 inches long. Use the bridge grip to cut each piece in half lengthwise, lay the flat sides down, then use the claw grip to cut each half into sticks.
4. Celery: trim off the ends. Cut each stalk into 3-inch pieces with the claw grip, then cut the wider pieces in half lengthwise.
5. Cucumber: cut off the ends and cut it crosswise into 3-inch pieces. Stand each piece on its flat end, or lay it down and use the bridge to cut it in half lengthwise, then into quarters, then into sticks.
6. Bell peppers: use the bridge to cut each pepper in half from top to bottom. Pull out the stem and seeds with your fingers. Lay each half skin side down (the waxy skin is slippery), flatten it gently with your hand, and use the claw to cut it into strips.
7. Arrange the sticks on a platter around the bowl of dip. Refrigerate until serving and put leftovers back in the refrigerator within 2 hours.

Allergy check: Contains milk (yogurt). For a milk-free dip, use a plain dairy-free yogurt, or serve the vegetables with hummus (hummus contains sesame from tahini).

Steps

1. **Mise en place.** Before you touch the knife, set out every tool and every ingredient in the order you will use them. Put a bowl for scraps and peels at your station. Ask your adult to check your station the way Escoffier would have.
2. **Grip practice.** With the knife on the board, make the claw grip and the bridge grip on a whole carrot without cutting. Show your adult both grips three times.
3. Make the vegetable sticks and dip from the recipe card, working from the easiest vegetable (celery) to the hardest (carrots).
4. **Measure your sticks.** Choose five sticks of each vegetable and measure them with a ruler. Are they all about 3 inches long and about as thick as your finger? Record the lengths in a table.
5. **Taste test.** Ask the family which vegetable they liked best with the dip, and why. Record the votes.

6. Clean up: wash and dry the knife yourself, holding it by the handle with the blade away from you, and put it away. Wash the board and bowls, and wipe the counter.
7. **Improve it.** Make the platter again later in the week and try to cut your sticks more evenly. Compare your new measurements with the first ones.

Tips

- Move your claw back a little after each cut, keeping the side of the blade against your knuckles. Go slowly; speed comes later on its own.
- If a vegetable starts to wobble, stop and cut a new flat side.
- Even pieces look nicer and, when you cook them, cook at the same speed.

Check your work

- ☐ I can show the claw grip and the bridge grip and explain when to use each.
- ☐ I gave every round vegetable a flat side before cutting it into sticks.
- ☐ I set out my mise en place before I started, and I cleaned and put away the knife safely.

COOK'S NOTEBOOK

1. Draw your hand in the claw grip and in the bridge grip, with arrows showing where the knife goes. Label the knuckles and fingertips.
2. Draw your mise en place: a map of your station with every tool and ingredient labeled.
3. Make a table of your stick measurements and write one sentence about how you could make them more even.

From history. Escoffier also wanted his cooks to stay healthy in the heat of the kitchen. He is said to have arranged for a barley drink to be made for his cooks to keep them cool and refreshed. In 1920 he received France's highest honor, the Legion of Honor, the first chef to be so honored.

COMMON MISTAKES

- Holding food with flat, outstretched fingers. Curl your fingertips under in the claw.
- Cutting a round vegetable without first giving it a flat side, so it rolls.

- Thinking a dull knife is safer. A dull knife slips; a sharp knife used slowly and carefully is safer.
- Leaving a knife in a sink of soapy water, where someone could reach in and be cut.

Make it a game • Mise en Place Relay. Choose a simple recipe and set a timer for two minutes. Gather and lay out every ingredient and tool before you start, as an Escoffier brigade would. Your parent checks the list and scores a point for each item in place. Then, with a banana and a butter knife, show the claw grip and bridge grip, adult beside you.

Scripture. “Let all things be done decently and in order.” (1 Corinthians 14:40, KJV)

Paul wrote these words about worship, but they describe a good kitchen too. Order and care keep a cook and everyone around her safe.

1.3 LOUIS PASTEUR AND THE GERMS THAT GROW

OBJECTIVES

- Tell how Louis Pasteur’s swan-necked flask experiment showed that microbes come from other microbes.
- Explain the temperature danger zone (40–140 °F) and the 2-hour rule, and why cold slows bacteria and heat destroys them.
- Use a food thermometer to check the refrigerator, the freezer, ice water and hot water, and chill hard-cooked eggs quickly.

Warm-up. Look in your refrigerator with an adult. Which foods are kept cold, and which foods in the pantry are not? Make two lists. What do the cold foods have in common? Guess: what temperature do you think the inside of your refrigerator is?

WATCH

Pasteur's Swan Necked Flask Experiments disproved the Theory of Spontaneous Generation

Scientist Cindy · 6:04

https://www.youtube.com/watch?v=_ZzJ6NcmiKU

WHEN TO WATCH

After the story paragraph, before the kitchen science. Pause when the flask’s neck is broken and predict what will happen to the broth.

Note: Begins with Leeuwenhoek and microscopes before reaching Pasteur’s flasks.

BACKUP VIDEO

Food Safety: Danger Zone, English

Tacoma-Pierce County Health Department · 1:16

<https://www.youtube.com/watch?v=Ef5tfUmNsU8>

KEY TERMS

microbe

A living thing too small to see without a microscope, such as a bacterium, a yeast or a mold.

spoil

To go bad because microbes are growing in the food, often with a sour smell, slime, mold or a changed color.

danger zone

The range of temperatures between 40 °F and 140 °F (4–60 °C), where bacteria in food can grow fastest.

pasteurization

Heating a food or drink, like milk or juice, to a set temperature for a set time to destroy most harmful microbes without boiling it.

food thermometer

A thermometer with a metal probe that you push into food to measure the temperature inside.

CORE IDEAS

The story. Louis Pasteur was a French chemist, born in 1822, the son of a leather tanner. In his day many people believed that living things could appear out of nothing. If a bowl of broth went cloudy and smelly, they said the tiny creatures in it had simply sprung up from the broth itself. This idea was called “spontaneous generation.” Pasteur suspected something else: that the microbes came from other microbes floating in the air on specks of dust.

How he figured it out. Between 1859 and 1862 Pasteur designed a clever experiment. He poured meat broth into glass flasks and heated the long necks of the flasks in a flame until he could bend them into an S-shape, like the neck of a swan. Then he boiled the broth to destroy any microbes already in it. Air could still flow in and out through the open, curving neck, but dust and the microbes riding on it got trapped in the low bend. The broth stayed clear for weeks and months. But when Pasteur broke off a neck, or tipped a flask so the broth touched the dusty bend, the broth soon turned cloudy with microbes. Microbes did not come from nothing; they came from other microbes. In 1864 Pasteur also showed that gently heating a liquid to a set temperature, without boiling it, destroyed most of the microbes that spoiled it. We call this *pasteurization*, and later the same idea was used to make milk and juice safe to drink.

The kitchen science. Bacteria grow by splitting in two. In the **danger zone**, between 40 °F and 140 °F (4–60 °C), the USDA warns that some bacteria can double in as little as 20 minutes, so a few can become many thousands in an afternoon. Cold slows them down: a refrigerator should be at or below 40 °F (4 °C), and a freezer at 0 °F (–18 °C), which stops their growth but does not destroy them. Heat destroys them: that is

why food is cooked to safe temperatures. That is also why perishable food, like eggs, meat, dairy and cut fruit, must go back into the refrigerator within **2 hours**, or within 1 hour if the air is above 90 °F (32 °C).

Let's cook. You will check your own refrigerator and freezer with a food thermometer, then make hard-cooked eggs, cool them quickly in ice water so they pass through the danger zone fast, and turn them into egg-salad sandwiches. Your one skill: reading a food thermometer carefully and writing down the number.

PICTURE STUDY



Louis Pasteur, Albert Edelfelt, 1885 · Oil on canvas · Musée d'Orsay, Paris

Image: [Wikimedia Commons](#), public domain

The Finnish painter Albert Edelfelt painted Pasteur at work in his laboratory in Paris, holding up a small glass bottle from one of his experiments to the light. Pasteur was more than sixty years old and famous by then, but he is shown as he liked to be: a working scientist, looking closely.

Look closely

- Find the glass bottle in Pasteur's hands. Why might he hold it up to the window light?
- Count the flasks, jars and bottles you can see on the bench and the shelves.
- Look for anything that covers or closes the jars. Why would a scientist studying microbes keep jars covered?
- Find the notebook or papers on the bench. What would Pasteur write down?

Talk about it

1. Pasteur kept careful records of every flask. Why would writing everything down matter in an experiment that lasts for months?
2. How is a covered jar in Pasteur's laboratory like a covered container of leftovers in your refrigerator?

3. If you could ask Pasteur one question about his swan-necked flasks, what would it be?

Safety first. An adult stands beside you at the stove and handles the pot of boiling water and the draining; use a slotted spoon to move the eggs, and keep pot handles turned in. Never put a thermometer probe into your mouth, and wash it in hot, soapy water between foods.

Thermometer Detective and Quick-Chilled Eggs

You will become a thermometer detective, checking how cold your refrigerator and freezer really are and testing your thermometer in ice water. Then you will cook eggs, chill them quickly through the danger zone and make egg salad.

You will need

- An instant-read food thermometer (and a refrigerator thermometer, if you have one)
- Two tall glasses, ice cubes and water
- A medium pot with a lid, a slotted spoon, a large bowl for ice water, a timer and oven mitts
- A cutting board, a small knife or egg slicer, a fork, a mixing bowl and measuring spoons

HARD-COOKED EGGS AND EGG-SALAD SANDWICHES

Serves 4 (8 sandwich halves) · Cook 15 min · Chill 15 min · Prep 15 min

Ingredients

- 6 large eggs
- Ice cubes and cold water for an ice bath
- 3 tablespoons mayonnaise
- 1 teaspoon yellow mustard
- 1 stalk celery, finely chopped (about $\frac{1}{3}$ cup)
- $\frac{1}{4}$ teaspoon salt and a pinch of black pepper
- 8 slices whole-wheat or white sandwich bread
- Lettuce leaves (optional)

Method

1. Wash your hands. Place the eggs in a single layer in a medium pot and add cold water to cover them by 1 inch.
2. With an adult beside you, set the pot on the stove with the handle turned in, and heat on high until the water comes to a full boil.

3. As soon as it boils, the adult turns off the heat and covers the pot. Let the eggs stand in the hot water for 12 minutes by the timer.
4. While they stand, fill a large bowl with ice and cold water. When the timer rings, use a slotted spoon to lift the eggs one at a time into the ice bath, with an adult beside you. Let them chill for at least 10 minutes.
5. Tap each egg on the counter, roll it gently to crack the shell all over, and peel it under a little running water. Wash your hands after handling the shells.
6. Chop the eggs on a clean board with a small knife (with an adult beside you) or an egg slicer, or mash them in a bowl with a fork. Stir in the mayonnaise, mustard, celery, salt and pepper.
7. Spread the egg salad on 4 slices of bread, add lettuce if you like, top with the other 4 slices and cut each sandwich in half.
8. Serve right away. Refrigerate any leftover egg salad within 2 hours and eat it within 3–4 days.

Allergy check: Contains eggs and wheat (bread). Many mayonnaises are made with soybean oil and eggs; check the label if soy is a concern. For a wheat-free version, serve the egg salad in lettuce leaves or on gluten-free bread.

Steps

1. **Check your thermometer.** Fill a tall glass with ice, add cold water and stir. Wait 3 minutes, then put the thermometer probe into the middle of the glass (not touching the sides). It should read 32 °F (0 °C). If it is off by a degree or two, write down the difference and remember it.
2. **Thermometer detective.** Measure and record the temperature of (a) a glass of water that has been in the refrigerator for an hour, (b) the freezer air or a bag of frozen peas, (c) cold tap water and (d) hot tap water. Which are in the danger zone? Is your refrigerator at or below 40 °F?
3. Cook the eggs from the recipe card. When you move them to the ice bath, take the temperature of the ice water. After 10 minutes, ask the adult to cut one egg in half and check the temperature in the very center of the yolk. Record it.
4. Make the egg salad and sandwiches and serve them. Note the time you served them, and set a 2-hour timer for the leftovers.

5. Clean up: wash the thermometer probe, the pot, the board, the bowls and the knife in hot, soapy water, wipe the counter, and put everything away.
6. **Improve it.** Next time, try cooking one egg for 9 minutes and one for 12 minutes. Cut them open and compare the yolks. Which do you prefer, and which is better for egg salad?

Tips

- Older eggs (a week or two in the refrigerator) usually peel more easily than very fresh ones.
- A green ring around the yolk means the egg was cooked too long or cooled too slowly. It is safe to eat, but the quick ice bath helps prevent it.
- Read a dial thermometer at eye level, looking straight at the needle.

Check your work

- ☐ I can explain Pasteur's swan-necked flask experiment and what it proved.
- ☐ I measured my refrigerator and freezer and know whether they are cold enough.
- ☐ I can name the danger zone and the 2-hour rule, and I chilled my eggs quickly.

COOK'S NOTEBOOK

1. Draw Pasteur's swan-necked flask in two pictures: one with the neck whole and the broth clear, and one with the neck broken off and the broth cloudy. Label where the dust gets trapped.
2. Make a thermometer chart: draw a tall thermometer from 0 °F to 212 °F and mark your freezer, refrigerator, ice water, tap water, the danger zone (shade it red) and boiling water.
3. Copy your egg-salad recipe in your own words and record how long your eggs cooked and what the yolks looked like.

From history. Pasteur went on to study the diseases of silkworms, which were ruining France's silk industry, and later found ways to protect people and animals from chicken cholera, anthrax and rabies. The Pasteur Institute he founded in Paris in 1887 still studies microbes and disease today. Pasteurization of milk became common in American cities in the early 1900s.

COMMON MISTAKES

- Thinking that the freezer kills germs. Freezing stops bacteria from growing, but most survive and wake up again when the food thaws.
- Leaving egg salad, milk or cut fruit on the table all afternoon. Perishable food goes back in the refrigerator within 2 hours (1 hour above 90 °F).
- Judging whether food is safe by smell. The bacteria that make people sick usually do not change how food smells, looks or tastes.
- Pushing the thermometer all the way through the food or touching the pan, which gives a wrong reading.

Make it a game · Swan-Neck Story Chain. Tell Pasteur's swan-necked flask story one sentence at a time, trading turns with your parent. Each sentence must add a fact, such as broth, the curved neck, trapped dust, or microbes coming from other microbes. Then set a timer and say the danger zone numbers and the two-hour rule. Beat your time on the second round.

Scripture. “A prudent man foreseeth the evil, and hideth himself” (Proverbs 22:3, KJV)

A prudent cook looks ahead: she knows food left out can grow harmful bacteria, so she chills it in time instead of waiting for trouble.

1.4 CLEAN, SEPARATE, COOK, CHILL

OBJECTIVES

- Name and explain the four steps of home food safety: Clean, Separate, Cook and Chill.
- Know the safe minimum internal temperatures for chicken (165 °F), ground meat (160 °F), whole cuts and fish (145 °F) and leftovers (165 °F).
- Cook chicken to 165 °F, checked with a food thermometer, using separate boards for raw and ready-to-eat foods, and chill the leftovers within 2 hours.

Warm-up. Play “Which one is it?” Your adult reads each of these, and you say Clean, Separate, Cook or Chill: washing a cutting board; putting raw chicken on the bottom shelf of the fridge; checking a hamburger with a thermometer; packing leftover soup into the fridge; washing your hands; using a clean plate for cooked meat.

WATCH

The Importance of Cooking to a Safe Internal Temperature and How to Use a Food Thermometer

USDAFoodSafety · 3:17

<https://www.youtube.com/watch?v=-2KkV2yFiN0>

WHEN TO WATCH

Before you cook the chicken. Watch where each cook puts the thermometer.

Note: From the USDA Food Safety and Inspection Service. The grilling scenes show adults at the grill, as in this course.

BACKUP VIDEO

Food Safety & Hygiene for Kids! | Food Safety for Kids

Twinkl Educational Publishing · 4:15

<https://www.youtube.com/watch?v=mZlUTUBPnnw>

KEY TERMS

cross-contamination

When germs from one food, usually raw meat, poultry, seafood or eggs, get onto another food, often by way of hands, knives, boards or plates.

perishable

Food that spoils quickly unless it is kept cold, such as meat, dairy, eggs, cooked food and cut fruit.

shallow container

A wide, low container, about 2 inches deep or less, that lets leftovers cool quickly in the refrigerator.

safe minimum internal temperature

The lowest temperature the inside of a food must reach to destroy harmful germs, such as 165 °F for chicken.

ready-to-eat food

Food that will not be cooked again before eating, such as bread, cheese, fruit, salad and cooked meat.

CORE IDEAS

The story. By the 1990s food scientists knew a great deal about keeping food safe, but most families had never heard the rules, and they were long and hard to remember. In 1997 leaders from government agencies, the food industry and consumer groups in the United States agreed to work together, forming the Partnership for Food Safety Education. Soon afterward they launched a campaign called *Fight BAC!*, with a cartoon green germ named BAC (short for bacteria) as the villain. The USDA, the FDA and the CDC still teach its message.

How they figured it out. The experts looked at what most often went wrong in home kitchens when people got sick from food: hands and boards not washed, raw meat juices dripping onto other food, meat not cooked hot enough inside, and food left out too long. They boiled all of it down to four short words that even a child could remember: **Clean, Separate, Cook, Chill**. Short, clear rules that people actually use protect more families than long, perfect rules that nobody remembers.

The kitchen science. **Clean:** wash hands, boards, knives and counters with hot, soapy water before and after handling food, and rinse produce. **Separate:** keep raw meat, poultry, seafood and eggs away from ready-to-eat food, in the cart, the fridge (raw meat on the bottom shelf) and on the counter; use one board for raw meat and

another for everything else, and never put cooked food on a plate that held raw meat. Do not wash raw chicken: the splashing water spreads germs around the sink. **Cook:** you cannot tell by color whether meat is done, so use a food thermometer in the thickest part. Poultry must reach 165 °F (74 °C); ground beef and pork 160 °F (71 °C); egg dishes 160 °F; whole cuts of beef, pork and lamb and fish 145 °F (63 °C), with a 3-minute rest for the meat; and leftovers are reheated to 165 °F. **Chill:** refrigerate perishable food within 2 hours (1 hour above 90 °F), in shallow containers so it cools quickly.

Let's cook. You will make chicken quesadillas and use all four steps on purpose: clean hands and boards, a separate board and plate for the raw chicken, chicken cooked to 165 °F and checked with a thermometer, and leftovers chilled in time. Your one skill: placing the thermometer correctly, sideways into the thickest part of the chicken.

PICTURE STUDY



Kitchen Scene with Christ in the House of Martha and Mary, Diego Velázquez, 1618 · Oil on canvas ·
National Gallery, London

Image: [Wikimedia Commons](#), public domain

The Spanish painter Diego Velázquez was only about nineteen when he painted this kitchen. In front, a young cook pounds garlic in a mortar while an older woman seems to give her advice. Through an opening in the wall we see the story from Luke 10: Mary sits listening at Jesus' feet while Martha, busy with the serving, stands nearby. Serving is good work, and so is sitting at Jesus' feet.

Look closely

- Find the four fish on the plate. Are they raw or cooked? How can you tell?
- Find the two eggs and the garlic. Which foods on this table would need to be kept apart from ready-to-eat food?
- Find the brass mortar and pestle. What is the young cook doing with them?
- Find the opening in the back wall. Who do you see there?

Talk about it

1. This kitchen had no refrigerator. How do you think cooks in 1618 kept fish and eggs from spoiling? (Think about buying them fresh each day and cooking them soon.)
2. If this cook had only one board and one knife, what would she need to do between cutting the raw fish and chopping the garlic for a salad?

3. The young cook looks unhappy, perhaps because she is very busy. What do Martha and Mary teach us about the work of serving a meal?

Safety first. Use one cutting board and plate only for the raw chicken, and wash your hands, the board and the knife in hot, soapy water right after touching raw meat. An adult stands beside you at the stove, the pan handle is turned in, and the chicken must reach 165 °F before it is eaten.

KITCHEN PROJECT

The Four Steps on Purpose: Chicken Quesadillas

Today you will cook a whole meal while saying each food-safety step out loud as you do it, the way a pilot reads a checklist. You will check the chicken with a thermometer, keep raw and ready-to-eat food apart, and chill the leftovers on time.

You will need

- Two cutting boards (one marked for raw meat) and a damp towel for under each
- A small knife, a large skillet, a wide spatula, tongs and an instant-read food thermometer
- Two plates (one for raw chicken, one clean plate for cooked chicken), two forks, a pizza cutter
- Measuring spoons and cups, a small bowl, shallow containers with lids for leftovers, paper towels and hot, soapy water

CHICKEN QUESADILLAS

Serves 4 (8 quesadillas) · Prep 15 min · Cook 30 min

Ingredients

- 1 pound (450 g) thin-sliced boneless, skinless chicken breast cutlets
- 1 teaspoon chili powder
- ½ teaspoon ground cumin
- ½ teaspoon garlic powder
- ½ teaspoon salt
- 1 tablespoon olive oil or vegetable oil, plus a little more for the pan
- 8 flour tortillas (8-inch)
- 2 cups (8 ounces / 225 g) grated Monterey Jack or cheddar cheese
- Salsa and sour cream for serving (optional)

Method

1. **Clean.** Wash your hands and wipe the counter. Set out the raw-meat board and the raw-chicken plate on one side and the clean board and clean plate on the other.
2. **Separate.** Mix the chili powder, cumin, garlic powder and salt in a small bowl. Lay the chicken on the raw-meat plate straight from the package (do not rinse it) and sprinkle the spice mix over both sides using a fork. Wash your hands right away.
3. **Cook.** With an adult beside you, heat 1 tablespoon oil in the skillet over medium heat, handle turned in. Use tongs to lay the chicken in the pan. Cook 4–5 minutes, until golden underneath, then turn it with the tongs and cook 3–5 minutes more.
4. Push the thermometer probe sideways into the thickest part of the thickest piece. When it reads 165 °F (74 °C), lift the chicken onto the clean plate with clean tongs or a clean fork. Put the raw-meat plate and board straight into the sink.
5. Let the chicken rest 5 minutes, then chop it into small pieces on the clean board.
6. Wipe the skillet with a paper towel (an adult can help, since it is hot) and return it to medium-low heat with a few drops of oil. Lay one tortilla in the pan, sprinkle ¼ cup cheese over half, add a spoonful of chicken, and fold the empty half over.
7. Cook 2–3 minutes until the bottom is golden, then turn it carefully with the wide spatula and cook 1–2 minutes more until the cheese melts. Move it to the clean board, let it cool 1 minute, and cut it into wedges with the pizza cutter. Repeat with the rest.
8. **Chill.** Serve with salsa and sour cream. Within 2 hours, put leftover chicken and quesadillas into shallow containers in the refrigerator. Reheat leftovers to 165 °F.

Allergy check: Contains wheat (flour tortillas) and milk (cheese, sour cream). For wheat-free quesadillas, use corn tortillas; for milk-free, use a dairy-free grated cheese or fill them with chicken, beans and salsa.

Steps

1. Before you start, make a four-column chart in your notebook headed Clean, Separate, Cook, Chill. Each time you do one of the steps while cooking, say it

aloud and make a tally mark in its column.

2. Cook the quesadillas from the recipe card. Each time you check the chicken with the thermometer, write down the time and the temperature. How many minutes did it take to go from the first reading to 165 °F?
3. **Color is not enough.** Before the chicken reaches 165 °F, ask your adult to cut one piece open. Does it look done? Compare what you see with the thermometer's reading.
4. Clean up the raw-meat board, plate, knife, tongs and sink first, with hot, soapy water. Then wash everything else, wipe the counter and the faucet handles, and dry your hands on a clean towel.
5. Put the leftovers away and record the time. Was it within 2 hours of when the chicken came off the stove?
6. **Improve it.** Add a vegetable next time, such as sautéed bell peppers or a handful of baby spinach inside the quesadilla, and see whether the family likes it better.

Tips

- Thin-sliced chicken cutlets cook quickly and evenly. If you only have thick breasts, ask an adult to cut them in half through the middle to make them thinner.
- Keep the heat at medium. If the outside of the chicken browns too fast, the inside may not be cooked yet; turn the heat down a little.
- A tortilla that is too full is hard to flip. Use a little less filling than you think.

Check your work

- ☐ I can name the four steps and give an example of each from today's cooking.
- ☐ I cooked the chicken to 165 °F and checked it with a thermometer in the thickest part.
- ☐ I kept raw chicken on its own board and plate and washed them first, and I chilled the leftovers within 2 hours.

COOK'S NOTEBOOK

1. Draw a refrigerator with its shelves and show where each food should go: raw meat on the bottom shelf in a container, ready-to-eat foods above. Label your drawing.

2. Copy the safe-temperature list into your notebook as a chart: chicken 165 °F, ground meat 160 °F, egg dishes 160 °F, whole cuts and fish 145 °F, leftovers 165 °F.
3. Write the recipe in your own words, and record your thermometer readings and times in a table.

From history. Before thermometers were common in home kitchens, cooks went by the look and feel of food, and cookbooks said to cook meat “until done.” The USDA now recommends using a food thermometer every time you cook meat, poultry, seafood or egg dishes. Instant-read digital thermometers, which give a reading in a few seconds, became common and inexpensive in the 2000s.

COMMON MISTAKES

- Rinsing raw chicken in the sink. It spreads germs onto the sink, counter and nearby food. Cooking to 165 °F is what makes chicken safe.
- Putting cooked meat back on the plate that held it raw.
- Judging doneness by color. Only a thermometer tells you whether the inside is hot enough.
- Putting a big, deep pot of hot leftovers in the refrigerator. Divide it into shallow containers so it cools quickly.

Make it a game • Four Steps, Four Corners. Label the four corners of a room Clean, Separate, Cook and Chill. Your parent calls out a kitchen action, like washing a board or cooling soup, and you walk to the right corner and say why. Then your parent names a food and you give its safe temperature: chicken, ground meat, fish, or leftovers. Keep score.

KITCHEN & FOOD SAFETY

Every good cook is first a safe cook. Before you make a single dish this year, you will learn the habits that keep a family well: clean hands, clean food and clean tools; a knife held the right way; and cold food kept cold and hot food cooked hot. You will meet Ignaz Semmelweis, the doctor who asked his students to wash their hands in 1847, and Auguste Escoffier, the French chef who organized his kitchen so that every cook knew his station and every tool had its place.

Then you will follow Louis Pasteur as he proved that the tiny living things that spoil food come from other tiny living things, and you will learn the four steps that food scientists teach every family today: Clean, Separate, Cook, Chill. Along the way you will make a rainbow fruit salad, vegetable sticks with a yogurt dip, egg-salad sandwiches and chicken quesadillas checked with a thermometer. Safety is not a list of rules to be afraid of. It is a way of loving the people you feed.

PREREQUISITES

- Can read a simple recipe aloud and follow numbered steps with an adult
- Can read the numbers on a dial or digital thermometer
- Knows to ask an adult before using a knife, the stove, the oven or the microwave

MASTERY CHECKLIST

- ☐ I can wash my hands the right way for at least 20 seconds and tell when cooks must wash.
- ☐ I can use a small knife with the claw and bridge grips, with an adult beside me, on a board that does not slide.
- ☐ I can explain the temperature danger zone (40–140 °F) and the 2-hour rule.
- ☐ I can name the four steps, Clean, Separate, Cook, Chill, and show each one in my own kitchen.
- ☐ I can use a food thermometer to check that chicken reached 165 °F and that the refrigerator is at or below 40 °F.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **Fight BAC! (Partnership for Food Safety Education):** Free. Printable Clean, Separate, Cook, Chill posters, games and family activity sheets. Good for the unit challenge poster.
- **FoodSafety.gov: Safe Minimum Internal Temperatures chart:** Free. Search “FoodSafety.gov safe minimum internal temperatures” and print the chart to tape inside a cupboard door for Lessons 1.3–1.4 and the rest of the year.
- **An instant-read food thermometer and a refrigerator thermometer:** Inexpensive tools sold in most grocery and hardware stores. A digital instant-read thermometer is the easiest to read.
- **America’s Test Kitchen Kids:** Free recipes, kitchen-skills videos and experiments for young cooks from the America’s Test Kitchen team, and their cookbook *The Complete Cookbook for Young Chefs*.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

1.1 Ignaz Semmelweis and Clean Hands	2 sessions of 45–60 minutes
1.2 Knife Skills: The Claw and the Bridge	2 sessions of 45–60 minutes
1.3 Louis Pasteur and the Germs That Grow	2 sessions of 45–60 minutes
1.4 Clean, Separate, Cook, Chill	2 sessions of 45–60 minutes

UNIT 1 REVIEW

Answer each question in complete sentences unless it asks for a number or a list. The review is worth 50 points.

1. **5 pts**

What did Ignaz Semmelweis notice about the two clinics in his hospital, and what did he do about it in 1847?

2. (5 pts)

List the five handwashing steps and tell how long to scrub.

3. (5 pts)

Explain the claw grip and the bridge grip. Which would you use to cut a bell pepper in half, and which to cut it into strips?

4. (5 pts)

Why is a dull knife more dangerous than a sharp one?

5. (5 pts)

Describe Pasteur's swan-necked flask experiment and what it proved.

6. (5 pts)

What is the temperature danger zone, and what is the 2-hour rule?

7. (5 pts)

Predict: you leave one bowl of egg salad on the counter for 4 hours and keep another in the refrigerator. Will they look and smell different? Which one is safe to eat, and why?

8. (5 pts)

Name the four steps of food safety and give one example of each.

9. (5 pts)

Give the safe minimum internal temperature for each: chicken, ground beef, a pork chop or salmon fillet, and reheated leftovers.

10. (5 pts)

Why should you never wash raw chicken in the sink?

ANSWER KEY

1. Far more mothers became sick in the clinic where doctors came straight from the laboratory without washing than in the midwives' clinic. He made every doctor and student scrub their hands in chlorinated lime (bleach water) before examining a mother, and far fewer mothers became sick.
2. Wet, lather with soap, scrub, rinse, dry. Scrub for at least 20 seconds, including the backs of the hands, between fingers, thumbs and under nails.
3. Claw: fingertips curled under, the side of the knife against the knuckles. Bridge: hand arched over the food, cutting down through the arch. Use the bridge to cut the pepper in half and the claw to cut it into strips.
4. A dull knife needs more force, so it is more likely to slip off the food and cut the cook.
5. He boiled broth in flasks with long S-shaped necks. Air could get in, but dust and microbes were trapped in the bend, and the broth stayed clear. When the neck was broken off, the broth soon spoiled. Microbes come from other microbes, not from nothing.
6. 40–140 °F (4–60 °C), where bacteria grow fastest. Perishable food must go back in the refrigerator within 2 hours, or within 1 hour if it is above 90 °F.
7. They will probably look and smell the same, but only the refrigerated one is safe. Bacteria could have multiplied in the bowl left in the danger zone, and the bacteria that make people sick usually do not change the smell or look of food.
8. Clean (wash hands and boards), Separate (raw meat on its own board and on the bottom shelf), Cook (chicken to 165 °F checked with a thermometer), Chill (leftovers in the refrigerator within 2 hours). Other good examples accepted.
9. Chicken 165 °F; ground beef 160 °F; pork chop or fish 145 °F (the pork with a 3-minute rest); leftovers 165 °F.
10. Splashing water spreads germs from the chicken onto the sink, counter, hands and nearby foods. Cooking the chicken to 165 °F is what destroys the germs.

UNIT CHALLENGE: FAMILY KITCHEN SAFETY INSPECTION

Inspect your family's kitchen like a health inspector, with an adult as your partner. Make a checklist with at least three items for each of the four steps (for example: soap and a clean towel by the sink; a separate board for raw meat; a food thermometer in the drawer; raw meat on the bottom shelf; the refrigerator at or below 40 °F).

Measure and record the refrigerator and freezer temperatures with a thermometer. Mark each checklist item as “yes” or “needs work,” and fix at least one “needs work” item with your family. Finish with a colorful hand-washing poster showing the five steps and the 20-second rule, and hang it by the kitchen sink.

LOOK FOR	WHAT IT MEANS
Complete checklist	At least three items for each of Clean, Separate, Cook and Chill, each marked honestly.
Thermometer readings	Refrigerator and freezer temperatures measured correctly, recorded with the date, and compared with 40 °F and 0 °F.
One fix	At least one problem found and fixed with the family, with a sentence about what changed.
Hand-washing poster	Shows all five steps and the 20-second rule clearly enough for a younger child to follow.
Effort and care	Neat, careful work, done with a helpful attitude toward the family.

UNIT 2

FOOD GROUPS & THE BALANCED MEAL

God has filled the world with good things to eat: grain in the field, fruit on the tree, milk from the cow and fish in the sea. No single food gives the body everything it needs, so a wise cook puts different kinds of food together. In this unit you will learn how people in the United States have taught families to build balanced meals, from the colorful wartime “Basic Seven” wheel of 1943 to the Food Guide Pyramid and the MyPlate picture of 2011, and what each food group gives your body.

You will look closely at a grain of wheat and find out what the roller mills of the 1870s took away and what whole grains keep. You will meet Gail Borden, who found a way to keep milk from spoiling, and read the bread recipe God gave Ezekiel, made of grains and beans together. Finally you will learn the history of the lunch pail and pack balanced lunches that stay cold and safe until noon. Along the way you will make wraps, oatmeal, a bean-and-cheese skillet and a lunch box full of all five food groups.

PREREQUISITES

- Washes hands and uses Clean, Separate, Cook, Chill (Unit 1)
- Uses the claw and bridge grips with an adult beside (Lesson 1.2)
- Can read a measuring cup and add fractions such as $\frac{1}{2} + \frac{1}{4}$

MASTERY CHECKLIST

- ☐ I can name the five food groups and give three foods from each.
- ☐ I can tell what each food group gives the body.
- ☐ I can explain the difference between a whole grain and a refined grain and name the bran, germ and endosperm.
- ☐ I can tell how food guides changed from the Basic Seven (1943) to the Food Guide Pyramid (1992) to MyPlate (2011).
- ☐ I can plan and pack a balanced lunch that includes all five food groups and stays cold until lunchtime.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **MyPlate Kids’ resources (USDA):** Free. Search “MyPlate Kids” for the USDA’s printable plate, activity sheets and the Start Simple with MyPlate app, all for families.
- **Whole Grains Council:** Free. Pictures of the whole-grain kernel, a guide to reading labels for whole grains, and cooking times for oats, brown rice, barley and other grains. Useful for Lesson 2.2.
- **An insulated lunch bag and two small reusable ice packs:** Inexpensive. Used in Lesson 2.4 and the unit challenge to keep packed lunches cold until noon.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

2.1 From the Basic Seven to MyPlate

2 sessions of 45–60 minutes

2.2 Grains: Whole and Refined

2 sessions of 45–60 minutes

2.3 Protein and Dairy: Gail Borden’s Milk and Ezekiel’s Bread

2 sessions of 45–60 minutes

2.4 Packing a Balanced Lunch

2 sessions of 45–60 minutes

UNIT 2 REVIEW

Answer each question in complete sentences unless it asks for a list. The review is worth 50 points.

1. **5 pts**

Name the five MyPlate food groups and give two foods from each.

2. **5 pts**

Put these food guides in order from oldest to newest and give the year of each: MyPlate, the Basic Seven, the Food Guide Pyramid.

3. **5 pts**

What does each of these give the body: dairy, protein foods, fruits?

4. (5 pts)

Name the three parts of a grain kernel and tell which one white flour is made from.

5. (5 pts)

How did roller mills in the 1870s change bread in America, and what was lost?

6. (5 pts)

Predict: you cook a pot of oatmeal on high heat without stirring. What will happen, and what should you do instead?

7. (5 pts)

How did Gail Borden boil the water out of milk without scorching it?

8. (5 pts)

What is protein for, and why do grains and beans go well together?

9. (5 pts)

What does the USDA recommend for keeping a packed lunch safe until noon?

10. (5 pts)

Plan a balanced lunch that includes all five food groups. Label each food's group.

ANSWER KEY

1. Fruits (apples, oranges), vegetables (carrots, spinach), grains (bread, rice), protein foods (chicken, beans), dairy (milk, yogurt). Other correct foods accepted.
2. Basic Seven (1943), Food Guide Pyramid (1992), MyPlate (2011).
3. Dairy: calcium, vitamin D and protein for bones and teeth. Protein foods: protein to build and repair the body, plus iron and zinc. Fruits: vitamin C, potassium and fiber.
4. Bran, germ and endosperm. White flour is made from the endosperm.
5. Rollers cracked the wheat gently so the bran and germ could be sifted away, making fine white flour cheap. Much of the fiber, vitamins and iron in the bran and germ were lost (some B vitamins and iron were later added back by enrichment).
6. It will stick, scorch on the bottom and spatter. Cook it on medium-low and stir every minute or so.
7. He heated it in a vacuum pan with much of the air pumped out. With less air pressure, the milk's water boiled away at a lower temperature, so it did not scorch.
8. Protein builds and repairs the body. Grains and beans each run low on different amino acids, so together (in the same meal or the same day) they give all nine the body needs from food.
9. An insulated lunch bag with at least two cold sources (ice packs or a frozen water bottle), packed with cold food straight from the refrigerator.
10. Answers will vary. Example: whole-wheat crackers (grain), turkey roll-ups (protein), cheese stick (dairy), baby carrots (vegetable), clementine (fruit).

UNIT CHALLENGE: THREE BALANCED LUNCHES

Plan, pack and photograph three balanced lunches in one week, for yourself or a family member. Plan each lunch on paper first, using all five food groups and no two lunches exactly alike. Pack each one with an insulated bag and two cold sources.

For each lunch, make a MyPlate check: draw a plate, write each food in its group, and note the temperature of one cold food at lunchtime. At the end of the week, write a short paragraph about which lunch was the family favorite and what you would change.

LOOK FOR	WHAT IT MEANS
Balanced plans	Each of the three lunches includes all five food groups, planned on paper before packing.
Food safety	Each lunch was packed with two cold sources, and at least one lunchtime temperature was recorded for each.
Variety	The three lunches use different foods, including at least two different vegetables and two different proteins.
Record-keeping	Photos or sketches, MyPlate checks and a closing paragraph are neat and complete.
Effort and improvement	The student packed the lunches carefully, cleaned up each time, and made a thoughtful change based on what was learned.

2.1 FROM THE BASIC SEVEN TO MYPLATE

OBJECTIVES

- Tell how the USDA's food guides changed from the Basic Seven (1943) to the Food Guide Pyramid (1992) to MyPlate (2011).
- Name the five food groups and tell what each one gives the body.
- Build a balanced wrap and plate that includes all five food groups.

Warm-up. Draw a circle on a piece of paper to stand for your plate. Draw what you ate for supper last night on it. Then, with a colored pencil, circle each food that came from a plant and, with another color, each food that came from an animal. What do you notice?

WATCH

Food Groups for Kids | Learn about the five food groups and their benefits

Learn Bright • 7:47

<https://www.youtube.com/watch?v=pmgkj01uUTw>

WHEN TO WATCH

After the story of the food guides. Make a list of the foods named for each group.

Note: Learn Bright notes one small slip about broccoli and steak in its description. Use the MyPlate plate picture in this lesson for amounts rather than the video's serving numbers.

KEY TERMS

food group

A set of foods that give the body similar nutrients, such as the fruit group or the dairy group.

nutrient

A substance in food that the body needs to grow, move, heal and stay well, such as protein, vitamins, minerals, carbohydrates, fats and water.

MyPlate

The picture of a plate divided into fruits, vegetables, grains and protein, with a cup of dairy beside it, introduced by the USDA in 2011.

vitamin

A nutrient the body needs in small amounts to work properly, such as vitamin C for healing and vitamin A for eyesight.

balanced meal

A meal that includes foods from several food groups, so that together they give the body what it needs.

CORE IDEAS

The story. In 1943, during the Second World War, much food in the United States was rationed so that soldiers and sailors could be fed. Families had to make careful choices, and the government wanted to help them stay strong on what they had. So the U.S. Department of Agriculture (USDA) printed a bright poster shaped like a wheel, with seven colored slices, called the **Basic Seven**. Each slice was a food group: green and yellow vegetables; oranges, tomatoes and grapefruit; potatoes and other fruits and vegetables; milk and milk products; meat, poultry, fish, eggs, dried beans and nuts; bread, flour and cereals; and butter and fortified margarine. The poster said to eat some food from each group every day.

How they figured it out. Food guides are only as good as what scientists know about nutrients, and that knowledge kept growing. Vitamins had been discovered only a few decades before 1943. Seven groups proved hard to remember, so in 1956 the USDA cut them to the **Basic Four**: milk, meat, fruits and vegetables, and breads and cereals. In 1992 it introduced the **Food Guide Pyramid**, with grains along the wide bottom and sweets and fats in the small tip at the top. In 2011 it replaced the pyramid with **MyPlate**, a simple picture of a dinner plate, because a plate is something every family already looks at three times a day. Food guides are reviewed every five years as scientists learn more, but the idea has stayed the same since 1943: eat a variety of foods from every group.

The kitchen science. Each group gives the body something different. **Fruits** give vitamin C (for healing and healthy gums), potassium and fiber. **Vegetables** give vitamins A and C, potassium, folate and fiber; dark green and orange ones are especially rich. **Grains** (bread, rice, oats, pasta, tortillas) give carbohydrates, the

body's main fuel, plus B vitamins and, if they are whole grains, fiber. **Protein foods** (meat, poultry, fish, eggs, beans, peas, lentils, nuts, seeds and soy) give protein to build and repair muscles and every other part of the body, plus iron and zinc. **Dairy** (milk, yogurt, cheese) gives calcium and vitamin D for bones and teeth, and protein. The body also needs small amounts of healthy fats, like those in olive oil, nuts and fish.

Let's cook. MyPlate shows a plate about half filled with fruits and vegetables, a little more than a quarter with grains, a little less than a quarter with protein, and a cup of dairy on the side. You will make build-your-own wraps with something from every group and check each family member's plate against MyPlate. Your one skill: preparing several fillings in small bowls, mise en place, so everyone can build their own.

PICTURE STUDY



For Health... Eat Some Food from Each Group... Every Day! (The Basic Seven), U.S. Department of Agriculture, 1943 · Printed poster · U.S. Department of Agriculture

Image: [Wikimedia Commons](#), public domain

This poster was printed by the USDA during the Second World War, when many foods were rationed. It turned the science of nutrition into a simple, colorful wheel that a family could hang in the kitchen.

Look closely

- Count the slices of the wheel. Read the name of each group.
- Find the three groups that are all fruits and vegetables. How are they divided?
- Find the group with meat, poultry, fish and eggs. What other foods are in it? (Look for dried beans and nuts.)
- Read the words at the bottom of the poster. What does it say you may eat “in addition to the Basic 7”?

Talk about it

1. Which of the seven groups match today’s five MyPlate groups? Which group from 1943 is not a MyPlate group today?
2. Why do you think a round wheel, a pyramid and a plate were each chosen to teach families? Which do you think is easiest to remember?

3. Look at the family in the center. Why would a country at war care so much about whether its families were eating well?

Safety first. Wash your hands and the vegetables before you start, and use the small knife only with an adult right beside you. Check every filling for food allergies before the family builds their wraps, and put the deli meat and cheese back in the refrigerator within 2 hours.

KITCHEN PROJECT

A Five-Group Wrap Bar

You will set out a “wrap bar” with a choice from each of the five food groups and let every family member build a wrap and a plate. Then you will check each plate against MyPlate and see which groups were easy to fill and which were forgotten.

You will need

- A cutting board with a damp towel underneath, a small knife, a vegetable peeler and a box grater
- Small bowls or a muffin tin for fillings, spoons and a platter
- Plates for each family member, toothpicks (optional), paper and colored pencils

BUILD-YOUR-OWN BALANCED WRAPS

Serves 4 • Prep 25 min

Ingredients

- Grains: 4 large whole-wheat tortillas (10-inch)
- Protein: 8 ounces (225 g) sliced turkey or chicken, or 1 can (15 ounces) black beans, rinsed and drained, or ½ cup hummus
- Dairy: 4 slices cheddar or Swiss cheese, or ½ cup grated cheese
- Vegetables: 2 cups chopped lettuce or baby spinach, 1 large carrot (grated), ½ cucumber (cut into thin sticks), 1 bell pepper (cut into strips)
- Fruit: 2 apples (sliced) or 2 cups grapes, to serve alongside
- Optional: 2 tablespoons ranch dressing, plain yogurt or mustard for spreading

Method

1. Wash your hands. Rinse the vegetables and fruit under running water and pat them dry.
2. With an adult right beside you, grate the carrot on the large holes of a box grater, keeping your fingers away from the bottom of the carrot

(stop when it gets short). Cut the cucumber and pepper into thin sticks with the claw grip.

3. Put each filling in its own small bowl and set them out in a row in MyPlate order: grains, protein, dairy, vegetables, then fruit.
4. To build a wrap: lay a tortilla flat, spread a thin line of dressing or mustard across the middle if you like, add protein and cheese, then pile on a big handful of vegetables.
5. Fold the bottom edge up over the filling, fold in both sides, and roll it up tightly. Cut it in half on the diagonal with an adult beside you, and hold it closed with a toothpick if needed.
6. Serve with apple slices or grapes and a glass of milk or a cup of yogurt.
7. Return the meat, cheese and dressing to the refrigerator within 2 hours.

Allergy check: Contains wheat (tortillas) and milk (cheese, yogurt, ranch). Hummus contains sesame. Some deli meats contain milk or soy; check the label. Use corn or gluten-free tortillas for wheat-free wraps and leave off the cheese for milk-free.

Steps

1. Before cooking, draw a large MyPlate in your notebook: a circle divided into fruits, vegetables, grains and protein, with a small circle beside it for dairy.
2. Set up the wrap bar from the recipe card. Make a small card for each bowl naming its food group.
3. Let each family member build a wrap and a plate. Before they eat, take a photo or make a quick sketch of each plate.
4. **Plate check.** For each plate, list which of the five groups it has. Which group was most often forgotten? Which was most often piled high?
5. Clean up: put the cold foods back in the refrigerator, wash the board, knife and bowls, and wipe the counter.
6. **Improve it.** Make the wrap bar again for another lunch and add one new vegetable the family has not tried in a wrap. Did the plates look more balanced the second time?

Tips

- Warm the tortillas for 10–15 seconds in the microwave (with an adult nearby) so they fold without cracking.

- Don't overfill the wrap. A few spoonfuls of each filling are plenty, or it will not roll.
- Put the wettest fillings, like tomatoes or dressing, in the middle, wrapped in lettuce, so the tortilla does not get soggy.

Check your work

- ☐ I can name the five food groups and give three foods from each.
- ☐ I can tell the story of the food guides from the Basic Seven to MyPlate.
- ☐ I built a wrap and a plate with all five groups and checked the family's plates against MyPlate.

COOK'S NOTEBOOK

1. Draw the Basic Seven wheel and MyPlate side by side and draw lines connecting the groups that match.
2. Make a chart with five columns, one for each food group. Under each, write what the group gives the body and list five foods your family eats from it.
3. Copy your wrap recipe in your own words and record the plate check: which groups each family member included.

From history. The first USDA food guide for families was written in 1916 by Caroline Hunt, a nutrition scientist, in a booklet called *Food for Young Children*. It sorted foods into five groups: milk and meat; cereals; vegetables and fruits; fats and fatty foods; and sugars and sugary foods. Every guide since then has kept her basic idea of sorting foods into groups.

COMMON MISTAKES

- Thinking a food is “good” or “bad.” Foods are everyday foods or sometimes foods; what matters is the variety and balance over the whole day.
- Counting potatoes and corn chips as a full serving of vegetables every day. Aim for many colors of vegetables, especially dark green and orange ones.
- Forgetting that beans, peas and lentils are protein foods as well as vegetables.
- Thinking you must eat every group at every meal. MyPlate is a guide for the whole day; a snack can fill in a missing group.

Make it a game • Food Guide Timeline. Write Basic Seven, Pyramid and MyPlate on three slips with their years, then shuffle them. Race to put them in order from memory. Next, draw a plate with five groups and tell what each group gives the body. Your parent names one food and you answer instantly which group it belongs to.

Scripture. “He causeth the grass to grow for the cattle, and herb for the service of man: that he may bring forth food out of the earth” (Psalm 104:14, KJV)

Every food group comes in the end from God’s gift of growing things: grain, vegetables and fruit from the earth, and milk and meat from animals that eat the grass.

2.2 GRAINS: WHOLE AND REFINED

OBJECTIVES

- Name the three parts of a grain kernel, the bran, germ and endosperm, and tell what each gives.
- Explain how roller mills in the 1870s made white flour cheap, and what refining removes.
- Cook a pot of oatmeal and run a blind taste test of whole-wheat and white bread.

Warm-up. Hunt through your pantry with an adult for grain foods: bread, rice, oats, pasta, cereal, crackers, tortillas, popcorn. Make a list. Then read each label: does the first ingredient say “whole” (like “whole wheat flour” or “whole grain oats”)? Put a star next to the whole grains.

WATCH

Baked Bread: how flour is made

Eat Happy Project • 2:49

<https://www.youtube.com/watch?v=y8vLjPctrcU>

WHEN TO WATCH

After the story of the roller mills. Watch for the drawing of the bran, endosperm and germ.

Note: Filmed on an English farm and flour mill.

BACKUP VIDEO

What is a Whole Grain?

Columbia Dining • 1:38

<https://www.youtube.com/watch?v=zAcA9O10Jvc>

KEY TERMS

bran

The tough outer layers of a grain kernel, rich in fiber, B vitamins and minerals.

germ

The small part of the kernel that would sprout into a new plant; it holds healthy oils, vitamin E and B vitamins.

endosperm

The largest part of the kernel, mostly starch and some protein, which feeds the sprouting seed. White flour is ground from the endosperm.

whole grain

A grain food that keeps all three parts of the kernel: bran, germ and endosperm.

refined grain

A grain that has had the bran and germ removed, leaving only the endosperm, like white flour and white rice.

fiber

The part of plant foods the body cannot fully digest; it helps food move through the body and helps you feel full.

CORE IDEAS

The story. For thousands of years, people ground wheat between two heavy, flat millstones. The stones crushed the whole kernel, and the flour that came out held every part of the grain. Some of it could be sifted through cloth to make a lighter flour, but fine white flour was costly and was eaten mostly by the wealthy. Then, in the 1870s and 1880s, flour mills in Minneapolis, Minnesota, along the falls of the Mississippi River, began using an idea from Hungary: instead of stones, they cracked the wheat between pairs of steel or porcelain rollers, again and again, sifting after each pass. Minneapolis became the flour-milling capital of the world.

How they figured it out. The rollers did not smash the kernel all at once. They cracked it gently, so the tough bran came off in large flakes and the small, oily germ flattened out, and both could be sifted away. What remained was the white, starchy endosperm, ground fine. Roller-milled white flour was soft, made light, fluffy bread and kept longer on the shelf, because the oily germ that can go stale was gone. And it was cheap. Soon nearly everyone in America ate white bread. But millers and scientists later learned that much of the wheat's fiber, vitamins and iron had gone out with the bran and germ. Starting in 1941, white flour in the United States was *enriched*: some of the B vitamins and iron were added back.

The kitchen science. A grain kernel has three parts. The **bran** is the outer coat, rich in fiber, B vitamins and minerals. The **germ** is the tiny part that would sprout, full of healthy oils, vitamin E and B vitamins. The **endosperm** is the big starchy middle, the food supply for the sprout. A **whole grain** keeps all three; a **refined grain** keeps only the endosperm. Whole-grain foods have more fiber, which helps you feel full and keeps your digestion working well. MyPlate says to make at least half your grains

whole grains. Oats, brown rice, popcorn, whole-wheat bread and corn tortillas are all whole grains.

Let's cook. Rolled oats are whole oat kernels that have been steamed and pressed flat. You will cook a pot of oatmeal on the stove with an adult beside you and top it with fruit, then run a blind taste test of whole-wheat and white bread. Your one skill: stirring a pot safely, with the handle turned in and your face back from the steam.

PICTURE STUDY



The Gleaners, Jean-François Millet, 1857 · Oil on canvas · Musée d'Orsay, Paris

Image: [Wikimedia Commons](#), public domain

Jean-François Millet grew up on a farm in Normandy, France, and painted country people at work. Here three poor women are *gleaning*: after the harvest, they walk the field picking up the stalks of wheat the harvesters missed. The law of Moses told farmers to leave the gleanings for the poor (Leviticus 19:9-10), and that is how Ruth met Boaz.

Look closely

- Find the stalks of wheat in the women's hands. Where do you think the kernels are on each stalk?
- Find the great haystacks and the wagon far in the background. How is the harvest there different from the gleaning in front?
- Look at how the women are bending. How long do you think it would take to gather enough wheat for one loaf of bread?
- Find the woman on the right. What is she holding behind her back?

Talk about it

1. After gleaning, how would these women turn the wheat into bread? List every step you can think of, from stalk to loaf.
2. Their flour would have been ground between millstones. Would it have been whole grain or white? Why?

3. Why do you think God told farmers to leave some grain in the field for the poor?

Safety first. An adult stands beside you at the stove; keep the pot handle turned in and your face back when you stir, because oatmeal bubbles and spatters. Check the bread and toppings for allergies before the taste test.

Stovetop Oatmeal and the Blind Bread Test

You will cook a pot of whole-grain oatmeal for the family's breakfast, set out a topping bar of fruit, and then run a blind taste test: can your family tell whole-wheat bread from white bread with their eyes closed, and which do they prefer?

You will need

- A medium saucepan, a wooden spoon, measuring cups and spoons, a timer and bowls
- A cutting board with a damp towel underneath and a small knife for the fruit
- For the taste test: a plate, a blindfold or clean scarf, and paper for a tally chart

STOVETOP OATMEAL WITH FRUIT

Serves 4 • Cook 10 min

Ingredients

- 4 cups (950 mL) water or milk, or half of each
- 2 cups (180 g) old-fashioned rolled oats
- ¼ teaspoon salt
- ½ teaspoon ground cinnamon
- Toppings: 1 banana (sliced), 1 cup berries, 2 tablespoons maple syrup or brown sugar, a splash of milk
- For the taste test: 2 slices whole-wheat bread and 2 slices white bread

Method

1. Wash your hands. With an adult beside you, pour the water or milk into the saucepan, add the salt, and set it on the stove with the handle turned in.
2. Heat on medium-high until it just begins to bubble around the edges. (If you use milk, watch closely: milk boils over quickly.)
3. Stir in the oats and cinnamon. Turn the heat down to medium-low.

4. Cook for about 5 minutes, stirring every minute or so, until the oats are soft and most of the liquid is soaked up. Stand back from the bubbles and keep your face out of the steam.
5. Turn off the heat and let the oatmeal stand for 2 minutes; it will thicken as it cools a little.
6. While it stands, slice the banana with the claw grip, with an adult beside you, and rinse the berries.
7. Spoon the oatmeal into bowls and let each person add fruit, a little maple syrup or brown sugar, and a splash of milk.

Allergy check: Contains milk if made with milk. Oats are not wheat, but most oats are processed alongside wheat; families avoiding gluten should buy oats labeled gluten-free. The bread taste test contains wheat and may contain milk, eggs, soy or sesame; check the labels.

Steps

1. **Look at a kernel.** If you have whole oats, wheat berries or brown rice, look at a few kernels with a magnifying glass. Draw one and label where the bran, germ and endosperm are.
2. Cook the oatmeal from the recipe card. Time it, and write down how the oats change: what they look like at 1 minute, 3 minutes and 5 minutes.
3. **Blind bread test.** Cut each slice of bread into four squares and remove the crusts so color does not give it away. Blindfold each taster and give them one whole-wheat square and one white square in a random order. Ask: Which is which? Which do you like better? Why?
4. Record the results in a tally chart. How many guessed correctly? What words did they use for the whole-wheat bread (nutty, chewy, hearty) and for the white bread (soft, sweet, plain)?
5. Clean up: soak the oatmeal pot in warm water right away (dried oatmeal is hard to scrub), then wash it with the bowls and spoons, and wipe the stove and counter.
6. **Improve it.** Cook oatmeal again another morning with a new topping, such as diced apple and cinnamon cooked right in, or a spoonful of peanut butter, and ask the family to rate it against the first batch.

Tips

- Quick oats are cut smaller and cook in 1–2 minutes; steel-cut oats are chopped whole kernels and take 20–30 minutes. All three are whole grain.
- For thicker oatmeal use a little less liquid; for creamier oatmeal use part milk.
- Many people need to taste whole-wheat bread several times before they like it as much as white. Taste buds change, as you will learn in Unit 3.

Check your work

- ☐ I can name and draw the bran, germ and endosperm and tell what each gives.
- ☐ I can explain how roller mills made white flour cheap and what was lost.
- ☐ I cooked oatmeal safely at the stove and ran a fair blind taste test.

COOK'S NOTEBOOK

1. Draw a large wheat kernel cut in half and label the bran, germ and endosperm, with one sentence about what each gives.
2. Draw two pictures: wheat being ground between millstones, and wheat passing between steel rollers. Write what comes out of each.
3. Record your blind bread test in a chart and write the recipe for your favorite oatmeal topping.

From history. One of the great Minneapolis mills, the Washburn A Mill, was rebuilt in 1880 with roller-milling machinery and became one of the largest flour mills in the world. Its ruins are now part of the Mill City Museum in Minneapolis, where visitors can learn how flour was milled.

COMMON MISTAKES

- Thinking brown bread is always whole grain. Some brown breads are colored with molasses; read the label for the word “whole” first.
- Thinking “multigrain” or “wheat bread” means whole grain. Multigrain means several grains, which may all be refined.
- Turning the heat up high to cook oatmeal faster. It sticks to the pot and spatters; medium-low and stirring work best.

Make it a game • Kernel Cutaway. Draw a big wheat kernel on paper and label the bran, germ and endosperm. Cover the labels with sticky notes. Your parent points to a part and you tell what it gives: fiber, vitamins, or starch. Then tell what roller mills did in the 1870s and name the difference between a whole grain and a refined one.

Scripture. “Give us this day our daily bread.” (Matthew 6:11, KJV)

Jesus taught us to ask our Father for bread, the most ordinary grain food of all, and so to remember every day that our food is His gift.

2.3 PROTEIN AND DAIRY: GAIL BORDEN'S MILK AND EZEKIEL'S BREAD

OBJECTIVES

- Tell how Gail Borden found a way to keep milk from spoiling, and why milk and dairy foods matter for bones and teeth.
- Explain what protein does in the body, and how grains and beans eaten together give all the building blocks the body needs.
- Cook a black bean, corn and cheese skillet at the stove with an adult beside you.

Warm-up. Sort these foods into two piles, “protein foods” and “dairy”: eggs, cheese, peanut butter, yogurt, chicken, milk, black beans, tuna, almonds, tofu. Which food could go in both piles? (Hint: think about protein.) Which surprised you?

WATCH

What are proteins? - Healthy Eating for Kids

Smile and Learn - English · 3:17

https://www.youtube.com/watch?v=U-_uuU1i7oE

WHEN TO WATCH

Before you cook. Sort the animal and plant proteins as they appear on screen.

KEY TERMS

protein

A nutrient the body uses to build and repair muscles, skin, blood and every other part of the body.

amino acids

The small building blocks that proteins are made of. The body can make some of them, but nine must come from food.

calcium

A mineral that builds strong bones and teeth; milk, yogurt and cheese are rich in it.

condensed milk

Milk with much of its water boiled away and sugar added, so that it keeps for a long time in a sealed can.

legumes

Plants whose seeds grow in pods, such as beans, peas, lentils and peanuts; they are rich in protein and fiber.

CORE IDEAS

The story. Gail Borden was an inventor, surveyor and newspaper printer in Texas. In the 1800s, fresh milk was a problem in growing cities: there was no refrigeration, cows were often kept in crowded city stables, and milk spoiled within a day. Borden wanted to make milk that would keep. He had already invented a dried “meat biscuit” for travelers, which won a medal at the Great Exhibition in London in 1851, though it did not sell well. Now he turned to milk.

How he figured it out. Borden knew that boiling milk in an open pot scorched it and gave it a burnt taste. He borrowed an idea he had seen used by Shaker communities in New York, who boiled down fruit juice in a closed “vacuum pan” from which much of the air was pumped out. With less air pressure pressing down, liquid boils at a lower temperature (you will learn more about this in Lesson 4.2). Borden heated milk in a vacuum pan so that its water boiled away gently without scorching, then added sugar to help keep it. He also insisted that the cows, barns and cans be kept very clean. He received a patent in 1856. His first businesses failed, but he kept trying, and his canned condensed milk became famous, especially when the Union army bought it during the Civil War.

The kitchen science. **Protein** builds and repairs your body: muscles, skin, hair, blood and the tiny machines inside every cell. Proteins are made of about twenty kinds of building blocks called **amino acids**; your body can make some of them, but nine must come from food. Meat, fish, eggs and dairy have all nine in good amounts. Beans and grains each run a little low on different ones, but eaten together, or simply eaten at different meals on the same day, they fill in each other’s gaps. The bread God told the prophet Ezekiel to make was a mix of wheat, barley, beans, lentils and millet: grains and legumes together. **Dairy** foods give protein too, plus calcium and (in fortified milk) vitamin D, which build strong bones and teeth while you are growing.

Let’s cook. You will cook a skillet supper of black beans, corn, peppers and tomatoes topped with melted cheese and served with rice or corn tortillas: grains and legumes

together, plus dairy. Your one skill: sautéing chopped onion and pepper in a thin film of oil at the stove, stirring with a wooden spoon, with an adult beside you.

PICTURE STUDY



Woman Churning Butter, Jean-François Millet, 1855–56 · Etching · Metropolitan Museum of Art, New York

Image: [Wikimedia Commons](#), public domain

Millet made this etching, a print from lines scratched into a copper plate, of a farm woman making butter. Cream was poured into the tall wooden churn, and she pushed a wooden plunger called a dasher up and down, over and over, until the fat in the cream clumped together into butter.

Look closely

- Find the tall wooden churn and the long handle. Which way is she pushing it?
- Find the cat at her feet. Why might a cat like to stay close to the dairy?
- Look at the shelves behind her. What do you think is kept in the crocks and pans?
- Look at her arms and shoulders. Is churning easy or hard work?

Talk about it

1. Butter is made from cream, the fattiest part of milk. After the butter forms, a liquid is left behind, called buttermilk. What other foods are made from milk?
2. This farm had no refrigerator. How do you think the family kept milk and butter from spoiling? Why was Gail Borden's canned milk such a help to city

families?

3. Butter was one of the seven groups on the 1943 Basic Seven poster. Which MyPlate group does butter fit best in today, or does it belong with the fats?

Safety first. Use the small knife only with an adult right beside you, and cook at the stove with an adult beside you, the pan handle turned in. Use only a thin film of oil, and if oil ever catches fire, an adult covers the pan with a lid and turns off the heat; never use water.

KITCHEN PROJECT

Grains and Beans Together: A Skillet Supper

You will cook a one-pan black bean, corn and cheese skillet, serve it with rice or corn tortillas, and check the meal against MyPlate. Then you will try a little experiment with milk to see how the fat in cream behaves.

You will need

- A cutting board with a damp towel underneath and a small knife
- A large skillet (12-inch) with a lid, a wooden spoon, a can opener, a colander, measuring cups and spoons
- For the butter experiment: a small clean jar with a tight lid and ½ cup heavy cream (optional)

BLACK BEAN, CORN AND CHEESE SKILLET

Serves 4–6 • Prep 15 min • Cook 20 min

Ingredients

- 1 tablespoon olive oil or vegetable oil
- 1 small onion, chopped (about ¾ cup)
- 1 bell pepper, chopped
- 2 cans (15 ounces each) black beans, rinsed and drained
- 1 can (14.5 ounces) diced tomatoes, with their juice
- 1 cup (150 g) frozen corn
- 1 teaspoon ground cumin
- 1 teaspoon chili powder
- ½ teaspoon salt
- 1 cup (4 ounces / 115 g) grated cheddar or Monterey Jack cheese
- To serve: 3 cups cooked brown or white rice, or 8 warm corn tortillas; sliced avocado or plain yogurt (optional)

Method

1. Wash your hands and rinse the pepper. With an adult right beside you, cut the onion in half with the bridge grip, peel it, lay it flat side down,

and chop it with the claw grip. Chop the pepper the same way.

2. Open the beans and pour them into a colander. Rinse them under cold running water and let them drain.
3. With an adult beside you, heat the oil in the skillet over medium heat, handle turned in. Add the onion and pepper and cook, stirring every minute, for 5–6 minutes, until soft.
4. Stir in the cumin and chili powder and cook for 30 seconds, until fragrant.
5. Add the beans, tomatoes with their juice, corn and salt. Stir, and let it bubble gently for 8–10 minutes, stirring now and then, until slightly thickened.
6. Turn off the heat. Sprinkle the cheese over the top, cover with the lid and let it stand for 2–3 minutes until the cheese melts. Lift the lid away from you so the steam goes the other way.
7. Serve over rice or with warm corn tortillas, with avocado or a spoonful of yogurt on top. Refrigerate leftovers within 2 hours.

Allergy check: Contains milk (cheese, yogurt). For milk-free, leave off the cheese and top with avocado. Corn tortillas and rice contain no wheat; check that the spice blends have no added wheat.

Steps

1. Cook the skillet supper from the recipe card. Before you serve it, draw a MyPlate in your notebook and write each ingredient in the group it belongs to. Which groups are covered? What could you add to fill the empty one? (A glass of milk or a piece of fruit.)
2. **Grains and beans together.** Read Ezekiel 4:9 and list the grains and legumes in Ezekiel's bread. Which grain and which legume are in your skillet supper?
3. **Butter in a jar (optional).** Pour $\frac{1}{2}$ cup cold heavy cream into a small jar, close the lid tightly, and take turns shaking it hard. Time it. Write down what you see at 2, 5 and 10 minutes. When a lump of butter forms with liquid around it, pour off the buttermilk and taste a little butter on a cracker.
4. Ask the family to rate the skillet supper from 1 to 5 and to suggest one change.

5. Clean up: wash the skillet, board, knife and colander, wipe the stove and counter, and put leftovers in shallow containers in the refrigerator.
6. **Improve it.** Cook it again with the family's suggested change, such as a different bean, a squeeze of lime or more vegetables, and compare the ratings.

Tips

- Rinsing canned beans washes off the thick, salty liquid in the can.
- If the skillet looks dry, add a few tablespoons of water. If it looks soupy, let it bubble a few minutes longer with the lid off.
- The butter experiment works best with very cold cream and a jar no more than half full.

Check your work

- ☐ I can tell how Gail Borden made milk that would keep, and why dairy foods matter for growing bones.
- ☐ I can explain what protein does and why grains and beans go well together.
- ☐ I sautéed vegetables in a thin film of oil at the stove with an adult beside me.

COOK'S NOTEBOOK

1. Draw a vacuum pan and an open pot side by side, each heating milk. Label which one boils at a lower temperature and why Borden chose it.
2. List ten protein foods: five from animals and five from plants.
3. Copy your skillet recipe in your own words, draw the finished dish on a MyPlate, and record the family ratings.

From history. Gail Borden also helped lay out the city of Galveston, Texas, and published one of the first newspapers in Texas. Borden is often remembered for not giving up: his first condensed-milk factories failed before his company finally succeeded in 1858 with the help of a New York investor, Jeremiah Milbank.

COMMON MISTAKES

- Thinking protein comes only from meat. Beans, lentils, peas, nuts, seeds, eggs, dairy and soy are all protein foods.
- Thinking you must eat grains and beans in the very same bite. The body can put amino acids together from foods eaten through the day.

- Thinking cream cheese and butter are good sources of calcium. They are mostly fat; milk, yogurt and most cheeses give the calcium.

Make it a game · Milk Mystery Teach-Back. Be the teacher for five minutes. Explain to your parent how Gail Borden kept milk from spoiling, why dairy matters for bones and teeth, and what protein does. Draw a bean and a grain on paper to show how they team up. Your parent slips in one wrong fact. Spot it to win the round.

Scripture. “Take thou also unto thee wheat, and barley, and beans, and lentiles, and millet, and fitches, and put them in one vessel, and make thee bread thereof” (Ezekiel 4:9, KJV)

Ezekiel’s bread mixed grains and legumes in one loaf. Long before anyone knew about amino acids, it joined foods that work well together.

2.4 PACKING A BALANCED LUNCH

OBJECTIVES

- Tell how workers and schoolchildren carried their lunches, from the miner's dinner pail to the lunch box.
- Plan a lunch that includes all five food groups.
- Pack a lunch that stays safe, using an insulated bag and two cold sources.

Warm-up. Imagine you are packing a lunch to carry down into a mine at 6 o'clock in the morning, with no refrigerator, no microwave and no store nearby, and you will not eat until noon. What would you pack, and what would you carry it in? Write or draw your answer.

WATCH

USDA FOOD SAFETY ADVICE FOR PACKING LUNCHES

USDA · 1:32

<https://www.youtube.com/watch?v=5QtYk2uS0sc>

WHEN TO WATCH

After the kitchen science paragraph, before you plan your lunch. Count the cold sources used.

Note: A short USDA clip; a little older in style but clear.

KEY TERMS

dinner pail

A metal pail with a lid that factory workers and miners carried to work with their midday meal inside. In those days the midday meal was often called dinner.

insulated

Wrapped or lined with a material that slows the movement of heat, so cold things stay cold and hot things stay hot longer.

cold source

Something frozen or very cold, like an ice pack or a frozen water bottle, packed with food to keep it out of the danger zone.

bento

A Japanese packed meal arranged in a box with small sections, each holding a different food.

CORE IDEAS

The story. In the 1800s and early 1900s, millions of men, women and children worked long days in coal mines, copper mines, mills and factories, far from home. They carried their midday meal in a tin **dinner pail** with a tight lid. Some pails had stacked layers: a drink in the bottom, the main food in the middle, a piece of pie or fruit on top. Miners from Cornwall, in England, were famous for the *pasty*, a folded pie of meat, potato and turnip baked inside a sturdy crust, easy to carry and eat by hand. When Cornish miners came to work in the mines of Michigan, Wisconsin and Pennsylvania, they brought the *pasty* with them, and it is still sold there today.

How they figured it out. Schoolchildren carried their lunches too, often in a tin pail or a cloth tied around bread and cheese. In 1935 a company made a children's lunch kit printed with a cartoon mouse, and in 1950 a metal lunch box decorated with a cowboy television hero, Hopalong Cassidy, sold hundreds of thousands of copies. Lunch boxes became something children chose with delight. Meanwhile, many schools began serving hot lunches, and in 1946 the National School Lunch Act set up the school lunch program that still feeds millions of children today. Whether lunch comes from home or the school kitchen, the same questions matter: Does it give the body what it needs? Will it stay safe until noon?

The kitchen science. A packed lunch spends hours in the danger zone unless you plan for it. Perishable foods like meat, cheese, yogurt, hard-cooked eggs and cut fruit must stay at or below 40 °F. The USDA recommends an **insulated** lunch bag with at least **two cold sources**, such as two ice packs, or one ice pack and a frozen water bottle or a frozen box of juice. Pack the lunch right from the refrigerator, cold food next to the cold sources. Foods like whole fruit, crackers, peanut butter and bread are fine without cold packs. At the end of the day, throw away leftover perishable food that was not eaten, and wash the lunch box.

Let's cook. You will pack a snack-plate "bento" lunch box with all five food groups in separate sections: a protein, a grain, a fruit, a vegetable and a dairy food. Your one

skill: planning a balanced lunch on paper first, then packing it cold and safe.

PICTURE STUDY



The Harvesters, Pieter Bruegel the Elder, 1565 · Oil on wood · Metropolitan Museum of Art, New York

Image: [Wikimedia Commons](#), public domain

Pieter Bruegel painted this scene of a wheat harvest in the Netherlands as part of a series showing the seasons of the year. It is noon, and some of the harvesters have stopped for their midday meal in the shade of a tree, a packed lunch eaten right in the field.

Look closely

- Find the group eating under the tree. What foods can you see? (Look for loaves of bread, cheese, pears and bowls.)
- Find the woman cutting a large round loaf of bread. How is she holding it?
- Find the people still working in the wheat. What tools are they using?
- Find the people carrying jugs and baskets along the path through the tall wheat. Where do you think they are taking them?

Talk about it

1. The harvesters' lunch was carried out to the field. Which food groups can you find in it? Which groups are missing?
2. Why would these workers want to eat in the shade? How would the heat of the sun affect their food if it sat in the sun all morning?

3. Compare this field lunch with a miner's dinner pail and your own lunch box. What is the same and what is different?

Safety first. Keep perishable lunch foods cold with an insulated bag and at least two cold sources, and throw away any perishable food left over at the end of the day. Use the small knife only with an adult right beside you, and check every lunch food for allergies, including the allergy rules at the school or co-op where the lunch will be eaten.

Plan and Pack a Five-Group Lunch Box

You will plan a lunch on paper using all five food groups, then pack it in a lunch box with sections, cold and safe. At lunchtime you will check the temperature of the cold foods to see whether your packing worked.

You will need

- A lunch box with sections, or a box with small containers or silicone cups
- An insulated lunch bag and two ice packs (or one ice pack and a frozen water bottle)
- A cutting board with a damp towel underneath, a small knife, and your food thermometer
- Paper and colored pencils for planning

SNACK-PLATE BENTO LUNCH BOX

Serves 1 lunch box (multiply for each person) • Prep 15 min (plus hard-cooked eggs from Lesson 1.3, if using)

Ingredients

- Protein (choose one): 1 hard-cooked egg, peeled; 2 ounces (55 g) sliced turkey or ham, rolled up; or $\frac{1}{3}$ cup roasted chickpeas or hummus
- Grain (choose one): 6–8 whole-grain crackers, $\frac{1}{2}$ whole-wheat pita cut in triangles, or 1 small whole-wheat roll
- Dairy (choose one): 1 ounce (30 g) cheese cubes or a cheese stick, or a 5-ounce (150 g) cup of yogurt
- Vegetable (choose two): $\frac{1}{2}$ cup baby carrots, cucumber rounds, sugar snap peas, cherry tomatoes or bell pepper strips
- Fruit (choose one): 1 small apple, sliced and dipped in lemon water, a clementine, or $\frac{1}{2}$ cup grapes
- Water to drink, frozen in a bottle the night before so it is also a cold source

Method

1. The night before, put a water bottle (filled three-quarters full) and the ice packs in the freezer.
2. In the morning, wash your hands. Rinse the vegetables and fruit and pat them dry.
3. With an adult right beside you, slice the cucumber with the claw grip and halve cherry tomatoes with the bridge grip. Slice the apple and dip the slices for a minute in a cup of water with 1 tablespoon lemon juice to keep them from browning.
4. Fill each section of the lunch box with one food group, taking the cold foods straight from the refrigerator.
5. Close the box, put it in the insulated bag with an ice pack on top and the frozen water bottle or second ice pack beside it, and zip the bag.
6. At lunchtime, eat the perishable foods first. Throw away any leftover meat, egg, cheese or yogurt, and bring the box home to be washed.

Allergy check: Depends on your choices: crackers, pita and rolls contain wheat; cheese and yogurt contain milk; eggs are an allergen; hummus contains sesame; some deli meats contain milk or soy. Choose foods that are safe for the person eating the lunch, and follow any nut-free or other allergy rules where the lunch will be eaten.

Steps

1. **Plan on paper.** Draw your lunch box with its sections and write in one food for each of the five groups. Check your plan with an adult and against any allergies.
2. Pack the lunch from the recipe card the morning you will eat it. Write down the time you packed it.
3. **Temperature check.** At lunchtime (about 4 hours later), push your food thermometer into the cheese or yogurt or the center of the egg and record the temperature. Was it at or below 40 °F?
4. **Fair test (optional).** Pack a second small container of cheese cubes with no ice pack, leave it in a lunch bag on the counter, and take its temperature at the same time. Do not eat it; throw it away. How different were the two temperatures?
5. **Clean up:** wash the lunch box and containers in hot, soapy water, wipe out the insulated bag, and put the ice packs back in the freezer.

6. Improve it. Ask yourself: Was the lunch enough to keep me full until supper? Which food was left over? Change one food in your plan for next time.

Tips

- A frozen water bottle does two jobs: it keeps the lunch cold in the morning and has melted into cold water by lunchtime.
- Pack crunchy foods like crackers in their own section, away from wet fruit, so they stay crisp.
- Making lunches the night before and keeping the closed box in the refrigerator saves time in the morning; add the ice packs when you leave.

Check your work

- ☐ I can tell how workers and children carried their lunches, from the dinner pail to the lunch box.
- ☐ I planned and packed a lunch with all five food groups.
- ☐ I used an insulated bag and two cold sources, and my cold foods were at or below 40 °F at lunchtime.

COOK'S NOTEBOOK

1. Draw a miner's stacked dinner pail and label what might go in each layer. Then draw your own lunch box and label each food group.
2. Record the temperature check: the time packed, the time eaten, and the temperatures of the cold-packed and no-ice-pack foods.
3. Write a list of ten lunch foods you like, sorted by food group, to use when planning lunches for the unit challenge.

From history. The Cornish pasty is so closely tied to Cornwall that since 2011 only pasties made in Cornwall to the traditional recipe may be sold in Europe as "Cornish pasties." In Michigan's Upper Peninsula, where many Cornish miners settled, pasties are still a favorite lunch, and towns hold pasty festivals in summer.

COMMON MISTAKES

- Packing yogurt, meat or cheese without a cold source. Perishable food in a warm lunch bag sits in the danger zone all morning.
- Saving half a sandwich with meat or cheese from today's lunch to eat tomorrow. Throw away perishable leftovers from a packed lunch.

- Packing a lunch with only grains and snacks. Check for all five groups, especially vegetables and a protein.

Make it a game • Lunch Box Challenge. Make five cards: fruit, vegetable, grain, protein, dairy. Take sixty seconds to put together a lunch from real foods around the kitchen, using every card. Add an insulated cold source in your plan and tell why. Your parent then names the miner's dinner pail, and you explain how lunches have changed.

Scripture. “Whether therefore ye eat, or drink, or whatsoever ye do, do all to the glory of God.” (1 Corinthians 10:31, KJV)

Even a packed lunch eaten at a desk or in a field can be received with thanks and eaten to God's glory.

UNIT 2

FOOD GROUPS & THE BALANCED MEAL

God has filled the world with good things to eat: grain in the field, fruit on the tree, milk from the cow and fish in the sea. No single food gives the body everything it needs, so a wise cook puts different kinds of food together. In this unit you will learn how people in the United States have taught families to build balanced meals, from the colorful wartime “Basic Seven” wheel of 1943 to the Food Guide Pyramid and the MyPlate picture of 2011, and what each food group gives your body.

You will look closely at a grain of wheat and find out what the roller mills of the 1870s took away and what whole grains keep. You will meet Gail Borden, who found a way to keep milk from spoiling, and read the bread recipe God gave Ezekiel, made of grains and beans together. Finally you will learn the history of the lunch pail and pack balanced lunches that stay cold and safe until noon. Along the way you will make wraps, oatmeal, a bean-and-cheese skillet and a lunch box full of all five food groups.

PREREQUISITES

- Washes hands and uses Clean, Separate, Cook, Chill (Unit 1)
- Uses the claw and bridge grips with an adult beside (Lesson 1.2)
- Can read a measuring cup and add fractions such as $\frac{1}{2} + \frac{1}{4}$

MASTERY CHECKLIST

- ☐ I can name the five food groups and give three foods from each.
- ☐ I can tell what each food group gives the body.
- ☐ I can explain the difference between a whole grain and a refined grain and name the bran, germ and endosperm.
- ☐ I can tell how food guides changed from the Basic Seven (1943) to the Food Guide Pyramid (1992) to MyPlate (2011).
- ☐ I can plan and pack a balanced lunch that includes all five food groups and stays cold until lunchtime.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **MyPlate Kids’ resources (USDA):** Free. Search “MyPlate Kids” for the USDA’s printable plate, activity sheets and the Start Simple with MyPlate app, all for families.
- **Whole Grains Council:** Free. Pictures of the whole-grain kernel, a guide to reading labels for whole grains, and cooking times for oats, brown rice, barley and other grains. Useful for Lesson 2.2.
- **An insulated lunch bag and two small reusable ice packs:** Inexpensive. Used in Lesson 2.4 and the unit challenge to keep packed lunches cold until noon.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

2.1 From the Basic Seven to MyPlate

2 sessions of 45–60 minutes

2.2 Grains: Whole and Refined

2 sessions of 45–60 minutes

2.3 Protein and Dairy: Gail Borden’s Milk and Ezekiel’s Bread

2 sessions of 45–60 minutes

2.4 Packing a Balanced Lunch

2 sessions of 45–60 minutes

UNIT 2 REVIEW

Answer each question in complete sentences unless it asks for a list. The review is worth 50 points.

1. **5 pts**

Name the five MyPlate food groups and give two foods from each.

2. **5 pts**

Put these food guides in order from oldest to newest and give the year of each: MyPlate, the Basic Seven, the Food Guide Pyramid.

3. **5 pts**

What does each of these give the body: dairy, protein foods, fruits?

4. (5 pts)

Name the three parts of a grain kernel and tell which one white flour is made from.

5. (5 pts)

How did roller mills in the 1870s change bread in America, and what was lost?

6. (5 pts)

Predict: you cook a pot of oatmeal on high heat without stirring. What will happen, and what should you do instead?

7. (5 pts)

How did Gail Borden boil the water out of milk without scorching it?

8. (5 pts)

What is protein for, and why do grains and beans go well together?

9. (5 pts)

What does the USDA recommend for keeping a packed lunch safe until noon?

10. (5 pts)

Plan a balanced lunch that includes all five food groups. Label each food's group.

ANSWER KEY

1. Fruits (apples, oranges), vegetables (carrots, spinach), grains (bread, rice), protein foods (chicken, beans), dairy (milk, yogurt). Other correct foods accepted.
2. Basic Seven (1943), Food Guide Pyramid (1992), MyPlate (2011).
3. Dairy: calcium, vitamin D and protein for bones and teeth. Protein foods: protein to build and repair the body, plus iron and zinc. Fruits: vitamin C, potassium and fiber.
4. Bran, germ and endosperm. White flour is made from the endosperm.
5. Rollers cracked the wheat gently so the bran and germ could be sifted away, making fine white flour cheap. Much of the fiber, vitamins and iron in the bran and germ were lost (some B vitamins and iron were later added back by enrichment).
6. It will stick, scorch on the bottom and spatter. Cook it on medium-low and stir every minute or so.
7. He heated it in a vacuum pan with much of the air pumped out. With less air pressure, the milk's water boiled away at a lower temperature, so it did not scorch.
8. Protein builds and repairs the body. Grains and beans each run low on different amino acids, so together (in the same meal or the same day) they give all nine the body needs from food.
9. An insulated lunch bag with at least two cold sources (ice packs or a frozen water bottle), packed with cold food straight from the refrigerator.
10. Answers will vary. Example: whole-wheat crackers (grain), turkey roll-ups (protein), cheese stick (dairy), baby carrots (vegetable), clementine (fruit).

UNIT CHALLENGE: THREE BALANCED LUNCHES

Plan, pack and photograph three balanced lunches in one week, for yourself or a family member. Plan each lunch on paper first, using all five food groups and no two lunches exactly alike. Pack each one with an insulated bag and two cold sources.

For each lunch, make a MyPlate check: draw a plate, write each food in its group, and note the temperature of one cold food at lunchtime. At the end of the week, write a short paragraph about which lunch was the family favorite and what you would change.

LOOK FOR	WHAT IT MEANS
Balanced plans	Each of the three lunches includes all five food groups, planned on paper before packing.
Food safety	Each lunch was packed with two cold sources, and at least one lunchtime temperature was recorded for each.
Variety	The three lunches use different foods, including at least two different vegetables and two different proteins.
Record-keeping	Photos or sketches, MyPlate checks and a closing paragraph are neat and complete.
Effort and improvement	The student packed the lunches carefully, cleaned up each time, and made a thoughtful change based on what was learned.

UNIT 3

TASTE, SMELL & YOUR TASTE BUDS

“O taste and see that the LORD is good.” God gave us mouths that can tell sweet from sour and noses that can tell a ripe strawberry from a green one. In this unit you will become a scientist of your own senses. You will meet Kikunae Ikeda, the Japanese chemist who discovered the fifth basic taste, umami, in a bowl of seaweed broth, and you will find out why the famous “tongue map” in old textbooks was wrong all along.

You will learn why most of what we call flavor is really smell, why children taste bitterness more strongly than grown-ups, and why a vegetable you disliked last year may taste better this year if you keep trying it. Finally you will explore texture, crunchy, creamy and chewy, and make your own granola. Every taste test in this unit is done with thankfulness, good manners and a check for allergies first.

PREREQUISITES

- Follows Clean, Separate, Cook, Chill and the 2-hour rule (Unit 1)
- Knows the five food groups (Unit 2)
- Uses the stove and oven with an adult beside, with pot handles turned in

MASTERY CHECKLIST

- ☐ I can name the five basic tastes and give a food for each.
- ☐ I can tell how Kikunae Ikeda discovered umami.
- ☐ I can explain why the tongue map is a myth and why most flavor comes from smell.
- ☐ I can explain why tastes change as we grow and why trying a food many times helps.
- ☐ I can describe a food’s texture with good words and run a fair taste test.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **A set of small tasting cups or a muffin tin:** Inexpensive. Handy for the five-tastes tray, the jelly-bean smell test and the blind taste tests in this unit.
- **A blindfold or clean scarf:** For fair blind taste tests in Lessons 3.2–3.4 and the unit challenge.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

3.1 Kikunae Ikeda and the Fifth Taste

2 sessions of 45–60 minutes

3.2 Your Nose Knows: Smell, Flavor and the Tongue-Map Myth

2 sessions of 45–60 minutes

3.3 Taste Buds Change: Why Broccoli Gets Better

2 sessions of 45–60 minutes

3.4 Crunchy, Creamy, Chewy: Texture

2 sessions of 45–60 minutes

UNIT 3 REVIEW

Answer each question in complete sentences unless it asks for a list. The review is worth 50 points.

1. **5 pts**

Name the five basic tastes and give one food for each.

2. **5 pts**

How did Kikunae Ikeda discover umami?

3. **5 pts**

What was the tongue map, and why is it wrong?

4. **5 pts**

Predict: you pinch your nose and eat a piece of apple, then a piece of pear. What will you notice, and why?

5. (5 pts)

What is retronasal smell?

6. (5 pts)

What did Arthur Fox discover in 1931?

7. (5 pts)

Give two reasons a child might dislike broccoli now but like it later.

8. (5 pts)

Why does roasted broccoli often taste sweeter than boiled or steamed broccoli?

9. (5 pts)

Predict: you leave a bowl of crackers uncovered overnight on a humid night.

What will happen to their texture, and why?

10. (5 pts)

Why is granola soft when it comes out of the oven but crisp after it cools?

ANSWER KEY

1. Sweet (honey), salty (pretzels), sour (lemon), bitter (grapefruit peel or unsweetened chocolate), umami (broth, Parmesan, tomatoes). Other correct foods accepted.
2. In 1908 he noticed a savory taste in kombu broth that was not sweet, salty, sour or bitter. He separated the substances in the broth and found glutamic acid (glutamate), which had the same taste, and he named the taste umami.
3. A diagram showing each part of the tongue sensing only one taste. It came from a misreading of Hänig's 1901 data in Boring's 1942 graph. Every part of the tongue with taste buds senses all five tastes.
4. They will taste much alike, mostly sweet, because pinching the nose blocks the aromas that travel from the mouth to the nose. Most of flavor comes from smell.
5. Smelling food from inside the mouth: aromas travel up the back of the throat into the nose while you chew and breathe out.
6. That people differ in their ability to taste some bitter compounds: the PTC dust tasted very bitter to his coworker but had almost no taste to him.
7. Children taste bitterness more strongly than most adults, and sensitivity lessens with age; tastes are learned, and after many small tastes (often 8–15) a food becomes familiar and liked. Cooking it differently, such as roasting, also helps.
8. The dry heat of the oven browns the outside, and browning creates sweet, nutty flavors that balance the bitterness. Long boiling or steaming can release sulfur smells instead.
9. They will turn soft and lose their crispness, because they soak up moisture from the air.
10. While hot, the honey or syrup is soft and runny. As it cools, it hardens like candy and glues the dry oats into crisp clusters.

UNIT CHALLENGE: THE FAMILY BLIND TASTE TEST

Choose one food and prepare it three different ways, for example carrots raw, steamed and roasted, or potatoes boiled, mashed and roasted. Check allergies, then run a fair blind taste test with at least four family members: blindfold each taster, serve the three versions in a random order on plates marked A, B and C, and ask them to rate each for taste and texture from 1 to 5.

Make a results chart and a bar graph, and write a paragraph about which version won and why you think it did. Finish with a “try it again” plan for a vegetable someone in the family does not yet like: how you will cook it, and when you will offer small tastes over the next month.

LOOK FOR	WHAT IT MEANS
Fair test	Three versions of the same food, a blindfold, random order and the same questions for every taster.
Cooking and safety	The food was cooked safely with an adult beside, and the kitchen was cleaned afterward.
Results chart and graph	Ratings recorded clearly for every taster, with a neat bar graph.
Explanation	A paragraph that uses words from this unit (bitter, aroma, texture, browning) to explain the results.
Try-it-again plan	A thoughtful plan with dates for offering a disliked vegetable several more times, cooked in different ways.

3.1 KIKUNAE IKEDA AND THE FIFTH TASTE

OBJECTIVES

- Name the five basic tastes, sweet, salty, sour, bitter and umami, and give a food for each.
- Tell how Kikunae Ikeda discovered umami in kombu broth in 1908.
- Make a simple miso soup from kombu broth and taste how umami builds.

Warm-up. With an adult, set out five tiny tastes on a plate: a pinch of sugar, a pinch of salt, a small lemon wedge, a square of unsweetened baking chocolate or a sliver of grapefruit peel, and a crumb of Parmesan cheese. Check for allergies first. Taste each one, sip water in between, and try to describe it in one word.

WATCH

What is Umami? | ATK Kids Food Science Explainers

America's Test Kitchen Kids · 1:20

<https://www.youtube.com/watch?v=42xWxZgfE70>

WHEN TO WATCH

Right after the warm-up taste tray, before the story of Ikeda.

Note: A very short animated explainer from America's Test Kitchen Kids.

BACKUP VIDEO

Learn to Make Classic Miso Soup! 味噌汁

Just One Cookbook · 3:47

<https://www.youtube.com/watch?v=wshf6yZbhwk>

KEY TERMS

basic tastes

The five tastes the tongue can sense: sweet, salty, sour, bitter and umami.

umami

The savory, brothy, “meaty” taste found in foods such as broth, tomatoes, Parmesan cheese, mushrooms, soy sauce and seaweed. The word comes from Japanese and means something like “delicious taste.”

glutamate

A natural substance found in many foods that gives the umami taste.

kombu

A kind of dried seaweed (kelp) used in Japan to make broth.

dashi

A light Japanese broth, often made from kombu, which is the base of miso soup and many other dishes.

CORE IDEAS

The story. In 1908 Kikunae Ikeda was a chemistry professor at Tokyo Imperial University in Japan. At home, he noticed something about his family’s simple suppers. A pot of *yudofu*, tofu warmed in a broth made from **kombu** seaweed, had a deep, savory taste that was not sweet, not salty, not sour and not bitter. The same taste was in tomatoes, cheese and meat broth. Scientists in Europe taught that there were only four basic tastes. Ikeda thought there was a fifth.

How he figured it out. Ikeda set out to find what in the kombu made that taste. He boiled down a large amount of kombu broth and, step by step, separated its substances, tasting each as he went. At last he found crystals of **glutamic acid**, and when it was combined with a little sodium, the crystals had the very same savory taste as the broth. He named the taste **umami**, from the Japanese word *umai*, “delicious.” In 1908 he received a patent for making the seasoning monosodium glutamate (MSG), which a Japanese company began selling the next year. Later Japanese scientists found two more umami substances: one in dried bonito fish flakes (1913) and one in dried shiitake mushrooms (1957). For many years some

scientists doubted that umami was a true basic taste, until around 2000, when researchers found special receptors on the tongue that respond to glutamate.

The kitchen science. Your tongue and the roof and back of your mouth are covered with thousands of **taste buds**, and each taste bud has cells that can sense all five basic tastes. Each taste may point to something the body needs or should avoid.

Sweet often means sugars for energy. **Salty** means sodium, a mineral the body needs in small amounts. **Sour** means acid, as in lemons, vinegar and yogurt. **Bitter** appears in coffee beans, cocoa, grapefruit peel and some greens; strong bitterness can be a warning, because many harmful plants are bitter. **Umami** often means protein-rich foods like broth, meat, fish, aged cheese, ripe tomatoes and mushrooms. Cooks use umami to make simple dishes taste rich and satisfying.

Let's cook. You will make Ikeda's kombu broth, called *dashi*, and turn it into a simple miso soup with tofu and green onions, tasting at each step to notice the umami grow. Your one skill: heating a broth gently, just below a boil, at the stove with an adult beside you.

PICTURE STUDY



Still Life, Luis Egidio Meléndez, about 1770 · Oil on canvas · Private collection

Image: [Wikimedia Commons](#), public domain

Luis Meléndez was a Spanish painter who spent much of his life painting the food of Spain's kitchens, each object painted so carefully you can almost feel its weight. Here he has laid out what looks like the makings of a Spanish *cocido*, a slow-cooked stew of meat and vegetables, ready to go into the copper pot.

Look closely

- Find the copper pot with its lid. What do you think will be cooked in it?
- Find the slice of ham, the slab of cured pork and the sausage. These cured meats are rich in umami. Which foods in your kitchen have that same savory taste?
- Find the garlic, the onion, the green cabbage and the herbs. How would they change the taste of a broth?
- Find the bronze mortar and pestle. What might the cook grind in it?

Talk about it

1. Which of the five basic tastes can you find in this painting? Point to a food for each one you can.
2. Long before anyone named umami, cooks in Spain, Japan and everywhere else made broth from meat, fish, seaweed or vegetables. Why do you think broth is found in almost every country's cooking?

3. If you were painting the ingredients for your family's favorite soup, what would you put on the table?

Safety first. Check every taste-tray food and the soup ingredients for allergies before tasting; miso and tofu contain soy. An adult stands beside you at the stove, the pot handle is turned in, and you lift the lid away from your face so the steam goes the other way.

The Five-Tastes Tray and Ikeda's Miso Soup

You will set up a five-tastes tray for the family, then make kombu broth and turn it into miso soup, tasting at each step. You will discover what Ikeda tasted: plain broth, then broth with umami building, then the full soup.

You will need

- A plate or muffin tin and small spoons for the taste tray, and glasses of water
- A medium saucepan, a slotted spoon or tongs, a ladle, a small bowl, a whisk or fork
- A cutting board with a damp towel underneath and a small knife
- Small tasting cups and soup bowls

SIMPLE MISO SOUP WITH KOMBU BROTH

Serves 4 · Soak 20 min · Cook 15 min

Ingredients

- 4 cups (950 mL) cold water
- 1 piece kombu (dried kelp), about 4 by 4 inches (10 g)
- 3 tablespoons white or yellow miso paste
- 7 ounces (200 g) soft or firm tofu
- 2 green onions
- 1 handful baby spinach (optional)
- If you cannot find kombu, use 4 cups low-sodium vegetable or chicken broth instead

Method

1. Wash your hands. Put the water and the kombu in the saucepan and let it soak for 20 minutes. (Do not wash off the white powder on the kombu; it holds much of the flavor.)
2. With an adult beside you, set the pan on medium heat, handle turned in. Heat slowly until small bubbles form around the edge, about 8–10

minutes. Just before it boils, lift out the kombu with tongs. This is your dashi.

3. While it heats, cut the tofu into ½-inch cubes on the cutting board, using the claw grip, with an adult beside you. Slice the green onions thinly.
4. Turn the heat to low. Add the tofu and spinach and warm them for 2 minutes.
5. Put the miso in a small bowl. Ladle in about ½ cup of the hot broth and whisk until the miso is smooth with no lumps.
6. Turn off the heat and stir the miso mixture into the pot. Do not let the soup boil after the miso goes in; boiling dulls its flavor.
7. Ladle the soup into bowls and sprinkle with green onions. Serve hot, and refrigerate leftovers within 2 hours.

Allergy check: Contains soy (miso, tofu). Some miso is made with barley or wheat; check the label if you avoid gluten. For a soy-free soup, skip the miso and tofu and make a simple broth soup with kombu dashi, a pinch of salt, cooked chicken or noodles and vegetables.

Steps

1. **Five-tastes tray.** Set out the five tastes from the warm-up for each family member. Let everyone taste, sip water between tastes, and name the taste. Make a chart: taste, food, describing word, liked or not.
2. Make the dashi from the recipe card. Before adding anything to it, pour a little into a tasting cup for each person. What do you taste? Most people say it tastes faintly of the sea, mild and smooth.
3. **Umami builds.** Make three tasting cups: plain dashi; dashi with a tiny pinch of salt; dashi with ½ teaspoon miso stirred in. Taste them in order. In which cup does the taste seem “fuller” or longer-lasting? Record what each person says.
4. Finish the miso soup and serve it to the family. Ask everyone to rate it from 1 to 5.
5. Clean up: wash the pan, ladle, bowls and board, wipe the counter, and put the leftover miso back in the refrigerator.

6. **Improve it.** Another day, add one more umami food to the soup, such as a few sliced mushrooms simmered in the broth, and compare it with the first batch.

Tips

- Kombu and miso are sold in the Asian foods section of many grocery stores. Opened miso keeps for months in the refrigerator.
- White (shiro) miso is mild and a little sweet; red miso is saltier and stronger. Start with white.
- If the soup tastes too salty, add a little hot water. If it tastes flat, whisk in a little more miso.

Check your work

- ☐ I can name the five basic tastes and give a food for each.
- ☐ I can tell how Ikeda found glutamate in kombu broth and named umami.
- ☐ I heated the broth gently without boiling and tasted how umami builds.

COOK'S NOTEBOOK

1. Draw a tongue and fill it with tiny taste buds all over. Around it, draw a food for each of the five tastes and label it.
2. Copy your five-tastes chart and write one sentence about which taste your family liked most and least.
3. Write the miso soup recipe in your own words and record your three-cup umami test.

From history. Ikeda wrote that he hoped his seasoning would help make plain, inexpensive foods more nourishing and enjoyable for ordinary families. The Japanese patent office later named him one of Japan's ten great inventors. In 1985 an international symposium in Hawaii officially recognized umami as a scientific term for the fifth basic taste.

COMMON MISTAKES

- Thinking there are only four tastes. Umami is now accepted by scientists as the fifth basic taste.
- Boiling the soup after adding the miso, which dulls its flavor.
- Confusing umami with saltiness. Salt tastes salty on its own; umami is a savory, brothy taste that makes food seem fuller and richer.

Make it a game • Name That Taste. Your parent sets out five small tastes: sweet, salty, sour, bitter, and a savory broth for umami. With your eyes closed, name each one. Score a point for each correct answer. Then tell the story of Kikunae Ikeda and the kombu broth in 1908. Explain what glutamate is, then switch and quiz your parent.

Scripture. “O taste and see that the LORD is good” (Psalm 34:8, KJV)

God made our sense of taste and filled the world with good things to taste. The psalmist uses tasting as a picture of knowing how good God is.

3.2 YOUR NOSE KNOWS: SMELL, FLAVOR AND THE TONGUE-MAP MYTH

OBJECTIVES

- Explain why the “tongue map” is a myth and how it got into textbooks.
- Explain how smell, especially smell from inside the mouth, makes up most of what we call flavor.
- Run a nose-pinch taste test and make herbed popcorn and lemon-mint water, comparing them with and without smell.

Warm-up. Close your eyes and pinch your nose shut. Have an adult put a small piece of apple or pear in your mouth (check allergies first). Chew it with your nose still pinched. Can you tell which it is? Now let go of your nose and keep chewing. What happens?

WATCH

Why This Taste Map Is Wrong. | WIRED

WIRED • 8:50

https://www.youtube.com/watch?v=0klEcayEJ_o

WHEN TO WATCH

After the story of the tongue map. Listen for what the scientist says about where taste receptors are found.

Note: Robert Margolskee of the Monell Chemical Senses Center explains the science; best for the student and parent to watch together.

BACKUP VIDEO

Your Tongue: The Taste-Maker!

SciShow Kids • 3:52

<https://www.youtube.com/watch?v=C4rdqXXzPGU>

KEY TERMS

flavor

The whole experience of a food: its tastes, its smells, its texture and even its temperature, all put together by the brain.

aroma

The smell of a food, carried by tiny particles that float into the nose.

retronasal smell

Smelling food from inside the mouth: aromas travel up the back of the throat into the nose while you chew and breathe out.

tongue map

An old, wrong diagram showing sweet at the tip of the tongue, bitter at the back and sour and salty along the sides.

myth

A story or idea that many people believe but that is not true.

CORE IDEAS

The story. For most of the 1900s, schoolbooks showed a picture of the tongue divided into zones: sweet on the tip, salty and sour on the sides, bitter at the back. Children were told to test it with sugar and salt. Many tried, felt confused that it did not seem to work, and decided they must be doing it wrong. The map was printed again and again for about seventy years. It was wrong.

How they figured it out. The map began with a careful German scientist, David Hänig, who in 1901 tested how strongly people sensed each taste at different spots around the edge of the tongue. He found only small differences: some spots were a little more sensitive to one taste than another. In 1942 a Harvard psychologist, Edwin Boring, drew Hänig's results as a graph in a book on the history of the senses. Readers misunderstood the graph to mean that each part of the tongue senses only one taste, and textbooks turned it into the tongue map. In 1974 another scientist, Virginia Collings, tested the tongue again and found what Hänig had really found: every part of the tongue that has taste buds can sense every taste. Later, scientists found that each taste bud has cells for all five tastes. The lesson: always look at the evidence for yourself.

The kitchen science. Your tongue senses only five basic tastes. Then how can you tell a strawberry from a raspberry, both sweet and a little sour? By **smell**. When you chew, aromas from the food float up the back of your throat into your nose. This is called **retronasal smell**, and it gives most of what we call **flavor**. When your nose is pinched or stuffed up with a cold, the air stops flowing, and an apple and a pear can taste almost the same: just sweet. Herbs, spices, citrus peel, browned butter and toasted bread all add flavor mostly through smell. Your brain puts taste, smell, texture and temperature together into one flavor.

Let's cook. You will make two snacks that are mostly about aroma: herbed popcorn and lemon-mint water. You will taste each with your nose pinched and then unpinched. Your one skill: popping corn safely in the microwave with an adult nearby, and opening a hot, steamy bag away from your face.

PICTURE STUDY



Basket of Wild Strawberries, Jean-Siméon Chardin, 1761 · Oil on canvas · Musée du Louvre, Paris

Image: [Wikimedia Commons](#), public domain

Late in his life, Chardin painted this simple picture of a basket piled high with tiny wild strawberries, a glass of water and two white carnations. Wild strawberries are smaller than garden strawberries, and many people say their smell is even stronger and sweeter. Chardin could not paint a smell, but he painted the berries so that you can almost smell them.

Look closely

- Look at the pile of strawberries. How do you think it was stacked so high without falling over?
- Find the glass of water. How did Chardin paint it so it looks clear?
- Find the two white carnations. Carnations have a spicy, sweet scent, like cloves. Why might the painter put flowers beside the fruit?
- Find the peach and the cherries. What do you think each of them smells like?

Talk about it

1. Close your eyes and imagine the smell of fresh strawberries. Is the smell part of how strawberries taste? How could you test that?
2. Every item in this painting has a smell except one. Which one? (The glass of water.)

3. Why do you think a painter would choose to paint such a simple, small thing so carefully?

Safety first. Check the jelly beans, popcorn ingredients and herbs for allergies before tasting. Stay near the microwave while the popcorn pops and stop it when the popping slows, and let an adult open the hot bag away from both of your faces, because the steam can burn. Popcorn is a choking hazard for children under four, so keep it away from little ones.

The Nose-Pinch Test: Herbed Popcorn and Lemon-Mint Water

You will run a nose-pinch test with jelly beans, then make two aroma-rich snacks, herbed popcorn and lemon-mint water, and taste each with and without smell. You will find out for yourself how much of flavor comes from your nose.

You will need

- A large pitcher, a wooden spoon, a cutting board with a damp towel underneath, and a small knife
- Brown paper lunch bags, a microwave, a large bowl, measuring cups and spoons, oven mitts
- A blindfold, a small bag of mixed-flavor jelly beans (or apple and pear cubes) and paper cups

HERBED POPCORN AND LEMON-MINT WATER

Serves 4–6 • Prep 15 min • Chill 1 hr (water) • Pop 6 min

Ingredients

- Lemon-mint water: 8 cups (2 liters) cold water, 1 lemon, ½ cucumber, 8–10 fresh mint leaves, ice
- Popcorn: ½ cup (100 g) popcorn kernels, divided into two ¼-cup batches
- 3 tablespoons butter, melted, or 3 tablespoons olive oil
- 1 teaspoon dried Italian herbs or dried dill
- ½ teaspoon garlic powder
- ½ teaspoon salt
- 2 tablespoons finely grated Parmesan cheese (optional)

Method

1. Wash your hands and rinse the lemon, cucumber and mint. With an adult beside you, slice the lemon and cucumber into thin rounds with the claw grip.
2. Put the lemon, cucumber and mint leaves in the pitcher. Gently press the mint with the back of a wooden spoon to release its smell. Add the

cold water and refrigerate for at least 1 hour.

3. For the popcorn, pour $\frac{1}{4}$ cup kernels into a brown paper lunch bag and fold the top over twice, tightly.
4. Lay the bag flat in the microwave. With an adult nearby, microwave on high for 2 to 3 minutes. Stay and listen; stop the microwave when there are about 2 seconds between pops. Never leave popcorn popping alone.
5. Using oven mitts, the adult lifts out the bag and opens it away from your faces. Pour the popcorn into a large bowl. Repeat with the second $\frac{1}{4}$ cup.
6. Set aside one cup of plain popcorn for the test. Drizzle the melted butter or olive oil over the rest and toss. Sprinkle with the herbs, garlic powder, salt and Parmesan, and toss again.
7. Serve the popcorn with glasses of lemon-mint water over ice.

Allergy check: Contains milk (butter, Parmesan). For milk-free popcorn, use olive oil and leave out the Parmesan. Some jelly beans contain soy, milk or other allergens; check the label or use apple and pear cubes instead.

Steps

1. **Jelly-bean test.** Blindfold a taster and have them pinch their nose. Give them one jelly bean to chew. Ask: What flavor is it? Then let go of the nose and keep chewing. Record their guesses before and after. Test at least five jelly beans and three tasters.
2. Make the lemon-mint water and the herbed popcorn from the recipe card.
3. **Popcorn test.** With noses pinched, taste a piece of plain popcorn and then a piece of herbed popcorn. Can you tell them apart? (You may notice the salt and the butter's richness, but not the herbs.) Unpinch and taste again.
4. **Water test.** With noses pinched, sip plain water and then lemon-mint water. What do you notice? Unpinch and sip again.
5. Record all results in a chart: food, guess with nose pinched, guess with nose open, and how many tasters were right each way.
6. **Clean up:** wash the pitcher, bowl and board, wipe the microwave and counter, and throw away the paper bags.

7. **Improve it.** Invent your own popcorn seasoning using one strong-smelling herb or spice (cinnamon, smoked paprika, rosemary) and test whether tasters can identify it with their noses pinched.

Tips

- Use plain paper lunch bags with no printing. Do not use staples.
- Toss the popcorn with the butter or oil first so the seasonings have something to stick to.
- Pressing the mint leaves just a little releases their aroma without making the water bitter.

Check your work

- ☐ I can explain why the tongue map is a myth and where it came from.
- ☐ I can explain retronasal smell and show with a test that most flavor comes from smell.
- ☐ I popped corn safely with an adult nearby and opened the bag away from my face.

COOK'S NOTEBOOK

1. Draw the old tongue map with a big red X over it. Next to it, draw a correct picture: a tongue with taste buds that can sense all five tastes everywhere.
2. Draw a side view of a head with arrows showing how aromas travel from the mouth up the back of the throat into the nose.
3. Copy your jelly-bean results chart and write two sentences about what you learned.

From history. Scientists at the Monell Chemical Senses Center in Philadelphia, founded in 1968, study taste and smell. Their work and that of others helped show that the tongue map was wrong and that each taste bud holds cells for every basic taste. Some scientists today are studying whether people can also taste fat as a sixth basic taste.

COMMON MISTAKES

- Believing the tongue map. Every part of the tongue with taste buds senses all five tastes.
- Thinking a stuffy nose ruins your taste buds. A cold blocks smell, not taste; the taste buds still work.

- Leaving the microwave while popcorn pops. Kernels can scorch quickly once the popping slows.

Make it a game • Nose-Pinch Showdown. Pinch your nose shut while your parent hands you a jelly bean or a piece of lemon-mint candy without telling you the flavor. Guess, then let go and guess again. Score both guesses. Then explain why the tongue map is a myth and why smell from inside the mouth is retronasal. Swap roles.

3.3 TASTE BUDS CHANGE: WHY BROCCOLI GETS BETTER

OBJECTIVES

- Explain why children often taste bitterness more strongly than adults, and tell the story of Arthur Fox's bitter-taste discovery.
- Explain how taste buds renew and why it often takes many tastes to learn to like a new food.
- Roast broccoli in the oven and compare it with steamed broccoli in a family taste test.

Warm-up. Make a list of three foods you used to dislike when you were little but like now, and three foods you still dislike. Ask a grandparent or parent to make the same lists. Compare them. Which foods are on many lists?

WATCH

Are You a Supertaster?

SciShow • 2:45

<https://www.youtube.com/watch?v=W7Pzhvypg9A>

WHEN TO WATCH

After the story of Arthur Fox. Listen for the date and the place of his discovery.

Note: Mentions taste-test paper strips; this course does not use them. Never taste a chemical.

KEY TERMS

bitter

A sharp taste found in foods like coffee beans, grapefruit peel, dark greens and broccoli; strong bitterness can be a warning of something harmful.

exposure

Each time you see, smell or taste a food. Many exposures help a person learn to like a food.

taste receptor cells

The cells in a taste bud that sense tastes. They wear out and are replaced every week or two.

roasting

Cooking food uncovered in a hot oven, where dry heat browns the outside and brings out sweet, nutty flavors.

steaming

Cooking food over boiling water, so the hot steam cooks it without browning.

CORE IDEAS

The story. One day in 1931, a chemist named Arthur Fox was working in a laboratory at the DuPont company, pouring a fine white powder into a bottle. Some of the dust blew into the air. His coworker, C. R. Noller, complained that the dust tasted terribly bitter. Fox had breathed the same dust and tasted nothing at all. Puzzled, Fox tested the chemical, a compound called PTC, on friends and family, and found that some people tasted it as very bitter while others could barely taste it. People are born with different abilities to taste certain bitter things.

How they figured it out. Later scientists found that people who strongly taste PTC often find foods in the cabbage family, such as broccoli, Brussels sprouts, cabbage and kale, more bitter than other people do. They also found that **children** taste bitterness more strongly than most adults, which helps explain why so many children dislike vegetables. Researchers who studied how children learn to like foods, including Leann Birch of the University of Illinois and later Penn State, found that tastes are learned. Children often needed to taste a new food many times, often 8 to 15 small tastes, on different days, before they liked it. The food did not change. The children did.

The kitchen science. Taste buds are always being renewed: the taste cells in each bud wear out and are replaced every week or two. As you grow, you become less sensitive to bitterness, and every taste teaches your brain that a food is safe and familiar. In old age, taste and smell slowly fade, which is one reason grandparents may like stronger flavors. Cooking changes bitterness too. **Steaming** or boiling broccoli for too long releases sulfur smells; **roasting** in a hot oven browns the outside, and browning creates sweet, nutty flavors that balance the bitterness. A little fat, salt and cheese balance it even more.

Let's cook. You will roast broccoli with olive oil, salt and Parmesan and steam a small batch for comparison, then run a family taste test. Your one skill: spreading vegetables in a single layer on a pan and using the oven safely, with oven mitts and an adult beside you.

PICTURE STUDY



Still Life with Cabbage and Clogs, Vincent van Gogh, 1881 · Oil on paper, mounted on panel · Van Gogh Museum, Amsterdam

Image: [Wikimedia Commons](#), public domain

This is one of the very first paintings Vincent van Gogh ever made, in the Netherlands in 1881, when he was teaching himself to paint. He chose the plainest things in a poor family's kitchen: a cabbage, some potatoes and a pair of wooden clogs. Cabbage and potatoes were everyday food for Dutch farm families.

Look closely

- Find the cabbage. How did van Gogh show its curling leaves and pale veins?
- Find the potatoes. How many can you count?
- Find the wooden clogs. Why might they be sitting on a kitchen table next to the food?
- Look at the colors. Is this a bright, cheerful painting or a quiet, plain one?

Talk about it

1. Cabbage is in the same family as broccoli and Brussels sprouts, and it can taste bitter to some people. How might a cook make cabbage taste sweeter?
2. A Dutch farm family might eat cabbage and potatoes many times a week. Do you think the children grew to like them? Why?

3. Why do you think a beginning painter would practice by painting vegetables?

Safety first. Use the oven with an adult beside you and wear oven mitts to slide the pan in and out; the pan and the broccoli will be very hot. Use the small knife only with an adult right beside you, and lift the steamer lid away from your face.

Roasted versus Steamed: A Broccoli Taste Test

You will cook broccoli two ways, roasted and steamed, and run a family taste test to see which tastes less bitter and which the family likes better. Then you will start a “try it again” chart for a vegetable you have not liked before.

You will need

- A large rimmed baking sheet, a large bowl, measuring spoons, tongs or a spatula, oven mitts
- A small pot with a lid and a steamer basket (or a microwave-safe bowl with a lid)
- A cutting board with a damp towel underneath and a small knife
- Small plates, toothpicks or forks, and a pencil for the chart

OVEN-ROASTED BROCCOLI WITH PARMESAN

Serves 4–6 • Prep 10 min • Roast 18–22 min

Ingredients

- 2 heads broccoli (about 1½ pounds / 680 g)
- 2 tablespoons olive oil
- ½ teaspoon salt
- ¼ teaspoon black pepper
- 2 tablespoons grated Parmesan cheese
- 1 lemon wedge (optional)
- For the comparison: 1 cup of the broccoli florets, set aside for steaming

Method

1. Wash your hands. With an adult, set the oven rack in the middle and heat the oven to 425 °F (220 °C).
2. Rinse the broccoli under running water and dry it well with a towel; dry broccoli browns better.
3. With an adult right beside you, cut off the thick stem. Cut the head into bite-sized florets, using the claw grip. Peel the stem with a vegetable

peeler and slice it into coins; it is sweet and good to eat.

4. Set aside 1 cup of florets for steaming. Put the rest in a large bowl, add the olive oil, salt and pepper, and toss with your hands until every piece is shiny.
5. Spread the broccoli in a single layer on the baking sheet, cut sides down, with a little space between pieces.
6. With oven mitts on and an adult beside you, slide the pan into the oven. Roast for 10 minutes, then use the mitts to pull the pan out, turn the pieces with tongs, and roast 8–12 minutes more, until the edges are browned and crisp.
7. Sprinkle the hot broccoli with Parmesan and a squeeze of lemon, and serve.

Allergy check: Contains milk (Parmesan). For milk-free broccoli, leave out the Parmesan and add an extra squeeze of lemon or a sprinkle of toasted sesame seeds (sesame is an allergen).

Steps

1. **Steam the comparison batch.** With an adult beside you, put 1 inch of water in a small pot, set the steamer basket inside, and bring it to a boil. Add the reserved florets, cover, and steam for 4–5 minutes, until bright green and just tender. Lift the lid away from your face.
2. Roast the broccoli from the recipe card.
3. **Taste test.** Give each taster one steamed and one roasted floret (without the Parmesan, for fairness) on a plate marked A and B. Ask them to rate each from 1 to 5 for bitterness and from 1 to 5 for how much they like it. Then let them try a roasted piece with Parmesan.
4. Record the results in a chart and compare children's ratings with adults' ratings. Did the children taste more bitterness?
5. Clean up: wash the baking sheet, pot, bowl and board, wipe the counter, and turn off the oven.
6. **Try it again.** Choose one vegetable you do not like yet. Make a chart with 10 boxes. Over the next weeks, taste a small bite of it, cooked a new way when you can, and color in a box each time. Rate it every time. Do your ratings change?

Tips

- Crowded pieces steam instead of browning. Use two pans if one is too full.
- Dry broccoli browns better than wet broccoli, so dry it well after rinsing.
- The most-browned, crispiest pieces usually taste the sweetest.

Check your work

- ☐ I can tell the story of Arthur Fox and explain why children often taste bitterness more strongly.
- ☐ I can explain how taste buds renew and why it can take many tastes to like a new food.
- ☐ I roasted broccoli safely with an adult beside me and ran a fair taste test.

COOK'S NOTEBOOK

1. Draw two plates, roasted broccoli and steamed broccoli, and color them carefully. Under each, write three words that describe its taste and texture.
2. Copy your taste-test chart and write two sentences about what the results show.
3. Start your “try it again” chart for a vegetable you are learning to like, and draw a small picture of it at the top.

From history. Brussels sprouts once tasted more bitter than they usually do today. In the 1990s, scientists in the Netherlands identified the substances that made sprouts bitter, and farmers began growing older, milder varieties and crossing them with the newer, high-yielding ones. Today many people who disliked sprouts as children find they enjoy them roasted.

COMMON MISTAKES

- Deciding you dislike a food after one taste. Most people need many small tastes before a new food becomes familiar.
- Overcooking broccoli until it turns olive-drab and smells of sulfur. Cook it until bright green and just tender, or roast it until browned.
- Making faces or saying “yuck” at the table. Say “I’m still learning to like it,” and thank the cook.

Make it a game • Broccoli Brave Challenge. Taste one small bite of steamed broccoli and one of roasted broccoli, and rate each from one to five. Tell why many children taste bitterness more strongly and how taste buds renew. Then try three bites of a new food over three days and keep a tally. Beat your own rating from the first day.

Scripture. “Doth not the ear try words? and the mouth taste his meat?” (Job 12:11, KJV)

In the King James Bible, “meat” means food of any kind. Just as the ear tests words, the mouth tests food, and both can be trained over time.

3.4 CRUNCHY, CREAMY, CHEWY: TEXTURE

OBJECTIVES

- Describe a food's texture with precise words such as crisp, crunchy, creamy, chewy and tender.
- Explain why crackers go soft and bread goes stale, and how baking makes granola crisp.
- Tell the story of James Caleb Jackson's "Granula," and bake a batch of granola with an adult beside you.

Warm-up. With an adult, set out four foods with very different textures, such as a cracker, a slice of banana, a raisin and a spoonful of yogurt (check allergies first). Taste each one with your eyes closed and describe only how it feels in your mouth, not how it tastes. How many different texture words can you think of?

WATCH

Best Homemade Granola Recipe (Super Easy!).

Jessica Gavin · 7:26

<https://www.youtube.com/watch?v=Zwb4lWeezDE>

WHEN TO WATCH

Watch it all the way through before you bake, then again while you set out your ingredients.

Note: Jessica Gavin is a trained food scientist and cook. Her recipe differs a little from ours; follow the recipe card.

KEY TERMS

texture

How a food feels when you touch, bite and chew it: crisp, soft, creamy, chewy, smooth, lumpy and so on.

mouthfeel

The way a food feels inside the mouth, such as creamy, thick, dry, juicy or fizzy.

crisp

Dry and firm, breaking with a clean snap, like a fresh cracker or a cooled granola cluster.

stale

No longer fresh in texture: crackers that have gone soft from soaking up moisture, or bread that has gone hard and dry.

granola

Rolled oats and other grains, nuts or seeds coated with a little oil and sweetener and baked until crisp.

CORE IDEAS

The story. In 1863 Dr. James Caleb Jackson ran a large health resort called Our Home on the Hillside in Dansville, New York. He believed people should eat more whole grains. He mixed whole-wheat (graham) flour and water into a dough, baked it in thin sheets, broke the sheets into chunks, and baked the chunks again until they were very dry and hard. He called it *Granula*. It was one of the first breakfast cereals in America, and it was so hard that it had to be soaked in milk overnight before anyone could chew it.

How they figured it out. A few years later, Dr. John Harvey Kellogg in Battle Creek, Michigan, made a similar baked cereal from wheat, oats and corn and also called it Granula. When Jackson objected, Kellogg changed the name to *Granola*. Over the next century, cooks learned to make granola less like gravel and more like a treat: they tossed rolled oats with a little oil and honey or maple syrup, added nuts and dried fruit, and baked it just until golden and crisp. The changes were all about texture.

The kitchen science. Texture depends a great deal on water. A **crisp** food, like a cracker or a granola cluster, is dry; it snaps because there is little water holding it together. When a cracker sits out in damp air, it soaks up moisture and goes soft. Bread goes **stale** in a different way: as it sits, the starch in it slowly rearranges itself into firm crystals and pushes water out, so the bread turns hard and crumbly even in a bag. Bread stales fastest in the refrigerator; toasting it softens the starch again for a little while. When granola bakes, the water in the oats and honey evaporates. As it cools, the honey or syrup hardens like candy and glues the oats into crisp clusters. That is why granola is soft when it comes out of the oven and crisp after it cools.

Let's cook. You will bake a batch of granola and make a texture chart, tasting it warm and cooled, and with creamy yogurt and chewy dried fruit. Your one skill: stirring and checking a pan in a hot oven safely, with oven mitts and an adult beside you.

PICTURE STUDY



Still Life with Quince, Cabbage, Melon and Cucumber, Juan Sánchez Cotán, about 1602 · Oil on canvas ·

San Diego Museum of Art, California

Image: [Wikimedia Commons](#), public domain

Juan Sánchez Cotán was a Spanish painter who later became a lay brother in a Carthusian monastery, a community of men devoted to prayer and simple living. In his kitchen windowsill paintings, fruits and vegetables hang on strings to keep them cool and safe from mice. Each one is painted so clearly that you can almost feel its texture.

Look closely

- Find the quince hanging on a string. Is its skin smooth or bumpy?
- Find the cabbage. How did the painter show its crisp, crinkly leaves?
- Find the melon and the slice cut from it. What would its inside feel like to bite?
- Find the cucumber hanging over the edge of the ledge. Describe its skin.

Talk about it

1. Give one texture word for each of the four foods. Which would be crunchiest? Which would be juiciest?
2. Why would a cook hang food on strings in a cool window, long before refrigerators?

3. The foods form a gentle curve from top left to bottom right. Why do you think the painter arranged them that way?

Safety first. Use the oven with an adult beside you and wear oven mitts to pull out the hot pan; hot sugar and oil can burn, so let the granola cool before you taste it. If you add nuts, check for nut allergies first, or use seeds instead.

Homemade Granola and a Texture Chart

You will bake a batch of granola, then taste it warm from the oven and again when it has cooled, and make a texture chart comparing it with creamy yogurt and chewy dried fruit. You will see for yourself how baking and cooling change texture.

You will need

- A large rimmed baking sheet lined with parchment paper, a large bowl, a small bowl or measuring cup
- Measuring cups and spoons, a wooden spoon or spatula, oven mitts and a timer
- An airtight jar or container for storage, small bowls and spoons for tasting

BAKED HONEY GRANOLA

Serves About 5 cups (10 half-cup servings) • Prep 10 min • Bake 25–30 min • Cool 30 min

Ingredients

- 3 cups (270 g) old-fashioned rolled oats
- 1 cup (about 130 g) chopped nuts such as almonds, pecans or walnuts, or pumpkin and sunflower seeds for nut-free granola
- ½ teaspoon ground cinnamon
- ½ teaspoon salt
- ⅓ cup (80 mL) honey or maple syrup
- ¼ cup (60 mL) olive oil or vegetable oil
- 1 teaspoon vanilla extract
- ½ cup (75 g) raisins or dried cranberries, added after baking

Method

1. Wash your hands. With an adult, heat the oven to 325 °F (165 °C) and line the baking sheet with parchment paper.
2. In a large bowl, stir together the oats, nuts or seeds, cinnamon and salt.

3. In a small bowl or measuring cup, stir together the honey or maple syrup, oil and vanilla.
4. Pour the wet mixture over the oats and stir until every oat is lightly coated.
5. Spread the granola evenly on the baking sheet and press it down gently with the back of the spoon.
6. With oven mitts on and an adult beside you, put the pan in the oven. Bake 15 minutes, then pull the pan out, stir the granola, press it down again, and bake 10–15 minutes more, until golden brown. Watch closely near the end; it browns quickly.
7. Set the pan on a cooling rack or the stovetop and let the granola cool completely without stirring, about 30 minutes. It will crisp as it cools.
8. Break it into clusters, stir in the raisins or cranberries, and store in an airtight jar for up to 2 weeks.

Allergy check: Contains tree nuts if made with almonds, pecans or walnuts; use pumpkin and sunflower seeds for nut-free granola. Oats are often processed with wheat; buy oats labeled gluten-free if needed. Contains honey, which must never be given to a baby under one year old; maple syrup works the same way.

Steps

1. Bake the granola from the recipe card.
2. **Warm versus cool.** When the pan comes out of the oven, let it sit 5 minutes, then use a spoon to take a small taste from the edge. Describe the texture. After 30 minutes, taste again. What changed? Write both descriptions.
3. **Texture chart.** Make a chart with columns for crunchy, crisp, chewy, creamy, soft and smooth. Taste plain granola, a raisin, a spoonful of yogurt, and granola stirred into yogurt. Put each food in the right columns. Which column did the granola-and-yogurt bowl land in? (More than one!)
4. **Stale test.** Leave a small handful of granola and two crackers uncovered on a plate overnight, and store the rest of the granola sealed in a jar. The next day, compare the textures. Which went soft? Why?
5. **Clean up:** wash the bowls, spoons and measuring cups, wipe the counter, and recycle or throw away the parchment.

6. **Improve it.** Make a second batch and change one thing to change the texture: more honey for bigger clusters, or a few minutes less baking for a chewier granola. Record what happened.

Tips

- For big clusters, press the granola down before baking and let it cool completely before breaking it up.
- Add dried fruit after baking; baked raisins turn hard and bitter.
- If the edges brown faster than the middle, stir the edges toward the center when you stir halfway.

Check your work

- ☐ I can describe textures with at least six different words.
- ☐ I can explain why crackers go soft, why bread goes stale, and why granola crisps as it cools.
- ☐ I baked granola safely with an adult beside me and made a texture chart.

COOK'S NOTEBOOK

1. Draw a granola cluster close up, as if under a magnifying glass, and label the oats, nuts or seeds and the honey “glue.”
2. Copy your texture chart and add three more foods from your kitchen.
3. Write the granola recipe in your own words, with the change you would make next time and why.

From history. Dr. Jackson's Granula was sold by mail in small packages, and some people say it was the first ready-to-eat cold breakfast cereal in America. Granola became popular again in the 1960s and 1970s, when cooks began making the toasted, sweetened kind most people know today.

COMMON MISTAKES

- Stirring granola while it cools, which breaks it into small crumbs. Let it cool undisturbed for clusters.
- Storing bread in the refrigerator to keep it fresh. The cold makes it stale faster; keep it at room temperature or freeze it.
- Leaving crackers or granola open to the air. Seal them so they cannot soak up moisture.

Make it a game • Texture Word Duel. Take turns picking foods from the pantry, such as crackers, oats, jam, and a pickle. Describe each with a different texture word: crisp, crunchy, creamy, chewy, tender. You cannot repeat a word your partner used. First to run out of words loses the round. Then explain why crackers go soft and how baking makes granola crisp.

Scripture. “he reached her parched corn, and she did eat, and was sufficed, and left.” (Ruth 2:14, KJV)

Parched corn was roasted grain, crunchy and filling, much like toasted oats. Boaz shared it generously with Ruth, a stranger, at his table.

UNIT 3

TASTE, SMELL & YOUR TASTE BUDS

“O taste and see that the LORD is good.” God gave us mouths that can tell sweet from sour and noses that can tell a ripe strawberry from a green one. In this unit you will become a scientist of your own senses. You will meet Kikunae Ikeda, the Japanese chemist who discovered the fifth basic taste, umami, in a bowl of seaweed broth, and you will find out why the famous “tongue map” in old textbooks was wrong all along.

You will learn why most of what we call flavor is really smell, why children taste bitterness more strongly than grown-ups, and why a vegetable you disliked last year may taste better this year if you keep trying it. Finally you will explore texture, crunchy, creamy and chewy, and make your own granola. Every taste test in this unit is done with thankfulness, good manners and a check for allergies first.

PREREQUISITES

- Follows Clean, Separate, Cook, Chill and the 2-hour rule (Unit 1)
- Knows the five food groups (Unit 2)
- Uses the stove and oven with an adult beside, with pot handles turned in

MASTERY CHECKLIST

- ☐ I can name the five basic tastes and give a food for each.
- ☐ I can tell how Kikunae Ikeda discovered umami.
- ☐ I can explain why the tongue map is a myth and why most flavor comes from smell.
- ☐ I can explain why tastes change as we grow and why trying a food many times helps.
- ☐ I can describe a food’s texture with good words and run a fair taste test.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **A set of small tasting cups or a muffin tin:** Inexpensive. Handy for the five-tastes tray, the jelly-bean smell test and the blind taste tests in this unit.
- **A blindfold or clean scarf:** For fair blind taste tests in Lessons 3.2–3.4 and the unit challenge.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

3.1 Kikunae Ikeda and the Fifth Taste

2 sessions of 45–60 minutes

3.2 Your Nose Knows: Smell, Flavor and the Tongue-Map Myth

2 sessions of 45–60 minutes

3.3 Taste Buds Change: Why Broccoli Gets Better

2 sessions of 45–60 minutes

3.4 Crunchy, Creamy, Chewy: Texture

2 sessions of 45–60 minutes

UNIT 3 REVIEW

Answer each question in complete sentences unless it asks for a list. The review is worth 50 points.

1. **5 pts**

Name the five basic tastes and give one food for each.

2. **5 pts**

How did Kikunae Ikeda discover umami?

3. **5 pts**

What was the tongue map, and why is it wrong?

4. **5 pts**

Predict: you pinch your nose and eat a piece of apple, then a piece of pear. What will you notice, and why?

5. (5 pts)

What is retronasal smell?

6. (5 pts)

What did Arthur Fox discover in 1931?

7. (5 pts)

Give two reasons a child might dislike broccoli now but like it later.

8. (5 pts)

Why does roasted broccoli often taste sweeter than boiled or steamed broccoli?

9. (5 pts)

Predict: you leave a bowl of crackers uncovered overnight on a humid night.

What will happen to their texture, and why?

10. (5 pts)

Why is granola soft when it comes out of the oven but crisp after it cools?

ANSWER KEY

1. Sweet (honey), salty (pretzels), sour (lemon), bitter (grapefruit peel or unsweetened chocolate), umami (broth, Parmesan, tomatoes). Other correct foods accepted.
2. In 1908 he noticed a savory taste in kombu broth that was not sweet, salty, sour or bitter. He separated the substances in the broth and found glutamic acid (glutamate), which had the same taste, and he named the taste umami.
3. A diagram showing each part of the tongue sensing only one taste. It came from a misreading of Hänig's 1901 data in Boring's 1942 graph. Every part of the tongue with taste buds senses all five tastes.
4. They will taste much alike, mostly sweet, because pinching the nose blocks the aromas that travel from the mouth to the nose. Most of flavor comes from smell.
5. Smelling food from inside the mouth: aromas travel up the back of the throat into the nose while you chew and breathe out.
6. That people differ in their ability to taste some bitter compounds: the PTC dust tasted very bitter to his coworker but had almost no taste to him.
7. Children taste bitterness more strongly than most adults, and sensitivity lessens with age; tastes are learned, and after many small tastes (often 8–15) a food becomes familiar and liked. Cooking it differently, such as roasting, also helps.
8. The dry heat of the oven browns the outside, and browning creates sweet, nutty flavors that balance the bitterness. Long boiling or steaming can release sulfur smells instead.
9. They will turn soft and lose their crispness, because they soak up moisture from the air.
10. While hot, the honey or syrup is soft and runny. As it cools, it hardens like candy and glues the dry oats into crisp clusters.

UNIT CHALLENGE: THE FAMILY BLIND TASTE TEST

Choose one food and prepare it three different ways, for example carrots raw, steamed and roasted, or potatoes boiled, mashed and roasted. Check allergies, then run a fair blind taste test with at least four family members: blindfold each taster, serve the three versions in a random order on plates marked A, B and C, and ask them to rate each for taste and texture from 1 to 5.

Make a results chart and a bar graph, and write a paragraph about which version won and why you think it did. Finish with a “try it again” plan for a vegetable someone in the family does not yet like: how you will cook it, and when you will offer small tastes over the next month.

LOOK FOR	WHAT IT MEANS
Fair test	Three versions of the same food, a blindfold, random order and the same questions for every taster.
Cooking and safety	The food was cooked safely with an adult beside, and the kitchen was cleaned afterward.
Results chart and graph	Ratings recorded clearly for every taster, with a neat bar graph.
Explanation	A paragraph that uses words from this unit (bitter, aroma, texture, browning) to explain the results.
Try-it-again plan	A thoughtful plan with dates for offering a disliked vegetable several more times, cooked in different ways.

UNIT 4

HEAT & COLD

Cooking is the art of moving heat into food, and keeping food is the art of moving heat out of it. In this unit you will learn the three ways heat travels, conduction, convection and radiation, from Count Rumford, the American-born scientist who built better stoves and cooked nourishing soup for the poor of Munich. You will learn why water boils at 212 °F at the seashore but at a lower temperature on a mountain, and how Denis Papin trapped steam in a sealed pot to cook hotter than boiling.

Then you will turn to cold and to keeping food. You will meet Nicolas Appert, the French confectioner who sealed food in glass jars and won a prize from his government, and Clarence Birdseye, who watched fish freeze in an instant on the Labrador ice and invented fast-frozen food. Along the way you will make pancakes, pasta with tomato sauce, quick refrigerator pickles and frozen yogurt bark, and finish with a big experiment: one potato, four heats.

PREREQUISITES

- Uses a food thermometer and knows the danger zone (Unit 1)
- Uses the stove and oven with an adult beside, handles turned in, oven mitts on
- Can read a thermometer in °F and knows that water freezes at 32 °F

MASTERY CHECKLIST

- ☐ I can explain conduction, convection and radiation and find each one in my kitchen.
- ☐ I can tell the difference between boiling, simmering and steaming, and explain why water boils at a lower temperature on a mountain.
- ☐ I can explain how heat, sealing, cold, acid, salt and drying keep food from spoiling.
- ☐ I can tell the stories of Count Rumford, Denis Papin, Nicolas Appert and Clarence Birdseye.
- ☐ I can cook a food four ways and compare the time, texture and taste.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **National Center for Home Food Preservation**: Free. The University of Georgia’s trusted, tested guide to canning, pickling, freezing and drying at home. If your family ever wants to can food for the shelf, use only tested recipes like these, with an adult.
- **A food thermometer that reads up to 220 °F or more**: The same instant-read thermometer from Unit 1. Used in Lesson 4.2 to measure boiling and simmering water.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

4.1	Count Rumford’s Kitchen	2 sessions of 45–60 minutes
4.2	Boiling, Simmering and Steaming	2 sessions of 45–60 minutes
4.3	Nicolas Appert and the Sealed Jar	2 sessions of 45–60 minutes
4.4	Clarence Birdseye and Fast Freezing	2 sessions of 45–60 minutes

UNIT 4 REVIEW

Answer each question in complete sentences unless it asks for a number or a list. The review is worth 50 points.

1. **5 pts**

Name the three ways heat travels and give a kitchen example of each.

2. **5 pts**

How did Count Rumford make kitchens use less fuel?

3. **5 pts**

Predict: your pancake comes out dark brown on the outside but runny in the middle. What should you change, and why?

4. (5 pts)

At what temperature does water boil at sea level? Why does it boil at a lower temperature in Denver?

5. (5 pts)

Predict: water is boiling hard and you turn the burner up to high. Will the water get hotter? Explain.

6. (5 pts)

What did Denis Papin's steam digester do, and why did it need a safety valve?

7. (5 pts)

Describe Appert's method, and explain why it worked (as Pasteur later showed).

8. (5 pts)

Name four ways to preserve food and tell what each does to microbes.

9. (5 pts)

What did Clarence Birdseye notice in Labrador, and what did he invent?

10. (5 pts)

Predict: you freeze one bag of strawberries slowly and one quickly, then thaw both. Which will be mushier, and why?

ANSWER KEY

1. Conduction (a hot pan heating a pancake), convection (hot air circling in an oven or water rising in a pot), radiation (heat from a broiler, toaster or campfire). Other good examples accepted.
2. He built enclosed brick ranges, with each pot set snugly into its own opening over its own small fire and flue, so the heat went into the food instead of up the chimney.
3. Turn the heat down. The griddle is too hot, so the outside browns before heat has time to conduct into the center.
4. 212 °F (100 °C). Denver is high up, with less air pressure pressing down, so water boils at a lower temperature, about 202 °F.
5. No. Boiling water stays at its boiling point; the extra heat only turns more water into steam faster.
6. It trapped steam in a sealed pot so the pressure rose and the water got hotter than its normal boiling point, cooking food faster (softening even bones). The safety valve let out steam if the pressure grew so high it might burst the pot.
7. He sealed food tightly in glass jars with cork, wire and wax, then heated the jars in boiling water. The heat destroyed the microbes, and the seal kept new ones out.
8. Any four: canning (heat destroys them and the seal keeps others out); refrigerating (cold slows them); freezing (stops their growth); drying (takes away water); salt or sugar (draws out water); acid such as vinegar (too sour for most to grow).
9. Fish caught by Inuit fishermen froze almost instantly in the very cold air and tasted nearly fresh months later. He invented machines to fast-freeze packaged food between very cold metal plates, and started selling frozen foods in 1930.
10. The slowly frozen berries, because slow freezing makes large ice crystals that pierce the cell walls, so the berries leak juice and turn soft when thawed.

UNIT CHALLENGE: ONE POTATO, FOUR HEATS

Cook the same vegetable four ways and compare them: boil, roast, microwave and pan-fry potato pieces of the same size (or another firm vegetable, such as carrots or sweet potatoes). Cut four equal batches of 1-inch cubes with an adult beside you. Boil one batch, roast one at 425 °F, microwave one in a covered dish with a spoonful of water (with an adult nearby), and pan-fry one in a thin film of oil with an adult beside you.

For each method, name the main way heat moved (conduction, convection or radiation), and record the cooking time, the color, the texture and a family taste rating. Make a results chart and write a paragraph explaining which method your family liked best and why, using what you learned in this unit.

LOOK FOR	WHAT IT MEANS
Fair test	The same vegetable, cut into equal pieces, cooked four different ways, with a little salt added the same way to each.
Safety	Knife, stove, oven and microwave steps done with an adult beside or nearby, with a thin film of oil only, handles turned in and oven mitts used.
Observations	Times, colors, textures and ratings recorded clearly for all four methods.
Science explanation	Each method is matched to conduction, convection or radiation, and the results are explained in the student's own words.
Cleanup and effort	Kitchen left clean, with a careful, cheerful attitude throughout.

4.1 COUNT RUMFORD'S KITCHEN

OBJECTIVES

- Tell how Count Rumford studied heat, built fuel-saving kitchen stoves and fed the poor of Munich.
- Explain conduction, convection and radiation, and find each one in your kitchen.
- Cook pancakes on a griddle with an adult beside you and use the first-pancake test to adjust the heat.

Warm-up. Find three ways heat moves in your kitchen right now. Hold your hand near (not on) a warm toaster or a sunny window; stir a cup of hot cocoa with a metal spoon and feel the handle; watch steam rise from a kettle. For each, write: where is the heat coming from, and how is it getting to you?

WATCH

Heat | Conduction, Convection, Radiation | Science for Kids

Little School • 3:32

<https://www.youtube.com/watch?v=V2NP-aSl1kM>

WHEN TO WATCH

After the story of Count Rumford, before the kitchen science. Pause at each of the three ways heat moves and find an example in your kitchen.

KEY TERMS

conduction

Heat moving through something solid, or between two things that touch, such as from a hot pan into a pancake.

radiation

Heat that travels as invisible rays through the air, such as the heat from a broiler, a campfire or the sun.

convection

Heat carried by a moving liquid or gas, such as hot air circling in an oven or hot water rising in a pot.

griddle

A flat, heavy pan or cooking surface with low or no sides, used for pancakes, eggs and toast.

fuel

Something burned to make heat, such as wood, coal or gas.

CORE IDEAS

The story. Benjamin Thompson was born in 1753 on a farm in Woburn, Massachusetts. As a young man he went to Europe and became a soldier, a statesman and a scientist in the service of the ruler of Bavaria, in what is now Germany, who made him a count. He took the name **Count Rumford**. In 1790 the city of Munich was full of hungry beggars. Rumford set up a great workhouse where poor people could earn their keep, and he set out to feed hundreds of them every day, as cheaply and nourishingly as possible.

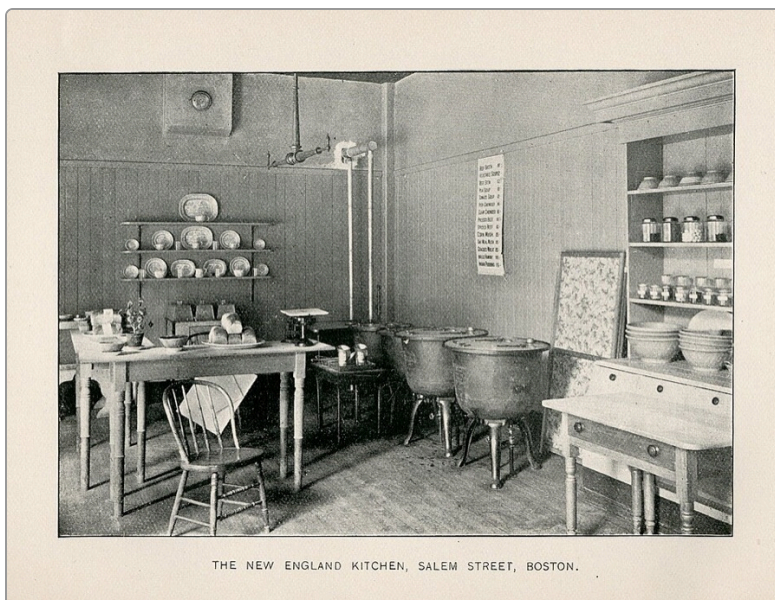
How he figured it out. Rumford watched the kitchen fires and saw that most of the heat went straight up the chimney. Open fireplaces with big pots hung over them wasted most of their wood. So he built enclosed brick ranges, with each pot set snugly into its own opening over its own small fire and its own little flue, so the heat went into the food instead of into the room. He reported that his kitchens used a small fraction of the fuel of the old ones. He also worked out a cheap, filling soup of pearl barley, dried peas, potatoes and bits of bread, simmered for hours. In 1798, while watching cannon barrels being bored out, he noticed that the metal grew hot enough to boil water as long as the boring went on, and he argued that heat is a kind of motion, not an invisible fluid, as most scientists then believed. He was right.

The kitchen science. Heat always moves from hotter things to cooler things, in three ways. **Conduction** is heat passing through something solid or between things that touch: the burner heats the pan, and the pan heats the pancake. Metals conduct heat well; wood and plastic conduct poorly, which is why spoon and pan handles are often made of them. **Convection** is heat carried by moving liquid or air: in a pot, hot water rises and cool water sinks, and in an oven, hot air circles around the food. **Radiation** is heat that travels as invisible rays: the glow of a broiler, a toaster or a campfire warms the food without touching it. Most cooking uses all three, but one is usually the main one. Pancakes are mostly conduction.

Let's cook. Pancakes are a perfect conduction experiment. If the griddle is too cool, the first pancake is pale and flat; if it is too hot, it burns outside before the inside sets. Cooks call this the *first-pancake test*: cook one, look at it, and adjust the heat.

Your one skill: reading the griddle's heat with a few drops of water and adjusting the burner, with an adult beside you.

PICTURE STUDY



*The New England Kitchen, Salem Street, Boston, Unknown photographer, 1890s (published 1899) · Photograph, printed in the *Rumford Kitchen Leaflets* · Boston, Massachusetts*

Image: [Wikimedia Commons](#), public domain

About a hundred years after Count Rumford fed the poor of Munich, a chemist named Ellen Swallow Richards and her friends opened the New England Kitchen in Boston in 1890. Following Rumford's ideas, they cooked nourishing soups, stews and porridges slowly and cheaply in closed, fuel-saving cookers and sold them to working families to carry home. A model kitchen named for Rumford was shown at the Chicago World's Fair in 1893, and in 1899 they published a set of booklets called the *Rumford Kitchen Leaflets*, where this photograph appeared.

Look closely

- Find the large round kettles standing on legs along the wall. How are they different from an open pot hanging over a fire?
- Find the scales on the table. Why would a kitchen feeding many people weigh its food?
- Find the printed list hanging on the wall. What do you think it shows?
- Look for anything that shows this kitchen was kept clean and orderly.

Talk about it

1. Rumford wanted heat to go into the food, not up the chimney. How do closed kettles like these save fuel?
2. Which way of heat moving (conduction, convection or radiation) do you think is most important inside a covered kettle of soup?
3. Why might a family in 1890 buy hot soup from a kitchen like this instead of cooking it at home?

Safety first. An adult stands beside you at the stove; keep the pan handle turned in, use a wide spatula, and keep your hand and sleeve away from the hot griddle. Never taste raw pancake batter, because uncooked flour and eggs can carry germs.

The First-Pancake Test

You will make a batch of pancakes and use them as a heat experiment, adjusting the griddle until each pancake comes out golden and cooked through. You will also find conduction, convection and radiation in your own kitchen.

You will need

- A large bowl, a medium bowl, a whisk, measuring cups and spoons, a ¼-cup measure for pouring
- A griddle or large nonstick skillet, a wide spatula, a plate and a clean towel to keep pancakes warm
- A metal spoon, a wooden spoon and a cup of hot water for the conduction test

FLUFFY GRIDDLE PANCAKES

Serves 4 (about 12 pancakes, 4 inches across) · Prep 10 min · Cook 20 min

Ingredients

- 1½ cups (190 g) all-purpose flour
- 2 tablespoons sugar
- 2 teaspoons baking powder
- ½ teaspoon salt
- 1¼ cups (300 mL) milk
- 1 large egg
- 3 tablespoons butter, melted and cooled a little, or vegetable oil
- 1 teaspoon vanilla extract
- A little butter or oil for the griddle
- To serve: maple syrup, fruit or yogurt

Method

1. Wash your hands. In the large bowl, whisk the flour, sugar, baking powder and salt.

2. In the medium bowl, whisk the milk, egg, melted butter and vanilla. Wash your hands after cracking the egg.
3. Pour the wet mixture into the dry mixture and stir gently with the whisk just until no dry flour shows. A few lumps are fine; over-mixing makes tough pancakes. Let the batter rest 5 minutes.
4. With an adult beside you, heat the griddle over medium heat for 3–4 minutes, handle turned in. Test it: flick a few drops of water onto it. If they sit and steam, it is too cool; if they dance and skitter across, it is ready; if they vanish instantly with smoke, it is too hot.
5. Brush the griddle with a thin film of butter or oil. Pour $\frac{1}{4}$ cup of batter for each pancake, leaving space between them.
6. Cook until bubbles appear and pop on top and the edges look dry, about 2 minutes. Slide the spatula under and flip in one quick motion. Cook 1–2 minutes more, until golden underneath.
7. Move the pancakes to a plate and cover them with a clean towel. Repeat with the rest of the batter, adjusting the heat as needed.
8. Serve with syrup and fruit. Refrigerate leftover pancakes within 2 hours; they freeze well.

Allergy check: Contains wheat, milk and eggs. For milk-free pancakes, use oat milk or soy milk (soy is an allergen) and oil instead of butter.

Steps

1. **Conduction test.** Put a metal spoon and a wooden spoon in a cup of hot tap water. After 1 minute, touch the handles. Which got warm? Why?
2. Make the batter from the recipe card and do the water-drop test on the griddle. Write down what the drops did.
3. **The first-pancake test.** Cook the first pancake and look closely at both sides. Pale and flat? Turn the heat up a little. Dark brown outside but wet inside? Turn the heat down. Record the color of each of your first three pancakes and what you changed.
4. **Find all three.** While the pancakes cook, find and write down one example of conduction (pan to pancake), one of convection (steam rising, or hot air

above the griddle) and one of radiation (heat you feel on your hand held above, not on, the griddle).

5. Clean up: let the griddle cool before washing it, wash the bowls and whisk, and wipe up any drips of batter.
6. **Improve it.** Make pancakes again another morning and add blueberries or sliced banana to each pancake right after you pour it. Did they cook differently?

Tips

- Lumpy batter makes tender pancakes. Stop stirring as soon as the flour disappears.
- Most stoves cook pancakes best at medium or a little lower. Heavy pans hold an even heat.
- Flip each pancake only once.

Check your work

- ☐ I can tell how Count Rumford built stoves that put heat into food instead of up the chimney.
- ☐ I can explain conduction, convection and radiation and give a kitchen example of each.
- ☐ I used the water-drop test and the first-pancake test to set the heat, with an adult beside me.

COOK'S NOTEBOOK

1. Draw a pot of soup on a stove and use arrows of three colors to show conduction (burner to pot), convection (water circling in the pot) and radiation (heat glowing from the flame).
2. Draw your first three pancakes side by side, color them carefully, and write what you changed each time.
3. Copy the pancake recipe in your own words and add one tip you learned.

From history. Count Rumford also designed a shallower, angled fireplace that threw more heat into the room and sent less smoke back down the chimney; “Rumford fireplaces” are still built today. In 1799 he helped found the Royal Institution in London, where scientists like Michael Faraday later did their famous work. A version of the House of Industry soup was cooked at soup kitchens in many cities for decades afterward.

COMMON MISTAKES

- Tasting raw batter. Uncooked flour and eggs can carry germs; wait until the pancakes are cooked.
- Cooking pancakes on high heat. They burn outside before they cook inside.
- Pressing pancakes flat with the spatula after flipping, which squeezes out the air and makes them dense.

Make it a game • Three Ways Heat Travels. Find a spot in the kitchen for conduction, convection and radiation, and walk to each one, saying how heat moves. For example, a pan handle, a boiling pot or an oven rack. Your parent names an object and you point to the right kind. Then tell how Count Rumford fed the poor of Munich with his fuel-saving stove.

Scripture. “And he looked, and, behold, there was a cake baken on the coals, and a cruse of water at his head.” (1 Kings 19:6, KJV)

God fed the tired prophet Elijah with a cake baked on hot coals: cooking by conduction and radiation, in the wilderness, as a gift of care.

4.2 BOILING, SIMMERING AND STEAMING

OBJECTIVES

- Tell how Denis Papin's steam digester of 1679 trapped steam to cook hotter than boiling, the first pressure cooker.
- Explain why water boils at 212 °F at sea level and at a lower temperature on a mountain, and tell boiling, simmering and steaming apart.
- Cook pasta al dente, testing it every minute, and make a quick tomato sauce, with an adult beside you.

Warm-up. With an adult, put a small pot of water on the stove and watch it heat. Write down what you see at each stage: tiny bubbles on the bottom, wisps of steam, small bubbles rising, big rolling bubbles. Predict: if you turn the burner up higher after the water is boiling hard, will the water get hotter?

WATCH

Boiling Water On Mount Everest! | Earth Science

BBC Earth Science · 3:28

<https://www.youtube.com/watch?v=8lyqFkFsH28>

WHEN TO WATCH

After the kitchen science paragraph. Predict the boiling temperature before each measurement is shown.

Note: A BBC presenter measures boiling water at different heights in Nepal on the way to Mount Everest.

KEY TERMS

boiling point

The temperature at which a liquid boils. Water boils at 212 °F (100 °C) at sea level.

simmer

To cook in liquid that is just below boiling, with small, gentle bubbles rising now and then, about 185–205 °F.

steam

Water that has turned into a gas. Steam is invisible; the white cloud you see is tiny droplets of water condensing in the cooler air.

pressure

How hard something pushes on a surface. The air around us presses on everything; higher pressure raises the boiling point.

al dente

Italian for “to the tooth”: pasta cooked until tender but still slightly firm in the center when you bite it.

CORE IDEAS

The story. Denis Papin was a French scientist born in 1647 who went to London to work with the chemist Robert Boyle on experiments with air and pressure. In 1679 he built a heavy iron pot with a lid clamped down so tightly that no steam could escape. He called it a “steam digester.” Papin showed that his digester could soften even hard beef bones into a jelly, something no ordinary pot could do. In 1682 he cooked a whole supper in it for members of the Royal Society, England’s great club of scientists.

How he figured it out. Papin knew from his work with Boyle that pressure changes how things behave. In an open pot, water cannot get hotter than its boiling point, because as soon as it reaches that temperature it turns into steam and escapes. In his sealed digester the steam could not escape, so it pressed harder and harder on the water, and the water could get much hotter before boiling. Hotter water cooked food faster and more completely. But trapped steam is powerful; the pressure could burst the pot. So Papin added a **safety valve**: a weighted lever over a small hole that let steam out if the pressure grew too high. Every pressure cooker today still has one, and his work with steam helped lead to the steam engine.

The kitchen science. Water **boils** at 212 °F (100 °C) at sea level. Once it is boiling, turning the burner higher makes it boil faster but not hotter; the extra heat just turns more water into steam. High on a mountain, there is less air pressing down, so water boils at a lower temperature: about 1 °F lower for every 500 feet you climb, about 202 °F in Denver, Colorado, a mile high. That is why pasta and beans take longer to cook in the mountains. A pressure cooker does the opposite, raising the boiling point to about 250 °F. **Simmering** (small, lazy bubbles) is gentler than a full

boil and is used for soups and sauces. **Steaming** cooks food in the steam above boiling water. Steam can cause bad burns, because when it touches your skin it turns back into water and gives up a great deal of heat all at once.

Let's cook. Pasta is made mostly of starch. In boiling water, the starch soaks up water and swells, and the pasta softens from the outside in. You will cook spaghetti or penne and test it every minute until it is al dente, while a tomato sauce simmers beside it. Your one skill: telling a boil from a simmer and adjusting the burner, with an adult beside you.

PICTURE STUDY



A Copper Cauldron, a Pestle and Mortar, a Stoneware Jug, Eggs and a Spring Onion on a Ledge, Jean-Siméon Chardin, about 1750 · Oil on canvas · Private collection

Image: [Wikimedia Commons](#), public domain

Chardin painted many small pictures of kitchen things: pots, jugs, eggs and onions, waiting quietly for the cook. Here the great copper pot is the center of the picture. In Chardin's day, cooks boiled and simmered almost everything in pots like this over an open fire.

Look closely

- Find the copper pot. Look at its lid and its long handle. How would a cook lift it off the fire?
- Find the eggs. How might they be cooked in the pot?
- Find the wooden mortar and pestle. What could a cook crush in it before adding it to the pot?
- Look at how the light shines on the copper. Where do you see the brightest spot?

Talk about it

1. Copper conducts heat very well. Why would cooks want a pot made of copper?
2. The lid sits on top of the pot. How does a lid help water come to a boil faster?

3. If you boiled these eggs at the foot of a mountain and at the top, which would take longer to cook, and why?

Safety first. An adult stands beside you at the stove and does the draining, pouring the heavy pot of boiling water into a colander in the sink. Keep pot handles turned in, lift lids away from your face, and never reach across a pot of boiling water or steam.

The Boiling Point and the Al Dente Test

You will measure the temperature of simmering and boiling water with your food thermometer, then cook pasta and test it every minute to find the moment it is al dente, while a quick tomato sauce simmers beside it.

You will need

- A large pot (at least 5 quarts) and a medium saucepan with a lid
- A wooden spoon, a slotted spoon or tongs, a colander in the sink, a ladle and a timer
- A cutting board with a damp towel underneath and a small knife or a garlic press
- Your food thermometer, a small plate and a fork for testing

PASTA WITH QUICK TOMATO SAUCE

Serves 4–6 • Prep 10 min • Cook 25 min

Ingredients

- 1 pound (450 g) spaghetti or penne
- 4 quarts (about 4 liters) water and 1 tablespoon salt for the pasta
- Sauce: 2 tablespoons olive oil
- 2 cloves garlic, minced or pressed
- 1 can (28 ounces / 794 g) crushed tomatoes
- 1 teaspoon dried basil or oregano
- ½ teaspoon salt
- ½ teaspoon sugar
- Grated Parmesan cheese, for serving

Method

1. Wash your hands. With an adult beside you, fill the large pot with 4 quarts of water, set it on a back burner with the handles turned in, cover it, and heat on high.

2. Make the sauce while the water heats: warm the olive oil in the saucepan over medium-low heat. Add the garlic and stir for 1 minute, just until it smells good; do not let it brown.
3. Add the crushed tomatoes, basil, salt and sugar. Stir, and when it begins to bubble, turn the heat to low so it simmers gently. Partly cover it (it spatters) and simmer 15–20 minutes, stirring now and then.
4. When the water is at a full rolling boil, add 1 tablespoon salt. With an adult beside you, add the pasta and stir right away so it does not stick. Keep it boiling, uncovered, and stir every few minutes.
5. Start testing 3 minutes before the time on the package: every minute, lift out one piece with a slotted spoon or tongs, let it cool on a plate, and bite it. It is done when it is tender but still a little firm in the very center.
6. Before draining, an adult scoops out ½ cup of the cooking water with a mug. Then the adult carefully pours the pasta into the colander in the sink, tilting the pot away from both of you so the steam rises away.
7. Return the pasta to the pot, add the sauce, and toss, adding a splash of the cooking water if it seems dry. Serve with Parmesan. Refrigerate leftovers within 2 hours.

Allergy check: Contains wheat (pasta) and milk (Parmesan). Use gluten-free pasta for wheat-free, and leave off the Parmesan for milk-free. Some fresh pastas contain eggs; check the label.

Steps

1. **Boiling-point test.** Before the pasta goes in, with an adult beside you, measure the temperature of the water at a simmer and again at a full rolling boil, holding the thermometer probe in the water (not touching the pot) with an oven mitt on. Record both. Then turn the burner up higher for 2 minutes and measure again. Did the temperature go up?
2. Cook the pasta and sauce from the recipe card.
3. **The al dente test.** Make a table with columns for minutes, what the center of the pasta looks like when you bite it (a white dot or line of uncooked starch?) and how it feels. Keep one piece from each minute on a plate in a row, so you can see the change.
4. Taste a piece that is past al dente (cook one extra minute). How is it different?

5. Clean up: let the pots cool, then wash them with the colander and spoons, wipe the stove (sauce spatters!) and the counter.
6. **Improve it.** Next time, add a vegetable to the sauce, such as a handful of spinach stirred in at the end or chopped zucchini simmered with the tomatoes, and note how it changes the cooking time.

Tips

- Use plenty of water so the pasta can move and the water comes back to a boil quickly.
- Do not add oil to the pasta water; it makes the sauce slide off the pasta.
- A little starchy pasta water helps the sauce cling to the pasta.

Check your work

- ☐ I can tell how Papin's steam digester and its safety valve worked.
- ☐ I measured simmering and boiling water and can explain why a higher flame does not make boiling water hotter.
- ☐ I cooked pasta al dente by testing it every minute, and an adult drained it safely.

COOK'S NOTEBOOK

1. Draw three pots side by side: one simmering, one at a rolling boil, one with a steamer basket of broccoli. Label the bubbles, the steam and the temperature of each.
2. Draw a mountain with water boiling at its foot (212 °F), halfway up and at the top. Label each with an estimated boiling temperature.
3. Copy your al dente table and tape in a drawing of your row of pasta pieces.

From history. Papin later built a model steam-powered boat and designed one of the first engines that used steam to push a piston. He spent his last years in London and died there, poor and nearly forgotten, around 1712. Today he is remembered as a pioneer of the steam engine and the inventor of the pressure cooker and the safety valve.

COMMON MISTAKES

- Thinking a harder boil means hotter water. Once it boils, water stays at its boiling point; more heat only makes more steam.

- Opening a lid toward your face or reaching over a boiling pot. Steam burns are serious.
- Letting a tomato sauce boil hard. It spatters and can scorch on the bottom; keep it at a gentle simmer.

Make it a game · Bubble Level Charades. Act out three levels of bubbling water: steaming, a simmer, and a full boil, using your hands and sound effects. Your parent guesses which one it is. Then explain why water boils at 212 degrees at sea level but lower on a mountain, and what Denis Papin's steam digester did in 1679.

4.3 NICOLAS APPERT AND THE SEALED JAR

OBJECTIVES

- Tell how Nicolas Appert invented a way to preserve food in sealed jars, and how Pasteur later explained why it worked.
- Explain how heat, sealing, acid, salt, sugar, drying and cold each keep microbes from spoiling food.
- Make quick refrigerator pickles and observe how acid and salt change a cucumber.

Warm-up. Look through your pantry and refrigerator for foods that have been preserved: canned, pickled, dried, salted, sugared or frozen. Make a list with one example of each way you find. Which is the oldest-looking package? How long do you think each food will keep?

WATCH

The Science of Canning. | Year-Round Gardening

wpsu · 3:15

<https://www.youtube.com/watch?v=9MN9X-pnjaY>

WHEN TO WATCH

After the story of Appert, before you make the pickles.

Note: Rick Kralj of Penn State Extension explains why heat and acid make canned food safe. The video opens with a short sponsor credit.

BACKUP VIDEO

How Does Canned Food Last So Long? | Earth Science

BBC Earth Science · 3:56

<https://www.youtube.com/watch?v=a0hxrGp1IJl>

KEY TERMS

preserve

To treat food so it keeps for a long time without spoiling.

canning

Sealing food in jars or cans and heating it long enough to destroy the microbes inside, so that it keeps on the shelf.

pickle

To preserve food in an acid, usually vinegar, or in salty water called brine.

brine

Water with salt dissolved in it, sometimes with vinegar, sugar and spices, used for pickling.

acid

A sour substance, such as vinegar or lemon juice. Strong acid keeps most harmful bacteria from growing.

CORE IDEAS

The story. Nicolas Appert was born in 1749 in Châlons, France, the son of an innkeeper. He became a confectioner, a maker of candies and sweets, in Paris. In his day, soldiers on long marches and sailors on long voyages lived for months on salted meat and hard, dry biscuit, and many grew sick for lack of fresh food. Around 1795 Appert began trying to find a way to keep foods like vegetables, fruit, soups and milk tasting nearly fresh for months.

How he figured it out. Appert worked by careful trial for about fifteen years, without knowing anything about microbes. He packed food into thick glass bottles and jars, sealed them tightly with corks held down with wire and wax, and then set the sealed jars in a big kettle of boiling water for a measured time, different for each food. He kept records of what worked. The French navy tested his jars on long voyages and found the food still good after months at sea. In 1810 the French government awarded him 12,000 francs, and in return he published his method in a book, *The Art of Preserving All Kinds of Animal and Vegetable Substances for Several Years*, for anyone to use. Appert did not know *why* his method worked. About fifty years later, Louis Pasteur showed that heat destroys the microbes that cause spoiling, and the seal keeps new ones from getting in.

The kitchen science. Microbes need warmth, water, food and time to grow. Every way of preserving food takes away one or more of those. **Canning** destroys microbes with heat and seals the jar so no more get in. **Cold** slows them (the refrigerator) or stops them (the freezer). **Drying** takes away their water, as in raisins, jerky and dried beans. **Salt and sugar** pull water out of food and out of microbes, which is why jam and salted fish keep. **Acid**, like vinegar, makes food too sour for most harmful

bacteria to grow. In a pickle, salt draws water out of the cucumber, and the vinegar brine soaks in; the acid also turns the bright green skin a dull olive color.

Let's cook. Safe home canning for the shelf requires tested recipes, special equipment and an adult, so today you will make **quick refrigerator pickles** instead. They are not sealed or heat-processed, so they must always be kept in the refrigerator. Your one skill: dissolving salt and sugar in a hot brine and pouring it safely, with an adult doing the pouring.

PICTURE STUDY



Still Life with Oranges, Jars, and Boxes of Sweets, Luis Egidio Meléndez, about 1760 · Oil on canvas · Kimbell Art Museum, Fort Worth, Texas
Image: [Wikimedia Commons](#), public domain

Luis Meléndez painted the food of eighteenth-century Spain with great care. The jars in this painting, with their tops tied over with cloth or paper, probably held preserved fruit or honey, and the thin wooden boxes held fruit pastes and sweets, foods made to keep for months. Meléndez painted this about fifty years before Nicolas Appert published his method.

Look closely

- Find the two jars with their tops tied over. What do you think is under the covers?
- Find the stacked wooden boxes. One has a letter on its lid. What might it be a label for?
- Look at the oranges. Are they fresh or preserved? How long do you think they would keep?
- Look for anything that would keep air, dust and insects out of the food.

Talk about it

1. Cooks in Meléndez's time preserved fruit by cooking it with a great deal of sugar. Why does sugar help keep fruit from spoiling?

2. How is a jar tied over with cloth different from Appert's jars sealed with cork, wire and wax and then boiled?
3. If you painted the preserved foods in your own pantry today, what would be in your picture?

Safety first. An adult heats the brine and pours it over the cucumbers, because hot vinegar steam stings the eyes and hot liquid can burn. Use the small knife only with an adult right beside you, keep these pickles in the refrigerator at all times, and never try shelf canning without a tested recipe and an adult.

Quick Refrigerator Pickles: Watching Salt and Acid Work

You will make a jar of quick refrigerator pickles and watch how salt and vinegar change a cucumber over a few days. You will also set up a small salt test that shows how salt draws water out of food.

You will need

- A clean 1-quart glass jar with a lid (or two pint jars), washed in hot, soapy water
- A small saucepan, a wooden spoon, a measuring cup and spoons, a funnel (optional)
- A cutting board with a damp towel underneath and a small knife
- Two small bowls and a teaspoon of salt for the salt test

QUICK REFRIGERATOR DILL PICKLES

Serves 1 quart (about 8 servings) · Prep 15 min · Chill at least 24 hours

Ingredients

- 1 pound (450 g) small pickling cucumbers (about 4–5), or 1 English cucumber
- 1 cup (240 mL) white vinegar (5% acidity)
- 1 cup (240 mL) water
- 1 tablespoon kosher salt or pickling salt (or 2 teaspoons table salt)
- 1 tablespoon sugar
- 2 cloves garlic, peeled and lightly smashed
- 4 sprigs fresh dill, or 1 teaspoon dill seed
- ½ teaspoon whole black peppercorns

Method

1. Wash your hands. Rinse the cucumbers under running water, rubbing them, and trim off both ends.
2. With an adult right beside you, cut the cucumbers into spears or ¼-inch rounds, using the bridge grip to halve them and the claw grip to slice.

3. Put the garlic, dill and peppercorns in the clean jar, then pack in the cucumbers tightly.
4. With an adult beside you, put the vinegar, water, salt and sugar in the small saucepan and heat on medium, stirring, until the salt and sugar dissolve and the brine just begins to steam, about 3 minutes. Do not lean over the pan; the vinegar fumes sting.
5. The adult pours the hot brine over the cucumbers until they are covered, leaving ½ inch of space at the top.
6. Let the jar cool on the counter for about 1 hour, then put on the lid and refrigerate.
7. The pickles are ready to taste after 24 hours and taste best after 2–3 days. Keep them in the refrigerator, never on the shelf, and eat them within about a month.

Allergy check: Contains none of the nine major allergens.

Steps

1. **Salt test.** Put 4 cucumber slices in each of two small bowls. Sprinkle one bowl with ½ teaspoon salt and leave the other plain. After 20 minutes, look and touch. Which bowl has water in the bottom? Which slices are bendier? Why?
2. Make the pickles from the recipe card. Before you put on the lid, draw the jar and color the cucumbers exactly as they look.
3. **Pickle log.** Look at the jar each day for 4 days without opening it. Record the color of the cucumbers, the color of the brine and anything else you notice. On day 1 and day 3, taste one pickle and describe its taste and crunch.
4. Compare a fresh cucumber slice with a pickle slice side by side. Which is greener? Which is saltier, sourer, crunchier?
5. Clean up: wash the saucepan, board and knife, wipe the counter, and wash the salt-test bowls (throw away the salted slices).
6. **Improve it.** Make a second small jar with a different vegetable, such as carrot sticks, green beans or thin slices of red onion, using the same brine. Which family members liked which pickle best?

Tips

- Small, firm pickling cucumbers (often called Kirby cucumbers) make the crunchiest pickles.
- Use vinegar labeled 5% acidity. Do not water the brine down more than the recipe says.
- Trimming off the blossom end of the cucumber helps keep pickles crisp.

Check your work

- ☐ I can tell how Appert preserved food in sealed jars and how Pasteur later explained why it worked.
- ☐ I can name six ways to keep food from spoiling and explain how each one works.
- ☐ I made refrigerator pickles, kept a pickle log, and know they must stay in the refrigerator.

COOK'S NOTEBOOK

1. Make a chart of six ways to preserve food (canning, cold, freezing, drying, salt or sugar, acid). For each, draw one food and write what it takes away from the microbes.
2. Draw your pickle jar on day 0 and day 4 and label the changes.
3. Copy your pickle recipe in your own words and record your family's ratings.

From history. In 1810, the same year Appert published his book, Peter Durand in England received a patent for preserving food in tin cans, which did not break like glass. Within a few years, British factories were making canned food for the navy. For about fifty years, though, the can opener had not been invented; early cans were opened with a hammer and chisel.

COMMON MISTAKES

- Storing refrigerator pickles on the pantry shelf. They are not canned or sealed; they must stay cold.
- Using a canning recipe from an old book or the internet that has not been tested. Use only tested recipes, such as those from the National Center for Home Food Preservation.
- Thinking a food is safe because it is in a jar. A bulging lid, leaking jar, spurting liquid or bad smell means throw it away without tasting.

Make it a game • Preserve It Pairs. Make cards for heat, sealing, acid, salt, sugar, drying and cold, plus matching cards with foods: jam, pickles, raisins, canned beans, frozen peas. Lay them face down and play memory match. When you make a pair, say how it keeps microbes from spoiling the food. Add the story of Appert's sealed jar.

4.4 CLARENCE BIRDSEYE AND FAST FREEZING

OBJECTIVES

- Tell how Clarence Birdseye learned about fast freezing from Inuit fishermen in Labrador and invented frozen food.
- Explain how ice crystals form and why fast freezing keeps food's texture better than slow freezing.
- Make frozen yogurt fruit bark and compare a fast freeze with a slow freeze.

Warm-up. Look in your freezer. List five frozen foods. Then imagine your family lived in 1900, with no electric refrigerator or freezer. How would you keep milk cold in summer? How could you have strawberries in January? Write down your ideas.

WATCH

Frozen Food: The \$300 Billion Idea That Changed How We Eat | Billion Dollar Breakthrough

Business Insider • 9:07

https://www.youtube.com/watch?v=_Ja15zDFDig

WHEN TO WATCH

After the story paragraph. Watch for the photos of Birdseye's machines and his first frozen-food packages.

Note: Told as a business history; it ends with today's frozen-food industry.

KEY TERMS

ice crystal

A tiny, solid piece of frozen water with a regular shape. Slow freezing makes large crystals; fast freezing makes small ones.

fast freezing

Freezing food very quickly at very low temperatures, so only small ice crystals form.

icehouse

A thick-walled building, often half underground and packed with sawdust or straw, where ice cut from lakes in winter was stored through the summer.

thaw

To let frozen food warm until it is no longer frozen; safest in the refrigerator.

freezer burn

Dry, pale, tough spots on frozen food where it has lost moisture to the cold air. It is safe but tastes poor.

CORE IDEAS

The story. Clarence Birdseye was born in Brooklyn, New York, in 1886, and loved the outdoors and nature from boyhood. As a young man he worked as a naturalist and then as a fur trader in Labrador, a cold, rocky land on the far northeast coast of North America, for several years beginning in 1912. In winter the air there could fall to 40 degrees below zero. The Inuit people of Labrador taught him to fish through holes cut in the ice. He noticed something wonderful: the fish froze stiff almost the moment they were pulled into the frigid air, and months later, when they were thawed and cooked, they tasted nearly fresh.

How he figured it out. Back in the United States, Birdseye knew that the frozen food sold in stores was poor: it had been frozen slowly, and when it thawed it was mushy and watery. He guessed that the speed of freezing made the difference. With little money, he began experimenting with an electric fan, buckets of brine and cakes of ice. In 1924 he started a company in Gloucester, Massachusetts, and built machines that pressed boxes of fish and vegetables between metal plates chilled far below freezing, so they froze in a short time. In 1929 he sold his company and its patents to the Postum Company, which became General Foods, and on March 6, 1930, the first Birds Eye frozen peas, berries, spinach, fish and meats went on sale in grocery stores in Springfield, Massachusetts.

The kitchen science. Fruits, vegetables and meat are made of tiny cells full of water. When food freezes **slowly**, the water has time to build **large ice crystals**, which grow sharp and big enough to pierce the cell walls. When the food thaws, the broken cells leak their juice, and the food turns soft and mushy. When food freezes **fast**, many

tiny crystals form all at once, the cells stay whole, and the food keeps its texture. A home freezer should be at 0 °F (−18 °C). Freezing stops bacteria from growing, but it does not destroy them, so thaw frozen food in the refrigerator, not on the counter. Before freezers, families kept food cold with ice cut from frozen lakes in winter and stored in **icehouses** packed with sawdust, and in “iceboxes” at home. Electric home refrigerators spread through American homes in the 1930s and 1940s.

Let's cook. You will make frozen yogurt bark with fruit, freezing one pan thin and fast and one container thick and slow, and compare their textures. Your one skill: spreading a mixture evenly and thinly so it freezes quickly.

PICTURE STUDY



Ice Harvest on Clearwater Lake, Photographer for the U.S. Bureau of Indian Affairs, Red Lake Agency, 1934 · Photograph · U.S. National Archives (Red Lake Agency, Minnesota)

Image: [Wikimedia Commons](#), public domain

Before electric refrigerators, communities in cold places harvested ice from frozen lakes every winter. Workers sawed the ice into large blocks, pulled them out with poles and tongs, and hauled them by horse to icehouses, where packed in sawdust they stayed frozen into the summer. This photograph was taken in northern Minnesota in 1934.

Look closely

- Find the wooden ramp. What is being pulled up it?
- Find the horses. How are they helping the men move the heavy ice?
- Look at the workers' clothes and the snow. How cold do you think it was?
- Find the open water where the ice has been cut. How thick do you think the lake's ice was?

Talk about it

1. Where do you think these blocks of ice were taken, and how did they keep from melting all summer?
2. Clarence Birdseye saw fish freeze in seconds on the Labrador ice. Why does food freeze faster outdoors at -40°F than in a freezer at 0°F ?

3. How would your family's cooking be different if you had to keep your food cold with a block of ice?

Safety first. Use the small knife only with an adult right beside you to slice the strawberries, and check the yogurt and toppings for allergies. Honey must never be given to a baby under one year old; thaw any frozen meat or leftovers in the refrigerator, never on the counter.

KITCHEN PROJECT

Fast Freeze, Slow Freeze: Frozen Yogurt Bark

You will make a sheet of frozen yogurt bark topped with fruit, spreading most of it thin on a metal pan for a fast freeze and packing the rest thick in a plastic container for a slow freeze. Then you will compare the textures, as Birdseye did.

You will need

- A rimmed metal baking sheet lined with parchment paper, and a small plastic container
- A mixing bowl, a spatula, measuring cups and spoons
- A cutting board with a damp towel underneath and a small knife
- A timer, your food thermometer and a magnifying glass (optional)

FROZEN YOGURT FRUIT BARK

Serves 6 • Prep 15 min • Freeze 2–3 hours

Ingredients

- 2 cups (about 480 g) plain or vanilla Greek yogurt
- 2 tablespoons honey or maple syrup (leave out if using sweetened vanilla yogurt)
- ½ teaspoon vanilla extract
- 1 cup (about 150 g) strawberries, sliced
- ½ cup (75 g) blueberries
- ¼ cup granola from Lesson 3.4, or 2 tablespoons mini chocolate chips (optional)

Method

1. Wash your hands. Rinse the berries under running water and pat them dry.
2. With an adult right beside you, hull the strawberries and slice them thinly with the claw grip.
3. In the mixing bowl, stir the yogurt, honey and vanilla until smooth.

4. Scoop $\frac{1}{2}$ cup of the mixture into the small plastic container, top it with a few berries and press on the lid. This is your slow-freeze sample.
5. Spread the rest of the yogurt on the parchment-lined baking sheet in a thin, even layer about $\frac{1}{4}$ inch thick.
6. Scatter the strawberries, blueberries and granola or chocolate chips over the top and press them in gently.
7. Put the baking sheet flat in the coldest part of the freezer, and the plastic container in the door. Freeze 2–3 hours, until firm.
8. Lift the bark out by the parchment, break it into pieces, and serve right away. Store leftovers in a freezer bag in the freezer.

Allergy check: Contains milk (yogurt). Granola may contain tree nuts and wheat; chocolate chips may contain milk and soy. For milk-free bark, use a thick dairy-free yogurt. Contains honey, which must never be given to a baby under one year old; use maple syrup instead.

Steps

1. Make the bark from the recipe card and set up the two samples: thin on a metal pan (fast) and thick in a plastic container (slow).
2. **Freezer check.** Put your thermometer in the freezer for 5 minutes and read it. Is your freezer at 0 °F or below?
3. **Timing.** Check both samples every 30 minutes. Write down when each one is frozen solid. Which froze first? Why do thin layers and metal pans freeze food faster?
4. **Texture test.** Taste a piece of the thin bark and a spoonful from the thick container. Which is smoother? Which is icier? Look at both with a magnifying glass for ice crystals.
5. **Berry test (optional).** Freeze 4 whole strawberries spread apart on a plate, and 4 more piled together in a covered cup. The next day, thaw both in the refrigerator for 2 hours. Which leaked more juice and turned softer?
6. Clean up: wash the bowl, spatula, knife and board, and wipe the counter.
7. **Improve it.** Make bark again with a different fruit, such as mango, kiwi or raspberries, and try spreading it even thinner. Did it freeze faster?

Tips

- Metal pans pull heat out of food faster than plastic or glass, because metal conducts heat well.
- Leave space around the pan in the freezer so the cold air can circulate (convection!).
- Frozen bark softens quickly. Take it out just before serving.

Check your work

- ☐ I can tell how Clarence Birdseye learned about fast freezing and turned it into frozen food.
- ☐ I can explain why fast freezing makes small ice crystals and keeps texture better than slow freezing.
- ☐ I compared a fast freeze and a slow freeze and recorded the times and textures.

COOK'S NOTEBOOK

1. Draw two plant cells side by side: one with large, sharp ice crystals poking through its walls (slow freezing) and one with many tiny crystals inside whole walls (fast freezing). Label them.
2. Make a timeline of keeping food cold: icehouses and iceboxes, Birdseye's first frozen foods (1930), the electric refrigerator in your kitchen.
3. Record your freezing times and texture notes in a table, and copy the bark recipe in your own words.

From history. Clarence Birdseye held nearly 300 patents during his life, including ones for a better light bulb for store windows, a harpoon for marking whales, and a way to dry food. His frozen food business was at first very slow to grow, because few grocery stores had freezer cases and few homes had freezers. After the 1940s, as home refrigerators with freezer compartments became common, frozen vegetables became an ordinary part of family meals.

COMMON MISTAKES

- Thawing frozen meat on the counter. Thaw it in the refrigerator, in cold water changed every 30 minutes, or in the microwave just before cooking.
- Thinking freezing kills germs. Freezing only pauses bacteria; they can grow again when the food warms.

- Freezing food in a big, thick block. Thin, flat packages freeze faster and thaw faster.

Make it a game • Ice Crystal Artists. Draw two pictures of ice crystals under a microscope: tiny ones from fast freezing and large jagged ones from slow freezing. Your parent guesses which picture is which and why the food would feel different. Then retell how Clarence Birdseye learned from Inuit fishermen in Labrador. Name freezer burn and how to prevent it.

Scripture. “By the breath of God frost is given: and the breadth of the waters is straitened.” (Job 37:10, KJV)

God made frost and ice, and the waters “straitened,” or frozen hard. Birdseye learned his great idea by watching closely what God’s cold already did.

UNIT 4

HEAT & COLD

Cooking is the art of moving heat into food, and keeping food is the art of moving heat out of it. In this unit you will learn the three ways heat travels, conduction, convection and radiation, from Count Rumford, the American-born scientist who built better stoves and cooked nourishing soup for the poor of Munich. You will learn why water boils at 212 °F at the seashore but at a lower temperature on a mountain, and how Denis Papin trapped steam in a sealed pot to cook hotter than boiling.

Then you will turn to cold and to keeping food. You will meet Nicolas Appert, the French confectioner who sealed food in glass jars and won a prize from his government, and Clarence Birdseye, who watched fish freeze in an instant on the Labrador ice and invented fast-frozen food. Along the way you will make pancakes, pasta with tomato sauce, quick refrigerator pickles and frozen yogurt bark, and finish with a big experiment: one potato, four heats.

PREREQUISITES

- Uses a food thermometer and knows the danger zone (Unit 1)
- Uses the stove and oven with an adult beside, handles turned in, oven mitts on
- Can read a thermometer in °F and knows that water freezes at 32 °F

MASTERY CHECKLIST

- ☐ I can explain conduction, convection and radiation and find each one in my kitchen.
- ☐ I can tell the difference between boiling, simmering and steaming, and explain why water boils at a lower temperature on a mountain.
- ☐ I can explain how heat, sealing, cold, acid, salt and drying keep food from spoiling.
- ☐ I can tell the stories of Count Rumford, Denis Papin, Nicolas Appert and Clarence Birdseye.
- ☐ I can cook a food four ways and compare the time, texture and taste.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **National Center for Home Food Preservation**: Free. The University of Georgia’s trusted, tested guide to canning, pickling, freezing and drying at home. If your family ever wants to can food for the shelf, use only tested recipes like these, with an adult.
- **A food thermometer that reads up to 220 °F or more**: The same instant-read thermometer from Unit 1. Used in Lesson 4.2 to measure boiling and simmering water.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

4.1	Count Rumford’s Kitchen	2 sessions of 45–60 minutes
4.2	Boiling, Simmering and Steaming	2 sessions of 45–60 minutes
4.3	Nicolas Appert and the Sealed Jar	2 sessions of 45–60 minutes
4.4	Clarence Birdseye and Fast Freezing	2 sessions of 45–60 minutes

UNIT 4 REVIEW

Answer each question in complete sentences unless it asks for a number or a list. The review is worth 50 points.

1. **5 pts**

Name the three ways heat travels and give a kitchen example of each.

2. **5 pts**

How did Count Rumford make kitchens use less fuel?

3. **5 pts**

Predict: your pancake comes out dark brown on the outside but runny in the middle. What should you change, and why?

4. (5 pts)

At what temperature does water boil at sea level? Why does it boil at a lower temperature in Denver?

5. (5 pts)

Predict: water is boiling hard and you turn the burner up to high. Will the water get hotter? Explain.

6. (5 pts)

What did Denis Papin's steam digester do, and why did it need a safety valve?

7. (5 pts)

Describe Appert's method, and explain why it worked (as Pasteur later showed).

8. (5 pts)

Name four ways to preserve food and tell what each does to microbes.

9. (5 pts)

What did Clarence Birdseye notice in Labrador, and what did he invent?

10. (5 pts)

Predict: you freeze one bag of strawberries slowly and one quickly, then thaw both. Which will be mushier, and why?

ANSWER KEY

1. Conduction (a hot pan heating a pancake), convection (hot air circling in an oven or water rising in a pot), radiation (heat from a broiler, toaster or campfire). Other good examples accepted.
2. He built enclosed brick ranges, with each pot set snugly into its own opening over its own small fire and flue, so the heat went into the food instead of up the chimney.
3. Turn the heat down. The griddle is too hot, so the outside browns before heat has time to conduct into the center.
4. 212 °F (100 °C). Denver is high up, with less air pressure pressing down, so water boils at a lower temperature, about 202 °F.
5. No. Boiling water stays at its boiling point; the extra heat only turns more water into steam faster.
6. It trapped steam in a sealed pot so the pressure rose and the water got hotter than its normal boiling point, cooking food faster (softening even bones). The safety valve let out steam if the pressure grew so high it might burst the pot.
7. He sealed food tightly in glass jars with cork, wire and wax, then heated the jars in boiling water. The heat destroyed the microbes, and the seal kept new ones out.
8. Any four: canning (heat destroys them and the seal keeps others out); refrigerating (cold slows them); freezing (stops their growth); drying (takes away water); salt or sugar (draws out water); acid such as vinegar (too sour for most to grow).
9. Fish caught by Inuit fishermen froze almost instantly in the very cold air and tasted nearly fresh months later. He invented machines to fast-freeze packaged food between very cold metal plates, and started selling frozen foods in 1930.
10. The slowly frozen berries, because slow freezing makes large ice crystals that pierce the cell walls, so the berries leak juice and turn soft when thawed.

UNIT CHALLENGE: ONE POTATO, FOUR HEATS

Cook the same vegetable four ways and compare them: boil, roast, microwave and pan-fry potato pieces of the same size (or another firm vegetable, such as carrots or sweet potatoes). Cut four equal batches of 1-inch cubes with an adult beside you. Boil one batch, roast one at 425 °F, microwave one in a covered dish with a spoonful of water (with an adult nearby), and pan-fry one in a thin film of oil with an adult beside you.

For each method, name the main way heat moved (conduction, convection or radiation), and record the cooking time, the color, the texture and a family taste rating. Make a results chart and write a paragraph explaining which method your family liked best and why, using what you learned in this unit.

LOOK FOR	WHAT IT MEANS
Fair test	The same vegetable, cut into equal pieces, cooked four different ways, with a little salt added the same way to each.
Safety	Knife, stove, oven and microwave steps done with an adult beside or nearby, with a thin film of oil only, handles turned in and oven mitts used.
Observations	Times, colors, textures and ratings recorded clearly for all four methods.
Science explanation	Each method is matched to conduction, convection or radiation, and the results are explained in the student's own words.
Cleanup and effort	Kitchen left clean, with a careful, cheerful attitude throughout.

UNIT 5

FOOD CHEMISTRY

Every kitchen is a chemistry lab, and every cook is doing experiments, whether he knows it or not. In this unit you will meet the ingredients that do the most work in a recipe and learn what each one is really doing. You will watch **starch** grains swell and burst to thicken a pudding, shake **oil and water** into an emulsion for a salad dressing, and see egg **proteins** unfold and set while bread turns golden in the Maillard reaction.

Then you will meet a living ingredient. Louis Pasteur showed that the yeast in bread dough is alive, a tiny fungus that eats sugar and breathes out the gas that makes bread rise. You will bake a pan of soft rolls, keep a rise log, and learn how **moisture** and steam finish the job in the oven. Jesus compared the kingdom of heaven to a little leaven working quietly through a whole batch of dough (Matthew 13:33); by the end of this unit you will know just what He meant.

PREREQUISITES

- Can measure dry and liquid ingredients with cups and spoons (Units 1–4)
- Uses the stove and oven only with an adult beside, pot handles turned in and oven mitts on (Unit 1)
- Knows the danger zone and that egg dishes are cooked to 160 °F (Unit 1)
- Knows how heat moves by conduction, convection and radiation (Unit 4)

MASTERY CHECKLIST

- ☐ I can explain how starch granules soak up water and swell when heated to thicken a sauce or pudding, and why cornstarch must be mixed with cold liquid first.
- ☐ I can explain why oil and water separate, what an emulsifier does, and make a vinaigrette that stays mixed longer.
- ☐ I can tell how egg proteins unfold and set when heated, and explain the Maillard reaction that browns toast and grilled cheese.
- ☐ I can tell how Pasteur showed that yeast is alive, explain how yeast makes bread rise, and bake rolls with a rise log.
- ☐ I can describe what moisture does in cooking: steam in baking, evaporation, and salt drawing water out of food.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **A digital kitchen scale:** Inexpensive and useful for the rest of the year. Weighing flour in grams makes bread dough come out the same every time (Lesson 5.4 and the unit challenge).
- **King Arthur Baking: Learn to bake guides and Baker's Hotline:** Free step-by-step baking guides with photographs, from the King Arthur Baking Company. Helpful for Lesson 5.4 and the unit challenge. Their Baker's Hotline answers baking questions by phone or chat.
- **A clear glass or plastic jar with a tight lid:** A clean jam jar or peanut butter jar is perfect for shaking the emulsion in Lesson 5.2 and watching it separate.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

5.1 Starch: The Thickener

2 sessions of 45–60 minutes

5.2 Oil and Water: Emulsions

2 sessions of 45–60 minutes

5.3 Protein: Eggs, Browning and Louis-Camille Maillard

2 sessions of 45–60 minutes

5.4 Yeast: Pasteur and the Living Leaven

2 sessions of 60–90 minutes

UNIT 5 REVIEW

Answer each question. Use complete sentences for explanations. The review is worth 50 points.

1. (5 pts)

What happens to starch granules when they are heated in water? Use the word gelatinization.

2. (5 pts)

Predict: you dump a spoonful of cornstarch straight into a pot of hot gravy. What will happen, and how should you have done it?

3. (5 pts)

Why do you need about twice as much flour as cornstarch to thicken the same amount of liquid?

4. (5 pts)

Why do oil and water separate? What does an emulsifier do?

5. (5 pts)

Name two emulsifiers used in cooking and two foods that are emulsions.

6. (5 pts)

Describe what happens to egg proteins as an egg cooks. Use the words denaturation and coagulation.

7. **5 pts**

Predict: you scramble one batch of eggs on low heat and one on high heat. How will they differ, and why?

8. **5 pts**

What did Louis-Camille Maillard discover in 1912, and why doesn't this reaction happen to bread boiled in water?

9. **5 pts**

What did Louis Pasteur show about yeast and fermentation?

10. **5 pts**

Explain three things that make a roll rise, from the bowl to the oven.

ANSWER KEY

1. They soak up water and swell, and long starch chains leak out and tangle together, trapping water and thickening the liquid. This is gelatinization.
2. It will form lumps: the outside of each clump cooks into a sticky skin around dry powder. Stir the cornstarch into a little cold liquid first to make a slurry, then stir the slurry into the hot gravy.
3. Cornstarch is almost pure starch, but flour is only about three-quarters starch; the rest is mostly protein, which does not thicken the same way.
4. Water molecules cling to each other and oil cannot fit in, so they push apart and the lighter oil floats. An emulsifier has one end that likes water and one end that likes oil; it coats oil droplets and keeps them from joining back together.
5. Emulsifiers: mustard, egg yolk (lecithin), honey helps thicken. Emulsions: vinaigrette, mayonnaise, milk, butter, gravy (any two of each).
6. Heat makes the tightly folded proteins unwind (denaturation). The loose strands link to each other in a net that traps water (coagulation), so the runny egg turns white and firm.
7. The low-heat eggs will be soft and moist; the high-heat eggs will be rubbery and may leak water. High heat makes the protein net squeeze too tight and push out the water.
8. He found that sugars and amino acids heated together turn brown and make new flavors and smells (the Maillard reaction). It needs temperatures around 280–330 °F and fairly dry food; boiling water cannot get hotter than 212 °F.
9. That yeast is a living microbe (he saw it budding and multiplying under the microscope) and that fermentation is caused by living things, not just a chemical change.
10. Yeast eats sugar and gives off carbon dioxide; gluten from kneaded wheat protein traps the gas bubbles; in the oven, gas and steam from the dough's moisture expand (oven spring) until the heat sets the starch and protein.

UNIT CHALLENGE: A LOAF OR PAN OF ROLLS WITH A RISE LOG

Bake a loaf of bread or a pan of rolls (the Lesson 5.4 recipe or another family recipe) with an adult beside you. Keep a full rise log: the water temperature, the time you started kneading, and the dough's height every 15 minutes through both rises.

When it is baked and cooled, have an adult cut it so you can photograph or draw the crumb. Write a short paragraph explaining what the yeast, the kneading (gluten) and the moisture (steam) each did, and one thing you would change next time. Serve it to your family with a word of thanks.

LOOK FOR	WHAT IT MEANS
Bread baked safely	Measured carefully, kneaded well, baked with an adult beside, with oven mitts and a clean, cleared-up kitchen afterward.
Rise log	Times and heights recorded honestly through both rises, with a simple graph.
Crumb photo or drawing	Shows the holes clearly and labels at least one thing they tell you.
Science explanation	Correctly explains the work of yeast, gluten and steam in your own words.
Improvement	Names one honest change for next time and the reason; a loaf that flopped but is well recorded earns full credit.

5.1 STARCH: THE THICKENER

OBJECTIVES

- Explain where starch comes from and what happens to starch granules when they are heated in water (gelatinization).
- Compare how cornstarch and flour thicken, and explain why cornstarch is first stirred into cold liquid.
- Cook a smooth cornstarch pudding with an adult beside you, stirring the whole time, and record how it changes.

Warm-up. Put 1 tablespoon of cornstarch in a small bowl and add 1 tablespoon of cold water. Stir it with your finger. Now push hard and fast, then slowly let your finger sink in. What strange thing happens? Then look in the pantry with an adult and find three foods that are mostly starch. (Hint: think of grains and potatoes.)

WATCH

A Tasting of Culinary Science—Starch

The Culinary Institute of America • 3:35

<https://www.youtube.com/watch?v=oiGUyvMHqM4>

WHEN TO WATCH

After the kitchen-science paragraph. Watch the animation closely: find the moment the starch granule swells and its long chains start to spill out.

Note: From the Culinary Institute of America’s culinary science series. The animation of water entering starch granules is especially clear.

KEY TERMS

starch

A carbohydrate that plants make from sugar and store in tiny grains (granules) in seeds, roots and tubers, such as corn, wheat, rice and potatoes.

granule

A tiny grain. Starch is packed in granules too small to see without a microscope.

gelatinization

What happens when starch granules are heated in water: they soak up water, swell, and release long starch chains that tangle and thicken the liquid.

slurry

Cornstarch or flour stirred into a little cold liquid until smooth, so it can be added to a hot liquid without lumps.

roux

Flour cooked in butter or oil, used to thicken sauces such as gravy and cheese sauce. Say it “roo.”

CORE IDEAS

The story. For a long time, cooks thickened their sauces and puddings with wheat flour, bread crumbs or eggs. In the 1840s Thomas Kingsford, who worked at a wheat-starch factory in Jersey City, New Jersey, found a way to separate pure starch from corn. In 1848 he and his son started a company in Oswego, New York, that became one of the largest starch makers in the world. Their fine white powder was first used for stiffening shirts, but cooks soon learned that corn starch made smooth, glossy puddings and pie fillings. Old American cookbooks are full of “cornstarch blanc mange” and cornstarch pudding.

How they figured it out. Cooks learned by trying. If you dump a spoonful of cornstarch straight into hot milk, you get lumps: the outside of each clump cooks into a sticky skin while the inside stays dry powder. If you stir the starch into *cold* liquid first, every grain is wet and separate before the heat arrives, and the pudding thickens smoothly. Cooks also learned that a cornstarch pudding is not finished until it bubbles; if you stop too soon, it stays thin. Much later, food scientists looked at starch under the microscope and saw why.

The kitchen science. Plants make sugar in their leaves and store it as **starch** in seeds and roots for later. Starch is packed in tiny, hard **granules**. In cold water they just sink. But when the water gets hot, the granules start soaking up water and swelling, many times their size. Long starch chains leak out and tangle together like a net that traps water. This is called **gelatinization**, and it is why a pudding or gravy thickens. Cornstarch is almost pure starch, so it thickens strongly and turns clear and glossy. Flour is only about three-quarters starch (the rest is mostly protein), so you need

about twice as much flour as cornstarch for the same thickness, and it makes a cloudy sauce. Flour is usually cooked in fat first to make a **roux**, which coats the grains so they cannot clump. As a starchy pudding cools, the chains hold on to each other even tighter, so it sets thicker in the refrigerator.

Let's cook. You will make a homemade cornstarch pudding, vanilla or chocolate, from scratch. The skill to do well is **stirring steadily** over medium heat, reaching into the corners of the pot with a heat-proof spatula, until the pudding thickens and bubbles. An adult stands beside you at the stove the whole time, because hot pudding is thick and sticky, and it can spatter and burn.

PICTURE STUDY



The Milkmaid, Johannes Vermeer, about 1657–1658 · Oil on canvas · Rijksmuseum, Amsterdam

Image: [Wikimedia Commons](#), public domain

A Dutch kitchen maid stands by a sunny window and pours milk into a bowl, as slowly and carefully as she can. Many art historians think she is making a bread pudding: the hard, broken bread on the table will soak up the milk and soften. Like a starch pudding, it is a dish that turns plain, inexpensive things into something good to eat, and nothing is wasted.

Look closely

- Find the stream of milk. Why is she pouring so slowly?
- Find the bread in the basket and on the table. Is it fresh and soft, or hard and broken? How can you tell?
- Look at the earthenware bowl. Bread is mostly starch. What will happen to the bread when it soaks in the milk and cooks?
- Look at the light on the bread crusts and the wall. Where is it coming from?

Talk about it

1. How is soaking hard bread in milk like stirring starch into milk for a pudding? How is it different?
2. The maid uses up old bread instead of throwing it away. What leftover starchy foods in your kitchen could become a new dish?

3. Vermeer gives one quiet kitchen task his full care. Why do you think he chose to paint something so ordinary?

Safety first. An adult stands beside you at the stove the whole time. Bubbling pudding is very hot and sticky and can spatter, so use a long-handled heat-proof spatula, keep your face back, and turn the pot handle in. Let the pudding cool before you taste it.

Watch Starch Thicken: Homemade Pudding

You will run a small starch test, then cook a pot of homemade pudding and record exactly when and how it thickens. You will see gelatinization happen in your own pot, and you will learn why the pudding keeps getting thicker as it chills.

You will need

- A medium heavy-bottomed saucepan
- A whisk and a heat-proof silicone spatula
- Measuring cups and spoons
- Two small cups, two spoons and a timer for the starch test
- Six small bowls or cups, and plastic wrap
- An instant-read thermometer (optional)
- Oven mitts

HOMEMADE VANILLA (OR CHOCOLATE) CORNSTARCH PUDDING

Serves 6 servings (about ½ cup each) · Prep 5 min · Cook 10 min · Chill 2 hr

Ingredients

- ½ cup (100 g) sugar
- ¼ cup (32 g) cornstarch
- ¼ teaspoon salt
- 2¾ cups (650 mL) milk, divided
- 2 tablespoons butter
- 1½ teaspoons vanilla extract
- For chocolate pudding: add ⅓ cup (30 g) unsweetened cocoa powder and 2 more tablespoons sugar

Method

1. Wash your hands. In the saucepan (not on the heat yet), whisk together the sugar, cornstarch and salt (and the cocoa, for chocolate) until there are no lumps.

2. Pour in $\frac{1}{2}$ cup of the *cold* milk and whisk to a smooth paste. This is your slurry. Then whisk in the rest of the milk.
3. With an adult beside you, set the pan over medium heat. Stir constantly with the spatula, scraping the bottom and the corners, for 6–8 minutes.
4. When the pudding begins to thicken, keep stirring. When big, slow bubbles pop on the surface, set a timer and stir for 1 more minute so all the starch is cooked.
5. An adult turns off the burner and moves the pot to a cool burner or a trivet. Stir in the butter and vanilla until the butter melts.
6. Ladle the pudding into the small bowls. Press plastic wrap right onto the surface of each (so a skin does not form) and refrigerate at least 2 hours, until cold and set.
7. Clean up: soak the pot in hot, soapy water right away, before the pudding dries on.

Allergy check: Contains milk. For a milk-free pudding, use an unsweetened oat or soy milk (soy is a major allergen) and a plant-based butter or 1 tablespoon of neutral oil; it will be a little softer. No eggs, wheat or nuts.

Steps

1. **Starch test.** Put 1 teaspoon of cornstarch in a cup of hot tap water and stir. Put 1 teaspoon of cornstarch in a cup with 1 tablespoon of cold water, stir it smooth, then add hot tap water. Which one made lumps? Write down why, using the word *slurry*.
2. **Predict.** Before you cook, write your guess: how many minutes until the pudding starts to thicken?
3. Cook the recipe with an adult beside you. Every 2 minutes, lift the spatula and look at the pudding. Record: thin like milk, coats the spatula, thick, or bubbling. If you have a thermometer, an adult can help you take its temperature when it first thickens.
4. Before you chill the pudding, put 1 spoonful on a cold saucer and look at it after 5 minutes. Is it thicker or thinner than the warm pudding in the pot? Write what you see.

5. **Taste test.** After chilling, rate the pudding for smoothness, thickness and flavor from 1 to 5. Were there any lumps? Where might they have come from?
6. **Improve it.** Plan one change for next time (for example: a chocolate batch, a little less sugar, or stirring in a mashed banana). Write it in your notebook.
7. **Clean up:** wash, dry and put away everything, and wipe the stove top once it is cool.

Tips

- A heavy pot and medium heat are your friends. High heat scorches the milk on the bottom before the starch thickens.
- If a few lumps form, whisk hard for a moment off the heat. They usually smooth out.
- Pudding keeps covered in the refrigerator for 3 days.

Check your work

- ☐ I can explain what happens to starch granules when they are heated in water.
- ☐ I can make a slurry and explain why it prevents lumps.
- ☐ I cooked a smooth pudding with an adult beside me and recorded when it thickened.

COOK'S NOTEBOOK

1. Draw a starch granule three times: cold and hard, swelling in hot water, and burst with chains tangling. Label each drawing.
2. Copy the pudding recipe in your own words, and mark the step where gelatinization happens.
3. Make a time chart from your stirring notes, with a little drawing of the pudding's thickness at each 2-minute mark.

From history. Cornstarch is one of many starches cooks use. Arrowroot and tapioca come from tropical roots, and potato starch from potatoes. Each thickens at a slightly different temperature and gives a different texture: tapioca pearls in pudding are little balls of gelatinized starch.

COMMON MISTAKES

- Dumping cornstarch straight into hot liquid. It forms lumps; always make a cold slurry first.

- Taking the pudding off the heat as soon as it looks thick. It needs to bubble and cook about 1 minute more or it may thin out later.
- Thinking flour and cornstarch are the same. Flour needs about twice as much to thicken the same amount and makes a cloudier sauce.

Make it a game · Thickener Showdown. Predict which will thicken a cup of warm milk better, a spoon of cornstarch or a spoon of flour. Say why cornstarch must go into cold liquid first. Your parent writes your prediction, and then you stir both with an adult at the stove. Explain gelatinization when the liquid thickens, using your own words.

5.2 OIL AND WATER: EMULSIONS

OBJECTIVES

- Explain why oil and water do not mix and what makes an emulsion.
- Tell how an emulsifier, like the compounds in mustard and egg yolk, holds oil droplets in water.
- Make a shake-in-a-jar honey-mustard vinaigrette, time how fast it separates, and compare it with oil and vinegar alone.

Warm-up. Pour a little water into a clear glass, then pour a spoonful of cooking oil on top. Stir it hard. Watch for one minute. What happens? Now look in the refrigerator for foods that have oil and water in them but do not separate. (Hint: check the door shelves.)

WATCH

Science: How to Make Salad Dressing Vinaigrette That Doesn't Separate or Break by Using an Emulsion

America's Test Kitchen · 2:52

<https://www.youtube.com/watch?v=tETrZUhqaQo>

WHEN TO WATCH

After the kitchen-science paragraph and before you make your dressing. Watch for the jars at the end: which emulsifier kept the dressing mixed longest?

Note: The vinegar shown in the opening shots is used for dressing. Our recipe uses apple cider vinegar and a mustard made with vinegar.

BACKUP VIDEO

The Science of Food: Emulsions

Houston Museum of Natural Science · 4:19

<https://www.youtube.com/watch?v=cuPpVQ14320>

A museum educator and a chef whisk a vinaigrette together. Good for a second look at how drizzling the oil slowly makes tiny droplets.

KEY TERMS

emulsion

A mixture of two liquids that normally do not mix, such as oil and vinegar, with tiny droplets of one spread through the other.

vinaigrette

A simple salad dressing made of oil, an acid such as vinegar or lemon juice, and seasonings. Say it “vin-uh-GRET.”

lecithin

An emulsifier found in egg yolks (and in soybeans) that helps hold mayonnaise and many sauces together.

emulsifier

An ingredient whose molecules have one end that likes water and one end that likes oil, so it can hold the droplets apart. Mustard and egg yolk are emulsifiers.

separate

When an emulsion breaks and the oil and water layers come apart again.

CORE IDEAS

The story. People around the Mediterranean Sea have dressed greens with oil, vinegar and salt since ancient times. In fact, our word *salad* comes from the Latin word for salt, *sal*, because the Romans salted their raw greens. The French word *vinaigrette* comes from *vinaigre*, vinegar. Every cook who has made one has noticed the same problem: you shake it, it looks creamy, and a few minutes later the oil is floating on top again.

How they figured it out. Cooks found by experience that a spoonful of mustard, a little honey, or an egg yolk made a dressing or sauce stay together much longer. Later, chemists learned why. In a famous kitchen experiment, the test cooks at America’s Test Kitchen made jars of the same dressing with no emulsifier, with mustard, with mayonnaise and with egg yolk, then watched how long each one took to separate. The plain oil and vinegar separated in a few minutes; the dressings with emulsifiers stayed mixed far longer.

The kitchen science. Water molecules cling tightly to each other. Oil molecules are a different shape and cannot fit in, so oil and water push apart, and the lighter oil floats on top. When you shake or whisk hard, you break the oil into tiny droplets

spread through the vinegar. That cloudy mixture is an **emulsion**. But the droplets bump into each other and join back together, and soon the layers separate. An **emulsifier** has molecules with two ends: one end likes water and one end likes oil. They line up around each oil droplet like a coat, with the oil-loving end inside and the water-loving end outside, so the droplets cannot join. Mustard contains compounds that do this, and egg yolks contain **lecithin**. Honey does not coat droplets, but it makes the vinegar thicker so the droplets move more slowly. Milk, butter, mayonnaise and gravy are all emulsions too.

Let's cook. You will make a honey-mustard vinaigrette by shaking it in a jar and serve it on a garden salad you cut yourself. The skill to do well is **safe knife work on round vegetables**: use the bridge grip to cut a cucumber or tomato in half, lay the flat side down so it cannot roll, then slice with the claw grip, with an adult right beside you. We do not make homemade mayonnaise with uncooked egg yolks; the mustard and honey do the emulsifying job safely.

PICTURE STUDY



Still Life with Cucumbers, Tomatoes and Vessels, Luis Egidio Meléndez, 1770s · Oil on canvas · Museo del Prado, Madrid

Image: [Wikimedia Commons](#), public domain

Luis Meléndez, a Spanish painter of the 1700s, painted the everyday foods of a Spanish kitchen so carefully that you can almost feel their skins. Here are all the makings of a summer salad: cucumbers, tomatoes, a tall cruet for oil, a jug, and a little salt cellar.

Look closely

- Find the tall metal container with a narrow spout. It is a cruet for olive oil. Why would a cook want a narrow spout for oil?
- Find the small white salt cellar on the right. How would salt change the taste of these vegetables?
- Look closely at the bumps on the cucumbers and the deep ridges on the tomatoes. How are they different from the ones in our stores?
- Find the bowl. What could a cook mix in it?

Talk about it

1. If you made a dressing from what you see on this table, what would you still need from the pantry to make it an emulsion?
2. Why do you think Meléndez chose to paint plain kitchen vegetables instead of a fancy feast?

3. Which of these foods would you cut with the bridge grip, and which with the claw?

Safety first. Cut with a small serrated or paring knife only with an adult right beside you, on a board that cannot slide (a damp towel underneath), using the bridge and claw grips. Hold the jar lid on tightly with both hands while you shake. Honey is never given to babies under one year old.

KITCHEN PROJECT

Shake an Emulsion: Honey-Mustard Vinaigrette and Garden Salad

You will run a fair test with two jars to see what an emulsifier does, then make a honey-mustard vinaigrette and a garden salad for your family. You will time how long each jar takes to separate and see which one holds together.

You will need

- Two clean clear jars with tight lids, the same size
- Measuring cups and spoons
- A cutting board, a damp towel to set under it, and a small serrated or paring knife
- A vegetable peeler and a salad spinner or clean kitchen towels
- A large salad bowl and salad tongs
- A timer and masking tape for labels

HONEY-MUSTARD VINAIGRETTE WITH A GARDEN SALAD

Serves 6 side salads (about 1 cup of dressing) • Prep 25 min

Ingredients

- **Vinaigrette:** $\frac{1}{4}$ cup (60 mL) apple cider vinegar
- 1 tablespoon prepared mustard (yellow or brown; check that it is made with vinegar)
- 1 tablespoon honey
- $\frac{1}{4}$ teaspoon salt and a pinch of black pepper
- $\frac{3}{4}$ cup (180 mL) olive oil or another vegetable oil
- **Salad:** 1 large head romaine lettuce (or 8 cups mixed greens)
- 1 cucumber
- 1 cup cherry tomatoes (or 2 medium tomatoes)
- 2 carrots
- $\frac{1}{2}$ cup grated cheese or 2 hard-cooked eggs, chopped (optional)

Method

1. Wash your hands. Rinse the lettuce, cucumber, tomatoes and carrots under cool running water. Dry the lettuce well in a salad spinner or roll it in a clean towel; dressing will not stick to wet leaves.
2. Tear the lettuce into bite-size pieces into the salad bowl.
3. With an adult right beside you, cut the cucumber in half lengthwise using the bridge grip, lay the flat sides down, and slice with the claw grip. Halve the cherry tomatoes the same way, flat side down first.
4. Peel the carrots with the peeler, stroking away from your hand, then shave them into ribbons with the peeler or slice them into thin coins with an adult beside you.
5. Put the vinegar, mustard, honey, salt and pepper in a jar. Close it and shake until the honey dissolves.
6. Add the oil, close the lid tightly, and shake hard for 30 seconds until the dressing looks creamy.
7. Just before serving, pour about $\frac{1}{3}$ cup of dressing over the salad and toss with tongs. Taste a leaf and add more if needed. Refrigerate the rest of the dressing for up to a week; shake again before using.
8. Clean up: wash the board and knife, wipe the counter, and compost or throw away the peels.

Allergy check: The vinaigrette and salad contain none of the nine major allergens. The optional cheese contains milk and the optional eggs contain eggs; leave them out if needed. Check your mustard label. Honey is not for babies under one year; use sugar or maple syrup instead if a baby will eat this.

Steps

1. **Fair test.** Label two jars A and B. In jar A put 2 tablespoons vinegar and 6 tablespoons oil. In jar B put the same, plus 1 teaspoon mustard and 1 teaspoon honey.
2. **Predict.** Write which jar you think will stay mixed longer, and why.
3. Shake each jar hard for exactly 30 seconds, set them side by side, and start the timer. Write down how many minutes until you see a clear oil layer on top of each one. Check every minute for 10 minutes, then at 20 and 30 minutes.

4. Shine a flashlight through each jar right after shaking. Which one is cloudier? Cloudier means smaller droplets.
5. Make the full recipe and the salad. Serve it to your family.
6. **Taste test.** Ask each person to rate the dressing from 1 to 5 for tang, sweetness and saltiness. Was it too sour? Too oily?
7. **Improve it.** Write the one change you would make next time (for example, a little more honey, lemon juice instead of vinegar, or chopped fresh herbs).
8. Clean up: wash the jars and bowls in hot, soapy water and wipe the counters.

Tips

- The classic vinaigrette ratio is about 3 parts oil to 1 part vinegar. Once you know the ratio, you can make any amount.
- Olive oil can turn cloudy and thick in the refrigerator. Let the dressing sit on the counter for 10 minutes before shaking.
- Dress a salad right before eating. Salt and vinegar pull water out of the leaves, and they wilt.

Check your work

- ☐ I can explain why oil and water separate and what an emulsifier does.
- ☐ I ran a fair test and recorded how long each jar took to separate.
- ☐ I cut round vegetables safely with the bridge and claw grips, with an adult beside me.

COOK'S NOTEBOOK

1. Draw a close-up of an oil droplet in vinegar with emulsifier molecules around it, like a coat. Label the oil-loving and water-loving ends.
2. Make a chart of your two jars: minutes until a clear oil layer appeared in each one.
3. List five emulsions you can find in your kitchen (look at labels!). Draw one of them.

From history. Mayonnaise, an emulsion of oil and egg yolk, became popular in America in the early 1900s. In 1912 Richard Hellmann, who ran a delicatessen in New York City, began selling mayonnaise in jars. Today store-bought mayonnaise is made with pasteurized eggs, which have been gently heated to destroy germs.

COMMON MISTAKES

- Thinking oil and water mix if you stir long enough. Without an emulsifier, they always separate in the end.
- Dressing a salad an hour before dinner. The leaves wilt; dress it just before serving.
- Making mayonnaise or Caesar dressing with uncooked egg yolks. Uncooked eggs can carry germs; use a mustard emulsion or a store-bought mayonnaise made with pasteurized eggs.

Make it a game • Emulsion Referee. Shake oil and water in a jar. Your parent is the referee and blows a whistle sound when they separate, timing it. Then add a spoon of mustard and shake again. Compare times and name the emulsifier. Say what lecithin is, and explain why a vinaigrette needs a good shake before every use.

5.3 PROTEIN: EGGS, BROWNING AND LOUIS-CAMILLE MAILLARD

OBJECTIVES

- Explain how heat makes egg proteins unfold and link together so eggs set (denaturation and coagulation).
- Tell how Louis-Camille Maillard discovered the browning reaction between sugars and proteins in 1912, and name foods it flavors.
- Cook soft scrambled eggs to 160 °F and a golden grilled-cheese sandwich with an adult beside you, comparing low and medium heat.

Warm-up. Toast one slice of bread until golden brown, and leave another slice plain. Smell each one with your eyes closed. Then taste a corner of each. Describe the difference in three words. What do you think happened to the toasted bread?

WATCH

A Tasting of Culinary Science—Denaturation and Coagulation

The Culinary Institute of America · 3:29

<https://www.youtube.com/watch?v=KV5i0VkJtR8>

WHEN TO WATCH

After the kitchen-science paragraph about eggs. Watch the protein chain unfold, then link up with its neighbors. That is what happens in your pan.

BACKUP VIDEO

What Is the Maillard Reaction? - Instant Egghead #44

Scientific American · 2:10

<https://www.youtube.com/watch?v=c7WI41huAok>

After the story of Louis-Camille Maillard. A quick explanation of the browning reaction from an editor at *Scientific American* magazine.

KEY TERMS

protein

A nutrient made of long chains of building blocks called amino acids, folded into special shapes. Eggs, meat, fish, beans, milk and wheat all contain protein.

coagulation

When unfolded proteins link to each other in a net, turning a runny food firm, as when an egg sets.

gluten

A stretchy protein net formed when wheat flour is mixed with water and kneaded.

denaturation

When heat, acid or beating makes a folded protein unwind and lose its shape.

Maillard reaction

The browning reaction between sugars and proteins in hot, fairly dry food, which makes hundreds of new flavors and smells. Say it “my-YAR.”

CORE IDEAS

The story. Louis-Camille Maillard was a French doctor and chemist, born in 1878. He was interested in how the body builds proteins out of smaller pieces called amino acids. In 1912 he heated amino acids together with sugars in his laboratory and noticed something surprising: the mixture turned brown and gave off smells like baking bread. He reported his discovery that year. He did not know that he had found the reaction behind nearly every delicious brown food in the kitchen.

How they figured it out. For about thirty years, few people paid attention. Then, in the 1940s, food scientists working to keep packaged and dried foods for soldiers fresh noticed that some foods slowly turned brown and changed flavor in storage. They traced it back to Maillard’s reaction. In 1953 an American chemist named John Hodge, working at a U.S. Department of Agriculture laboratory in Peoria, Illinois, published a map of the many steps of the reaction. Today we know the Maillard reaction makes the brown crust on bread, the golden outside of a grilled-cheese sandwich, the flavor of toasted nuts and roasted meat, and the brown on pancakes.

The kitchen science. An uncooked egg white is mostly water with proteins floating in it, each one folded up tight like a ball of yarn. Heat makes the proteins shake until they unwind (**denaturation**). The loose strands bump into each other and link up in a net that traps water (**coagulation**). That is why a clear, runny egg turns white and firm. Gentle heat makes a loose net that holds lots of water: soft, moist eggs. Too much heat pulls the net tight and squeezes out the water: rubbery eggs in a puddle. The **Maillard reaction** needs higher heat, about 280–330 °F (140–165 °C), and fairly dry food, so it happens on the outside of bread in a hot pan but not in boiling water, which cannot get hotter than 212 °F. Wheat protein matters too: when flour and water are mixed and kneaded, two proteins join into stretchy **gluten**, the net that holds bread together.

Let's cook. You will cook soft scrambled eggs and golden grilled-cheese sandwiches. The skill to do well is **heat control**: medium-low heat for the eggs and medium heat for the sandwich, with an adult beside you, turning the burner up or down as you watch. Egg dishes are cooked to 160 °F (71 °C), which means no runny, liquid egg is left in the pan.

PICTURE STUDY



An Old Woman Cooking Eggs, Diego Velázquez, 1618 · Oil on canvas · Scottish National Gallery, Edinburgh

Image: [Wikimedia Commons](#), public domain

Diego Velázquez painted this kitchen scene in Seville, Spain, when he was only about 19 years old. An old woman is poaching eggs in hot olive oil in a glazed clay dish set over a small charcoal stove. Look how carefully he painted the eggs: you can see the moment the clear whites are turning white.

Look closely

- Find the eggs in the clay dish. Which part has turned white already? Which part is still glossy and clear?
- Find the egg in the woman's hand. What is she about to do with it?
- Find the wooden spoon. Why would a cook use wood, not metal, in a hot dish?
- Find the brass mortar and pestle, the onion and the knife on the plate. What might she grind or chop next?

Talk about it

1. What is cooking in the clay dish? How can you tell the eggs are setting?
2. Where does the heat for the dish come from? Is it conduction, convection or radiation that cooks the bottom of the eggs?

3. The boy and the woman are both busy with the meal. What job might he have in this kitchen?

Safety first. An adult stands beside you at the stove; keep the pan handle turned in and use a spatula with a long handle. Cook egg dishes until no liquid egg remains (160 °F), and wash your hands after cracking eggs. Never leave a hot pan, and if butter starts to smoke, turn the heat down.

Watch Proteins Set and Bread Brown

You will watch egg proteins change in a pan, cook scrambled eggs on low and on medium heat to see what heat control does, and make grilled-cheese sandwiches that show the Maillard reaction in golden color.

You will need

- A medium nonstick skillet (or two), with a lid
- A heat-proof silicone spatula and a flat turner
- A mixing bowl, a fork or whisk, and measuring cups and spoons
- An instant-read thermometer
- A cutting board and a table knife
- Plates, oven mitts and a timer

SOFT SCRAMBLED EGGS AND GOLDEN GRILLED-CHEESE SANDWICHES

Serves 4 • Prep 10 min • Cook 20 min

Ingredients

- **Scrambled eggs:** 8 large eggs
- ¼ cup (60 mL) milk
- ¼ teaspoon salt and a pinch of black pepper
- 1 tablespoon butter
- **Grilled cheese:** 8 slices sandwich bread (white or whole wheat)
- 8 slices cheddar or American cheese (about 6 oz / 170 g)
- 2–3 tablespoons soft butter

Method

1. Wash your hands. Crack the eggs into a bowl, one at a time, fishing out any shell with a larger piece of shell. Wash your hands again. Add the milk, salt and pepper and whisk until no streaks of white remain.

2. With an adult beside you, melt the butter in the skillet over medium-low heat until it foams.
3. Pour in the eggs. Wait 20 seconds, then slowly push the spatula across the bottom from one side to the other, making big soft curds. Keep folding every few seconds.
4. When the eggs are set but still shiny and soft, with no runny liquid left (160 °F on the thermometer), turn off the heat and move them to a plate. They keep cooking a little from their own heat.
5. Wipe out the skillet with a paper towel once it is safe to handle. Spread butter thinly on one side of each bread slice. Build sandwiches with the buttered sides *out* and 2 slices of cheese inside.
6. With an adult beside you, cook the sandwiches over medium heat, 2 at a time, 3–4 minutes per side, until deep golden and the cheese melts. Covering the pan with a lid for the first side helps the cheese melt. Flip with the turner, away from you.
7. Let the sandwiches rest 1 minute, then cut them in half on the board. Serve with the eggs.
8. Clean up: wash the bowl, whisk and skillet, and wipe the stove when it is cool.

Allergy check: Contains eggs, milk and wheat (bread may also contain soy or sesame; check the label). For a milk-free version, use a plant-based butter, a milk-free cheese and water instead of milk. Gluten-free bread can replace wheat bread.

Steps

1. **Watch an egg set.** With an adult beside you, crack one egg into a small skillet over low heat, cover it and watch through the lid (or peek every 30 seconds). Write down, in order, what happens to the white near the edge, the white near the yolk, and the yolk.
2. **Heat test.** Scramble 2 eggs on low heat and 2 eggs on medium-high heat, in the same pan one after the other. Time each one. Compare the texture: soft and moist, or dry and rubbery? Is there liquid on the plate?
3. Cook the full recipe, checking the eggs with the thermometer.

4. **Maillard test.** Make one sandwich over low heat and one over medium heat. Compare the color of each side after 3 minutes. Which has more golden brown? Which smells toastier?
5. **Taste test.** Rate the eggs and the sandwiches for texture and flavor from 1 to 5. Ask your family to rate them too.
6. **Improve it.** Write what you would change next time: the heat, the timing, a different cheese, or chopped herbs or spinach in the eggs.
7. Clean up: wash, dry and put away everything, and wipe the counter where the eggs were cracked.

Tips

- Low and slow makes the softest scrambled eggs. Patience is a cooking skill.
- Thin, even butter on the outside of the bread browns more evenly than thick globs.
- Brown is flavor; black is burnt. If the bread browns before the cheese melts, turn the heat down and cover the pan.

Check your work

- ☐ I can explain denaturation and coagulation using an egg.
- ☐ I can explain the Maillard reaction and name three foods it browns.
- ☐ I cooked eggs to 160 °F and a golden sandwich with an adult beside me, controlling the heat.

COOK'S NOTEBOOK

1. Draw three boxes: folded egg proteins in an uncooked egg, unfolded proteins, and proteins linked in a net. Label them raw, denatured and coagulated.
2. Tape in, or draw, the color of your two grilled-cheese sandwiches side by side, with the heat and time for each.
3. Write a list of ten brown foods you love, and put a star next to the ones made brown by the Maillard reaction.

From history. Caramelization is a different browning reaction. It happens when sugar alone is heated to about 320 °F (160 °C) and turns into golden caramel. The Maillard reaction needs both sugars and proteins. Many foods, like a roasted onion, show both kinds of browning at once.

COMMON MISTAKES

- Cooking scrambled eggs on high heat. The proteins squeeze too tight, the eggs turn rubbery and water leaks out.
- Thinking browning is the same as burning. Browning is the Maillard reaction making flavor; burning is food turning to black carbon.
- Using the same unwashed hands or bowl after cracking eggs. Wash hands and tools; uncooked eggs can carry germs.

Make it a game · Egg Proteins in Motion. Act out egg proteins as a team. Stand curled up as a coiled protein, then unfold when your parent says heat. Link arms to show coagulation. Say each word as you act it out. Then name three foods the Maillard reaction browns and tell how Louis-Camille Maillard found it in 1912.

Scripture. “Can that which is unsavoury be eaten without salt? or is there any taste in the white of an egg?” (Job 6:6, KJV)

Job asked a cook’s question: plain egg white has little flavor on its own. Salt, butter and a golden crust are some of the ways God lets us make good food taste even better.

5.4 YEAST: PASTEUR AND THE LIVING LEAVEN

OBJECTIVES

- Tell how Louis Pasteur showed that yeast is a living thing and that it causes fermentation.
- Explain how yeast eats sugar and makes carbon dioxide gas, how gluten traps the gas, and how steam and heat finish the rise in the oven.
- Mix, knead, shape and bake soft dinner rolls with an adult beside you, keeping a rise log.

Warm-up. Look at a slice of bread through a magnifying glass. Draw the holes you see. Where do you think the holes came from? Then smell a packet of dry yeast. Is it alive or not? Write your guess and your reasons.

WATCH

Why Does Bread Have Holes In It? | The Science of Cooking | SciShow Kids

SciShow Kids · 5:34

<https://www.youtube.com/watch?v=JlDlZr7Ljrw>

WHEN TO WATCH

After the story of Pasteur, before you mix your dough. Watch how the yeast cells are drawn, then look for the same holes in your rolls when they come out of the oven.

Note: Made for younger children, but clear and accurate about yeast as a living fungus that makes gas bubbles.

KEY TERMS

yeast

A tiny, one-celled living fungus. Baker's yeast eats sugars and gives off carbon dioxide gas, which makes bread rise.

fermentation

The work of yeast and other tiny living things breaking down sugars in food, making gas and new flavors.

leaven

Anything that makes dough rise, especially yeast or a piece of old risen dough saved to start a new batch.

carbon dioxide

The gas yeast gives off as it feeds. Its bubbles, trapped in dough, make bread light.

proof

To let shaped dough rise before baking; also, to test yeast in warm water to see if it is alive.

oven spring

The quick last rise of bread in the first minutes of baking, as gas bubbles and steam expand in the heat.

CORE IDEAS

The story. For thousands of years, bakers saved a lump of risen dough from each batch to start the next one. They knew this “leaven” made bread rise, but no one knew why. Many scientists thought fermentation was just a chemical change, like rust, with nothing alive about it. Louis Pasteur, the French chemist you met in Unit 1, did not agree. He was a careful man who looked at everything under the microscope.

How he figured it out. In the late 1850s Pasteur studied fermentation, the change that makes dough rise and turns sweet juices sour. Under his microscope he saw that wherever fermentation happened, tiny round yeast cells were there, and they were budding: little new cells were growing out of the old ones, the way living things reproduce. He grew yeast in a liquid with sugar and a few simple nutrients, and the yeast multiplied as it used up the sugar. In 1857 and in the years that followed, Pasteur published his experiments showing that fermentation is caused by living things too small to see. Yeast was not a dead chemical; it was alive and eating.

The kitchen science. Baker’s yeast is a one-celled **fungus**, a distant cousin of mushrooms. A single packet holds billions of cells, dried and resting. In warm water (about 105–110 °F, or 40–43 °C, like a warm bath) they wake up. They feed on sugars in the dough and give off bubbles of **carbon dioxide** gas. Kneading turns the wheat proteins in flour into stretchy **gluten**, which traps the bubbles like thousands of tiny balloons, so the dough rises. **Moisture** matters too: water is needed to form gluten and wake the yeast, and in the hot oven some of the water turns to steam. Steam and gas expand and puff the rolls up in the first minutes of baking (**oven spring**). The heat kills the yeast at about 140 °F (60 °C), the starch sets (gelatinization again!), and

the Maillard reaction browns the crust. Too much heat in the water kills yeast before it starts; too cold, and it works slowly.

Let's cook. You will bake a pan of soft dinner rolls and keep a **rise log**. The skill to do well is **kneading**: push the dough away with the heels of your hands, fold it back, turn it a quarter turn, and repeat for 8–10 minutes until it is smooth and springs back. Jesus said the kingdom of heaven is like leaven hidden in a big batch of flour, working quietly until the whole batch has risen. Watch your dough, and you will see how a little yeast changes everything around it.

PICTURE STUDY



Woman Baking Bread, Jean-François Millet, 1854 · Oil on canvas · Kröller-Müller Museum, Otterlo, Netherlands

Image: [Wikimedia Commons](#), public domain

Jean-François Millet grew up on a farm in Normandy and spent his life painting the work of country people. Here a farm woman bakes the household's bread in a brick oven built into the wall. Families like hers baked a big batch once a week or so, and the bread had to last until the next baking day.

Look closely

- Find the oven's glowing mouth. Where is the fire, and how can you tell the oven is very hot?
- Follow the long wooden paddle, called a peel. Why would a baker need such a long handle?
- Find the round straw baskets. Bakers let shaped dough rise in baskets like these before baking. What was happening to the dough inside them?
- Look at how she stands and leans. Is baking for a whole family light work or hard work?

Talk about it

1. Her dough rose in the baskets before it went in the oven. What tiny living thing made it rise, and what gas did it make?

2. Inside the hot oven, the gas bubbles grow, the water turns to steam, and the crust browns. Which of these did you see happen to your rolls?
3. Why do you think Millet painted a woman baking bread instead of a king or a battle?

Safety first. Never taste unbaked dough: uncooked flour and eggs can carry germs. An adult stands beside you at the oven; use oven mitts, keep your face back when the door opens, and set the hot pan on a trivet or cooling rack.

KITCHEN PROJECT

Watch the Dough Rise: Rolls and a Rise Log

First you will prove that yeast is alive with a balloon experiment, just as Pasteur proved it with his microscope. Then you will make a pan of soft rolls, measuring how much the dough rises, and look inside a baked roll for the holes the yeast made.

You will need

- A large mixing bowl and a wooden spoon (or a stand mixer with a dough hook, with an adult)
- Measuring cups and spoons, or a kitchen scale
- An instant-read thermometer
- A clean kitchen towel or plastic wrap, and masking tape and a marker
- A 9 × 13-inch baking pan
- A pastry brush, oven mitts and a cooling rack
- For the balloon test: two small empty plastic bottles, two balloons, sugar and a funnel

EASY SOFT DINNER ROLLS

Serves 15 rolls · Prep 25 min · Rise 1 hr 15 min–1 hr 45 min · Bake 18–22 min

Ingredients

- 1 cup (240 mL) milk, warmed to 105–110 °F (40–43 °C)
- ¼ cup (60 mL) warm water, 105–110 °F (40–43 °C)
- 2¼ teaspoons (1 packet) instant or active dry yeast
- 3 tablespoons sugar
- 1 large egg, at room temperature
- 4 tablespoons (57 g) butter, melted and cooled, plus 1 tablespoon melted butter for brushing
- 1¼ teaspoons salt
- 3½–3¾ cups (440–470 g) all-purpose flour

Method

1. Wash your hands. With an adult, warm the milk in the microwave in short bursts and check it with the thermometer: 105–110 °F, like a warm bath, not hot.
2. In the large bowl, stir together the warm milk, warm water, yeast and sugar. Let it sit 5–10 minutes until foamy. (Foam means the yeast is alive.)
3. Add the egg, 4 tablespoons melted butter and salt, and stir. Add 3 cups of flour, one cup at a time, stirring until a shaggy dough forms.
4. Sprinkle some of the remaining flour on the counter. Turn out the dough and knead 8–10 minutes, adding flour a spoonful at a time only if the dough sticks badly. It is ready when smooth and it slowly springs back when poked.
5. Put the dough in a lightly greased bowl, cover it, and let it rise in a warm place until doubled, 45–75 minutes.
6. Press the dough down gently. Divide it into 15 equal pieces (about 55 g each on a scale). Roll each into a smooth ball and set them in rows in the greased pan. Cover and let rise until puffy and touching, 30–45 minutes.
7. While they rise, an adult heats the oven to 375 °F (190 °C). With an adult beside you, bake 18–22 minutes, until golden brown (190 °F inside). Brush the hot tops with melted butter.
8. Cool 10 minutes on a rack before pulling apart. Clean up: scrape dough off the counter with a bench scraper or spatula before washing (wet dough turns to glue), then wash all the bowls.

Allergy check: Contains wheat, milk and eggs. For egg-free rolls, leave out the egg and add 2 more tablespoons warm water. For milk-free rolls, use warm water instead of milk and olive oil instead of butter. Never taste the unbaked dough.

Steps

1. **Balloon test.** Into each bottle put ½ cup warm water (105–110 °F) and 1 teaspoon yeast. Add 1 tablespoon sugar to bottle A only. Stretch a balloon over each mouth. Predict, then check every 10 minutes for 30 minutes. Which balloon grew? What gas filled it?
2. Mix and knead the dough. Before kneading, gently pull a piece: does it tear? After kneading, stretch a small piece thin between your fingers until light

shows through (the windowpane test). That is gluten.

3. **Rise log.** Put the dough in a straight-sided bowl or container and mark its height with tape. Every 15 minutes, mark the new height and write the time. Note the room temperature if you can.
4. Take a photo or make a drawing of the rolls before they go in the oven, and again after baking. How much did they grow in the oven?
5. When the rolls are cool, an adult cuts one in half. Look at the crumb with a magnifying glass and draw the holes. Are they large, small, even or uneven?
6. **Taste test.** Rate the rolls for softness, flavor and crust color. Ask your family to rate them.
7. **Improve it.** Write what you would change next time (rise time, shaping, baking time, or a whole-wheat version) and why.
8. Clean up: wash, dry and put everything away, and wipe flour from the counters and floor.

Tips

- A warm spot for rising: inside the oven with only the light turned on, or near (not on) a warm stove.
- Too much flour makes heavy rolls. Sticky dough becomes less sticky as you knead.
- Rolls freeze well. Save some for the family feast in Lesson 8.4.

Check your work

- ☐ I can tell how Pasteur showed that yeast is alive.
- ☐ I can explain how yeast, gluten, moisture and steam make bread rise.
- ☐ I kneaded and baked rolls with an adult beside me and kept a rise log.

COOK'S NOTEBOOK

1. Rise log: a table of time and dough height, then a line graph with time across and height up.
2. Draw a yeast cell budding, the way Pasteur saw it under the microscope, and a sketch of the inside of your roll.
3. Copy the roll recipe in your own words, and write one sentence about what moisture did in the oven.

From history. Commercial baker's yeast was first sold widely in America after Charles and Maximilian Fleischmann displayed their compressed yeast and a model bakery at the 1876 Centennial Exhibition in Philadelphia. Quick-acting dry yeast came much later. Before that, many families kept a sourdough starter going from one baking day to the next.

COMMON MISTAKES

- Using water that is too hot. Water above about 130 °F (54 °C) can kill yeast; use a thermometer.
- Tasting unbaked dough. Uncooked flour and eggs can carry germs; wait for the baked roll.
- Adding lots of extra flour because the dough is sticky. Knead longer first; too much flour makes dry, heavy rolls.

Make it a game • Dough Rise Prediction. Mix a pinch of yeast, a spoon of sugar and warm water in a cup. Predict in writing how tall the foam will be in ten minutes, and mark the cup. Check at the end and score closeness. Explain how yeast eats sugar, how gluten traps gas, and what oven spring does. Pasteur gets a bow.

Scripture. “Another parable spake he unto them; The kingdom of heaven is like unto leaven, which a woman took, and hid in three measures of meal, till the whole was leavened.” (Matthew 13:33, KJV)

Three measures of meal is a very large batch of flour, and a little leaven worked through it all. Small, hidden, faithful things can change a great deal.

UNIT 5

FOOD CHEMISTRY

Every kitchen is a chemistry lab, and every cook is doing experiments, whether he knows it or not. In this unit you will meet the ingredients that do the most work in a recipe and learn what each one is really doing. You will watch **starch** grains swell and burst to thicken a pudding, shake **oil and water** into an emulsion for a salad dressing, and see egg **proteins** unfold and set while bread turns golden in the Maillard reaction.

Then you will meet a living ingredient. Louis Pasteur showed that the yeast in bread dough is alive, a tiny fungus that eats sugar and breathes out the gas that makes bread rise. You will bake a pan of soft rolls, keep a rise log, and learn how **moisture** and steam finish the job in the oven. Jesus compared the kingdom of heaven to a little leaven working quietly through a whole batch of dough (Matthew 13:33); by the end of this unit you will know just what He meant.

PREREQUISITES

- Can measure dry and liquid ingredients with cups and spoons (Units 1–4)
- Uses the stove and oven only with an adult beside, pot handles turned in and oven mitts on (Unit 1)
- Knows the danger zone and that egg dishes are cooked to 160 °F (Unit 1)
- Knows how heat moves by conduction, convection and radiation (Unit 4)

MASTERY CHECKLIST

- ☐ I can explain how starch granules soak up water and swell when heated to thicken a sauce or pudding, and why cornstarch must be mixed with cold liquid first.
- ☐ I can explain why oil and water separate, what an emulsifier does, and make a vinaigrette that stays mixed longer.
- ☐ I can tell how egg proteins unfold and set when heated, and explain the Maillard reaction that browns toast and grilled cheese.
- ☐ I can tell how Pasteur showed that yeast is alive, explain how yeast makes bread rise, and bake rolls with a rise log.
- ☐ I can describe what moisture does in cooking: steam in baking, evaporation, and salt drawing water out of food.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **A digital kitchen scale:** Inexpensive and useful for the rest of the year. Weighing flour in grams makes bread dough come out the same every time (Lesson 5.4 and the unit challenge).
- **King Arthur Baking: Learn to bake guides and Baker's Hotline:** Free step-by-step baking guides with photographs, from the King Arthur Baking Company. Helpful for Lesson 5.4 and the unit challenge. Their Baker's Hotline answers baking questions by phone or chat.
- **A clear glass or plastic jar with a tight lid:** A clean jam jar or peanut butter jar is perfect for shaking the emulsion in Lesson 5.2 and watching it separate.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

5.1 Starch: The Thickener

2 sessions of 45–60 minutes

5.2 Oil and Water: Emulsions

2 sessions of 45–60 minutes

5.3 Protein: Eggs, Browning and Louis-Camille Maillard

2 sessions of 45–60 minutes

5.4 Yeast: Pasteur and the Living Leaven

2 sessions of 60–90 minutes

UNIT 5 REVIEW

Answer each question. Use complete sentences for explanations. The review is worth 50 points.

1. (5 pts)

What happens to starch granules when they are heated in water? Use the word gelatinization.

2. (5 pts)

Predict: you dump a spoonful of cornstarch straight into a pot of hot gravy. What will happen, and how should you have done it?

3. (5 pts)

Why do you need about twice as much flour as cornstarch to thicken the same amount of liquid?

4. (5 pts)

Why do oil and water separate? What does an emulsifier do?

5. (5 pts)

Name two emulsifiers used in cooking and two foods that are emulsions.

6. (5 pts)

Describe what happens to egg proteins as an egg cooks. Use the words denaturation and coagulation.

7. **5 pts**

Predict: you scramble one batch of eggs on low heat and one on high heat. How will they differ, and why?

8. **5 pts**

What did Louis-Camille Maillard discover in 1912, and why doesn't this reaction happen to bread boiled in water?

9. **5 pts**

What did Louis Pasteur show about yeast and fermentation?

10. **5 pts**

Explain three things that make a roll rise, from the bowl to the oven.

ANSWER KEY

1. They soak up water and swell, and long starch chains leak out and tangle together, trapping water and thickening the liquid. This is gelatinization.
2. It will form lumps: the outside of each clump cooks into a sticky skin around dry powder. Stir the cornstarch into a little cold liquid first to make a slurry, then stir the slurry into the hot gravy.
3. Cornstarch is almost pure starch, but flour is only about three-quarters starch; the rest is mostly protein, which does not thicken the same way.
4. Water molecules cling to each other and oil cannot fit in, so they push apart and the lighter oil floats. An emulsifier has one end that likes water and one end that likes oil; it coats oil droplets and keeps them from joining back together.
5. Emulsifiers: mustard, egg yolk (lecithin), honey helps thicken. Emulsions: vinaigrette, mayonnaise, milk, butter, gravy (any two of each).
6. Heat makes the tightly folded proteins unwind (denaturation). The loose strands link to each other in a net that traps water (coagulation), so the runny egg turns white and firm.
7. The low-heat eggs will be soft and moist; the high-heat eggs will be rubbery and may leak water. High heat makes the protein net squeeze too tight and push out the water.
8. He found that sugars and amino acids heated together turn brown and make new flavors and smells (the Maillard reaction). It needs temperatures around 280–330 °F and fairly dry food; boiling water cannot get hotter than 212 °F.
9. That yeast is a living microbe (he saw it budding and multiplying under the microscope) and that fermentation is caused by living things, not just a chemical change.
10. Yeast eats sugar and gives off carbon dioxide; gluten from kneaded wheat protein traps the gas bubbles; in the oven, gas and steam from the dough's moisture expand (oven spring) until the heat sets the starch and protein.

UNIT CHALLENGE: A LOAF OR PAN OF ROLLS WITH A RISE LOG

Bake a loaf of bread or a pan of rolls (the Lesson 5.4 recipe or another family recipe) with an adult beside you. Keep a full rise log: the water temperature, the time you started kneading, and the dough's height every 15 minutes through both rises.

When it is baked and cooled, have an adult cut it so you can photograph or draw the crumb. Write a short paragraph explaining what the yeast, the kneading (gluten) and the moisture (steam) each did, and one thing you would change next time. Serve it to your family with a word of thanks.

LOOK FOR	WHAT IT MEANS
Bread baked safely	Measured carefully, kneaded well, baked with an adult beside, with oven mitts and a clean, cleared-up kitchen afterward.
Rise log	Times and heights recorded honestly through both rises, with a simple graph.
Crumb photo or drawing	Shows the holes clearly and labels at least one thing they tell you.
Science explanation	Correctly explains the work of yeast, gluten and steam in your own words.
Improvement	Names one honest change for next time and the reason; a loaf that flopped but is well recorded earns full credit.

CRAVINGS, REWARD & A BALANCED DIET

God made us able to enjoy food. A ripe strawberry tastes sweet, salty popcorn tastes wonderful, and a warm cookie smells like home. He also made our bodies to tell us when we need food and when we have had enough. In this unit you will learn how that works: how your stomach and brain talk to each other, and how a messenger chemical in the brain called **dopamine** helps us *want* things that have been good to us before.

You will also learn why it is so easy to eat a whole bag of chips, how food makers test recipes to hit a “bliss point” of sugar, salt and fat, and how to read the Nutrition Facts label to find added sugar. None of this is about good or bad people, or good or bad bodies. It is about understanding the gifts God gave us, using them with thankfulness and self-control, and enjoying treats in their place. You will make banana “nice cream,” seasoned popcorn, real lemonade and a batch of oatmeal cookies to share.

PREREQUISITES

- Knows the five food groups and how to build a balanced plate (Unit 2)
- Knows the five basic tastes and that tastes can change with practice (Unit 3)
- Can measure with cups, spoons and a scale, and use the stove and oven with an adult beside (Units 1–5)

MASTERY CHECKLIST

- ☐ I can explain, simply and correctly, that dopamine is a brain messenger connected with wanting and learning what is rewarding.
- ☐ I can explain why the stomach needs about 20 minutes to signal fullness, and how fiber, protein and water help us feel satisfied.
- ☐ I can tell what the “bliss point” is and why some packaged snacks are easy to keep eating past full.
- ☐ I can read a Nutrition Facts label, find the added sugars, and change grams to teaspoons (4 grams $\approx$ 1 teaspoon).
- ☐ I can plan where “sometimes foods” fit in my week, and share treats with thankfulness and self-control.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **FDA: Added Sugars on the Nutrition Facts Label**: Free. A clear page from the U.S. Food and Drug Administration explaining the Added Sugars line and the Daily Value. Useful for Lesson 6.3.
- **FDA: How to Understand and Use the Nutrition Facts Label**: Free. A labeled picture of the whole Nutrition Facts label with an explanation of each part, for parents and older students.
- **A set of clear glasses and a box of sugar cubes**: Inexpensive. For the sugar-spoon display in Lesson 6.3: one sugar cube is about 4 grams, or 1 teaspoon, of sugar.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

6.1 Your Brain's Reward System

2 sessions of 45–60 minutes

6.2 Sugar, Salt and Fat: The Bliss Point

2 sessions of 45–60 minutes

6.3 Reading the Label for Added Sugar

2 sessions of 45–60 minutes

6.4 Treats in Their Place

2 sessions of 45–60 minutes

UNIT 6 REVIEW

Answer each question. Use complete sentences for explanations and show your work for calculations. The review is worth 50 points.

1. 5 pts

What is dopamine, and what is it mostly connected with: liking a food while we eat it, or wanting it?

2. 5 pts

Why does it help to eat slowly?

3. 5 pts

Name three things in food that help us feel full and satisfied.

4. 5 pts

What is the “bliss point,” and how did Howard Moskowitz find it?

5. 5 pts

Predict: you eat a whole bag of chips while watching a show, and then a bowl of popcorn with a glass of water at the table. Which will leave you feeling full longer, and why?

6. 5 pts

A sweetened drink has 32 grams of added sugar per serving. How many teaspoons is that?

7. **5 pts**

A bottle has 2 servings. Each serving has 24 grams of added sugar. If you drink the whole bottle, how many grams and teaspoons of added sugar is that?

8. **5 pts**

What is the difference between Total Sugars and Added Sugars on the label?

9. **5 pts**

What happens to your taste buds when you eat less added sugar for a few weeks?

10. **5 pts**

Name two ways Scripture teaches us to enjoy treats and feasts rightly.

ANSWER KEY

1. Dopamine is a messenger chemical in the brain. It is mostly connected with wanting and motivation, and with learning what is rewarding, not with the enjoyment itself.
2. Fullness signals from the stomach and intestines take about 20 minutes to reach the brain. Eating slowly gives them time, so we notice we have had enough before we eat past full.
3. Fiber, protein and water.
4. The amount of sugar (or another ingredient) that the most people like best, not too little and not too much. He made many versions of a food, had many people taste them, and recorded which one most people preferred.
5. The popcorn with water. Popcorn is a whole grain with more fiber and fills a big bowl; the water fills the stomach too; eating at the table, slowly, lets fullness signals arrive. Chips have little fiber and are easy to eat quickly while distracted.
6. $32 \div 4 = 8$ teaspoons.
7. $24 \times 2 = 48$ grams. $48 \div 4 = 12$ teaspoons.
8. Total Sugars includes sugar naturally in foods like milk and fruit plus any added sugar. Added Sugars shows only the sugar put in when the food was made, such as table sugar, honey or syrup.
9. They adjust: foods with less sugar start to taste sweet enough, and very sweet foods may taste too sweet.
10. Give thanks to God; share with others, especially those who have less (Nehemiah 8:10); practice self-control or temperance (Proverbs 25:16, Galatians 5:22-23); keep feasts for special days. Any two.

UNIT CHALLENGE: A ONE-WEEK DRINK AND SNACK SWAP

For one week, swap one sweetened drink or packaged snack each day for something you make or choose yourself: water with fruit, your less-sugar lemonade, popcorn you popped, nice cream, fruit, or vegetables with dip.

Keep a daily log: what you swapped, how full and how energetic you felt (1 to 5), and what your taste buds noticed. At the end of the week, write a paragraph about what changed, add up the teaspoons of added sugar you skipped, and share one swap your family wants to keep.

LOOK FOR	WHAT IT MEANS
Daily log	Seven days recorded honestly, with the swap, the ratings and a note on taste.
Label math	Grams of added sugar correctly turned into teaspoons, with the week's total shown.
Homemade swaps	At least three swaps made in the kitchen, safely and with cleanup.
Reflection	A thoughtful paragraph on what changed, written without calling foods or people good or bad.

6.1 YOUR BRAIN'S REWARD SYSTEM

OBJECTIVES

- Explain that dopamine is a messenger chemical in the brain tied to wanting and motivation, released when we expect or get something good.
- Describe how the stomach and brain signal hunger and fullness, and why fullness takes about 20 minutes to arrive.
- Make banana “nice cream,” eat it slowly, and rate hunger and fullness before, during and after.

Warm-up. Close your eyes and imagine walking into the kitchen and smelling cookies baking. What happens in your mouth? In your stomach? Do you want one even if you just ate lunch? Rate how hungry you are right now on a scale of 1 (very hungry) to 5 (comfortably full), and write it down.

WATCH

How does your body know you're full? - Hilary Coller

TED-Ed • 4:33

<https://www.youtube.com/watch?v=YVfyYrEmzgM>

WHEN TO WATCH

After the story of Cannon and Washburn. Watch for the messages traveling from the stomach to the brain, and for the clock near the end.

Note: An animated TED-Ed lesson on hunger and fullness signals. It names several hormones; students do not need to remember their names.

KEY TERMS

dopamine

A messenger chemical in the brain tied to wanting and motivation. The brain releases it when we expect or get something good, which helps us learn what to want again.

reward system

The parts of the brain that notice good things, such as food when we are hungry, and help us remember them and want them again.

craving

A strong wish for a particular food or thing.

satiety

The satisfied feeling of having had enough to eat. Say it “suh-TIE-uh-tee.”

hunger scale

A 1-to-5 scale you use to notice how hungry or full you are, from very hungry (1) to comfortably full (5).

CORE IDEAS

The story. In 1911 and 1912, Walter Cannon, a professor at Harvard Medical School, wanted to know what a hunger pang really was. His student and helper, A. L. Washburn, trained himself to swallow a thin tube with a small, soft balloon at the end. The balloon was gently filled with air inside his stomach and connected to a recording drum. Every time Washburn felt a hunger pang, he pressed a key. The recordings showed that his empty stomach was squeezing in strong waves at the very moments he felt hungry. Cannon and Washburn published their findings in 1912.

How they figured it out. Later scientists learned that the stomach is only part of the story. Fullness is a conversation between the stomach, the intestines and the brain. As food arrives, the stomach stretches and the intestines send chemical messages to the brain. These signals take time, about 20 minutes, to add up to the feeling “I’ve had enough.” Scientists also discovered **dopamine**. In the 1950s a Swedish scientist, Arvid Carlsson, showed that dopamine is a messenger that brain cells use to talk to each other. In the 1990s, researchers led by Kent Berridge at the University of Michigan found something surprising: dopamine is not mainly about how much we *like* a food while we eat it. It is about *wanting* it, the pull that makes us go and get it.

The kitchen science. Your brain has a **reward system**. When you are hungry and you eat something good, or even when you just smell it and expect it, the brain releases dopamine. Dopamine helps your brain learn: “That was good. Remember it. Go get it again.” That is a gift; it helps us want food when our bodies need it. But the brain learns to want foods that are sweet, salty and rich most of all, and it can keep wanting them even after the stomach is full. That is why you may still want a cookie after a big lunch, and why shopping for food while you are very hungry can fill the

cart with snacks you did not plan to buy. Eating slowly gives the fullness signals time to reach the brain. So does drinking water and eating foods with **fiber** and **protein**, which help us feel satisfied longer. The good news: habits can be retrained. The brain learns what to want, so it can learn new things too.

Let's cook. You will make banana “nice cream,” a creamy frozen dessert made from nothing but frozen bananas (and a few add-ins if you like), then eat it slowly and notice what your body tells you. The skill to do well is **using a blender or food processor safely** with an adult nearby: lid on before you start, never reach inside, and turn it off and unplug it before scraping down the sides.

PICTURE STUDY



Mariko, Utagawa Hiroshige, about 1838 · Color woodblock print · The Metropolitan Museum of Art, New York

Image: [Wikimedia Commons](#), public domain

The Tōkaidō was the great road between Edo (now Tokyo) and Kyoto in Japan. Travelers walked it for about two weeks, and at each of its fifty-three stations they stopped to rest and eat. The town of Mariko was famous for one dish: *tororo-jiru*, a soup of grated mountain yam poured over rice. Hiroshige made many prints of the road and its tea houses.

Look closely

- Find the tea house. How can you tell it is a place to eat?
- Find the travelers who are sitting down and those who are still walking. Which ones do you think are hungry?
- Find the signboards on the shop. Signs like these told travelers about the famous local food. What would a sign need to say to make you stop?
- Look at the horse with its load. How far do you think these people have walked today?

Talk about it

1. After a long walk, how would these travelers know they were hungry? How would they know when they had eaten enough?

2. A famous dish and a sign can make a traveler *want* to stop even if he is not very hungry. What part of the brain is the sign speaking to?
3. What would you like to eat at a rest stop after walking all morning?

Safety first. Use the blender or food processor only with an adult nearby: lid on, hands out, and unplug it before scraping. Let an adult slice bananas if they are frozen hard. Check for food allergies before adding peanut butter or other nut butters.

KITCHEN PROJECT

Eat Slowly and Listen: Banana Nice Cream

You will make a frozen dessert from bananas and then run an experiment on yourself: eating slowly while you rate your hunger and fullness. You will find out how long it takes your body to tell you, “That’s enough.”

You will need

- A cutting board and a table knife or small knife
- A baking sheet lined with parchment or a freezer bag
- A blender or food processor and a spatula
- Measuring cups and spoons
- Bowls, spoons and a timer

BANANA “NICE CREAM”

Serves 4 (about ½ cup each) · Prep 10 min · Freeze 4 hr or overnight · Blend 5 min

Ingredients

- 4 ripe bananas (with brown speckles)
- 2–4 tablespoons milk, if needed for blending
- ½ teaspoon vanilla extract (optional)
- **Flavor add-ins (choose one):** 1 cup frozen strawberries; or 2 tablespoons unsweetened cocoa powder; or 2 tablespoons peanut butter
- **Toppings (optional):** sliced fresh fruit, a sprinkle of cinnamon or a few chopped nuts

Method

1. Wash your hands. Peel the bananas and slice them into coins about ½ inch thick with a table knife or small knife, with an adult beside you.
2. Spread the coins on the lined baking sheet in one layer (so they do not freeze in a lump) and freeze at least 4 hours or overnight.
3. Put the frozen banana coins in the blender or food processor. Add the vanilla and your add-in.

4. With an adult nearby and the lid on, pulse in short bursts. At first it looks crumbly, then like oatmeal, then suddenly smooth and creamy like soft-serve. If it is stuck, turn the machine off, unplug it, scrape down the sides and add 1 tablespoon of milk at a time.
5. Scoop into bowls and serve right away for soft-serve, or freeze 1 hour in a covered container for scoopable nice cream.
6. Clean up: rinse the blender right away (banana sets like glue), then wash, dry and put away.

Allergy check: The banana base contains none of the nine major allergens. Milk contains milk (use water or a milk-free milk instead). Peanut butter contains peanuts, and nut toppings contain tree nuts; check for allergies and leave them out if needed.

Steps

1. **Before.** Rate your hunger from 1 (very hungry) to 5 (comfortably full) and write the time. Do this lesson in the afternoon, a few hours after lunch.
2. **Slow bowl.** Serve yourself one ½-cup scoop. Eat it slowly: put your spoon down between bites, notice the cold, the sweetness and the creaminess. Take at least 10 minutes. Have a glass of water with it.
3. **During and after.** Rate your hunger halfway through, at the end, and again 20 minutes after you finish. Do you want more at the end? Do you still want more 20 minutes later?
4. Ask one family member to try the same experiment and compare your ratings in a little table.
5. **Taste test.** If you made two flavors, rate each for sweetness and creaminess from 1 to 5. Banana nice cream has no added sugar; was it sweet enough?
6. **Improve it.** Write one change for next time (a different add-in, riper bananas, a splash less milk).
7. Clean up: wash and put away everything, and wipe the counter.

Tips

- The riper the banana, the sweeter the nice cream. Freeze bananas when they have brown spots, before they get too soft.
- A food processor works better than a blender for small amounts.

- Keep a bag of frozen banana coins in the freezer for quick nice cream or smoothies.

Check your work

- ☐ I can explain that dopamine is about wanting, and that the brain learns what to want.
- ☐ I can explain why it takes about 20 minutes to feel full.
- ☐ I used the blender safely and recorded my hunger ratings honestly.

COOK'S NOTEBOOK

1. Draw a map from your stomach to your brain with arrows for “I’m hungry” and “I’ve had enough.” Add a clock showing about 20 minutes.
2. Make a table of your hunger ratings: before, halfway, at the end and 20 minutes after.
3. Write about a time you wanted a food even though you were full. What made you want it? A smell? A picture? Seeing others eat?

From history. Arvid Carlsson received the Nobel Prize in Physiology or Medicine in 2000 for his discoveries about dopamine as a messenger in the brain. His work also helped doctors understand and treat Parkinson’s disease, in which brain cells that make dopamine stop working well.

COMMON MISTAKES

- Thinking dopamine is the “pleasure chemical.” It is mostly about wanting and learning what to go after, not about enjoying.
- Eating fast and deciding you are still hungry. Fullness signals take about 20 minutes; slow down and wait.
- Thinking wanting a treat means something is wrong with you. Wanting good food is part of how God made us; self-control is choosing when and how much.

Make it a game • Slow Bite Challenge. Eat a small snack as slowly as you can, setting a timer for twenty minutes, and notice your hunger. Rate it on a one-to-five scale at the start, middle and end. Tell your parent what the stomach and brain are telling each other. Explain what dopamine does with wanting, and why fullness takes time to arrive.

Scripture. “The eyes of all wait upon thee; and thou givest them their meat in due season. Thou openest thine hand, and satisfiest the desire of every living thing.” (Psalm 145:15-16, KJV)

Hunger and wanting are part of how God made us, and He is the one who satisfies. Every meal is a chance to thank Him.

6.2 SUGAR, SALT AND FAT: THE BLISS POINT

OBJECTIVES

- Tell how Howard Moskowitz and other food scientists tested recipes to find the “bliss point,” and why sugar, salt and fat together are so appealing.
- Explain why some packaged snacks are easy to keep eating past full, and how fiber, protein and water help us feel satisfied.
- Pop and season a measured bowl of whole-grain popcorn on the stove with an adult beside you, and compare how full it makes you feel.

Warm-up. Look at the front of a bag or box of a packaged snack in your pantry. List every word or picture on the front that is meant to make you want it. Then guess: how many servings are in the whole bag? Check the label to see if you were right.

WATCH

Why Does Popcorn Pop? | The Science of Food! | SciShow Kids

SciShow Kids · 5:40

<https://www.youtube.com/watch?v=Y0e7zGF5Ows>

WHEN TO WATCH

Before you make your popcorn. Watch for what is inside each kernel and why heat makes it burst. (Popcorn is a whole grain!)

Note: Made for younger children, but a clear demonstration of the science inside this lesson’s recipe.

BACKUP VIDEO

Why Does Salt Make Food Taste Better?

SciShow · 4:11

<https://www.youtube.com/watch?v=ATrSoMlx5PE>

After the kitchen-science paragraph. Listen for how salt hides bitterness and makes sweet foods taste sweeter.

KEY TERMS

bliss point

The amount of sugar (or salt or fat) in a food that the most people like the most: not too little, not too much.

fiber

The part of plant foods that our bodies cannot digest. It adds bulk, helps us feel full, and keeps the digestive system working well.

texture

How a food feels in the mouth: crunchy, creamy, chewy, airy. Snack makers design textures carefully.

serving size

The amount of food the Nutrition Facts label describes, such as 1 ounce of chips or 3 cups of popcorn. A bag often holds several servings.

whole grain

A grain that still has all three parts: bran, germ and endosperm. Popcorn, oatmeal and brown rice are whole grains.

CORE IDEAS

The story. Howard Moskowitz is an American scientist who studied *psychophysics*, the measuring of how our senses respond to things like sweetness and loudness. In the 1970s he studied how people judge taste for the U.S. Army's food laboratory, and later many food companies hired him to help make their foods more popular. His method was simple and careful: make many versions of a food with a little more or a little less sugar, salt or other ingredients, have many people taste them, and record which one most people liked best. The perfect amount, not too little and not too much, came to be called the **bliss point**. In the 1980s he helped a spaghetti sauce company discover that many shoppers wanted an extra-chunky sauce that no one was making yet, and it sold very well.

How they figured it out. Food scientists learned that people like foods more when sweetness, saltiness, fat and texture are balanced just right. They also learned that a food with one strong flavor can tire the mouth, so you stop, while a food that combines salty, sweet, rich and crunchy keeps tasting interesting bite after bite. Some packaged snacks are designed this way on purpose. They often melt away quickly in the mouth, so it seems as if you have hardly eaten anything. A writer

named Michael Moss described this kind of testing in a book about the snack food industry in 2013.

The kitchen science. Sugar, salt and fat each have their own job. Sugar tastes sweet and tells us there is energy in the food. Salt makes many flavors stronger and hides bitterness. Fat carries flavor and makes food feel rich and smooth. Together, especially with a satisfying crunch, they make the brain's reward system say, "More!" Many packaged snacks have little **fiber**, protein or water, the things that fill the stomach and slow us down. So it is easy to eat past full before the 20-minute fullness signal arrives. Popcorn is different. It is a **whole grain** with lots of fiber, and it takes up a big bowl for a small amount. Three cups of plain popcorn is about the same weight as a 1-ounce serving of chips, but it fills a much bigger bowl and has several times the fiber. This is not about good or bad foods or good or bad people. It is about knowing how food works so you can choose wisely and enjoy it.

Let's cook. You will pop popcorn on the stove and season it three ways. The skill to do well is **stovetop popping safely** with an adult beside you: a big pot, a thin film of oil, the lid on, oven mitts to shake the pot, and lifting the lid away from your face so the steam goes the other way.

PICTURE STUDY



The Angelus, Jean-François Millet, 1857–1859 · Oil on canvas · Musée d'Orsay, Paris

Image: [Wikimedia Commons](#), public domain

Jean-François Millet grew up on a farm in Normandy, France. Here a husband and wife have been digging potatoes all afternoon. When the church bell rings in the evening, they stop their work and bow their heads to pray. The prayer is called the Angelus, after its first word.

Look closely

- Find the basket at the woman's feet. What have they been harvesting?
- Find the pitchfork, the wheelbarrow and the sacks. How did they dig and carry the potatoes?
- Find the church steeple far away on the horizon. What sound has made them stop?
- Look at the light in the sky. What time of day is it?

Talk about it

1. A potato can become a plain baked potato or a bag of chips. How would the two be different in salt, fat and fiber? Which would fill you up more?
2. These farmers stop to give thanks for their food before they go home to eat it. How might giving thanks change the way we eat?

3. Millet painted hard-working people with great respect. What do you notice about how they stand?

Safety first. An adult stands beside you at the stove. Use a large pot with a lid, only a thin film of oil, and oven mitts to shake it; lift the lid away from your face because hot steam and kernels can pop out. Popcorn is a choking hazard for children under 4, so do not share it with little brothers and sisters.

Seasoned Popcorn and the Fullness Test

You will pop a pot of whole-grain popcorn, measure it into bowls, season it three ways, and run a fair fullness test comparing a measured serving of popcorn with a measured serving of chips.

You will need

- A large heavy pot (at least 4 quarts) with a lid
- Oven mitts and a large bowl
- Measuring cups and spoons, and three small bowls for seasonings
- A kitchen scale (optional)
- A small bag (1 ounce / 28 g) of potato chips for the fullness test (optional)

STOVETOP POPCORN, SEASONED THREE WAYS

Serves About 12 cups (4 servings of 3 cups) · Prep 5 min · Cook 5 min

Ingredients

- 2 tablespoons vegetable oil (canola, sunflower or coconut)
- ½ cup (100 g) popcorn kernels
- ½ teaspoon fine salt, or to taste
- **Italian herb:** 1 teaspoon dried oregano or Italian seasoning and 2 tablespoons grated Parmesan cheese
- **Cinnamon:** ½ teaspoon cinnamon and 1 teaspoon sugar
- **Chili-lime:** ½ teaspoon chili powder and the finely grated zest of 1 lime

Method

1. Wash your hands. Mix each seasoning blend in its own small bowl.
2. With an adult beside you, put the oil and 3 popcorn kernels in the pot. Cover and heat over medium-high heat.
3. When the 3 test kernels pop, the oil is hot enough. With oven mitts on, an adult or you (with the adult beside you) lifts the lid and pours in the rest of the kernels in an even layer. Cover.

4. Shake the pot gently back and forth over the burner every few seconds, holding the lid on with a mitt.
5. When the popping slows to 2–3 seconds between pops, turn off the heat and move the pot off the burner. Lift the lid away from your face.
6. Pour the popcorn into the large bowl, removing any unpopped kernels. Sprinkle with salt and toss.
7. Measure 3 cups into each of three bowls and toss each with a seasoning blend while the popcorn is still warm.
8. Clean up: let the pot cool, then wash it. Wipe up stray kernels and salt.

Allergy check: Plain popcorn contains none of the nine major allergens. The Italian-herb blend contains milk (Parmesan); use nutritional yeast or leave the cheese out for a milk-free version. Check the chips' label if you use them.

Steps

1. **Measure.** Weigh or estimate: put 3 cups of popcorn in one bowl and a 1-ounce bag of chips in another. Which looks like more food? If you have a scale, weigh both.
2. **Read the labels.** Compare the fiber on the popcorn label (per 3 cups popped) and the chip label (per 1 ounce). Write both numbers.
3. **Fullness test, day 1.** In the afternoon, rate your hunger (1 to 5), eat the measured popcorn slowly with a glass of water, and rate your hunger right after and 20 minutes later.
4. **Fullness test, day 2.** At the same time of day, do the same with the 1-ounce bag of chips and a glass of water. (If your family does not buy chips, compare the popcorn with crackers instead.)
5. Make a little chart comparing your two days. Which kept you satisfied longer? Which did you want more of right away?
6. **Taste test.** Rate the three popcorn seasonings from 1 to 5 with your family. Which was the family favorite?
7. **Improve it.** Invent your own seasoning blend and write the recipe in your notebook.
8. Clean up: wash and put everything away.

Tips

- If many kernels do not pop, the oil may not have been hot enough, or the kernels are old and dried out. Store kernels in a sealed jar.
- Season while the popcorn is warm and a tiny bit oily so the seasonings stick.
- You can also pop corn in a hot-air popper, or in a brown paper lunch bag in the microwave ($\frac{1}{4}$ cup kernels, folded top, about 2 minutes, with an adult nearby).

Check your work

- ☐ I can explain the bliss point and why some packaged snacks are easy to eat past full.
- ☐ I can name three things that help us feel satisfied: fiber, protein and water.
- ☐ I popped popcorn safely on the stove with an adult beside me and recorded a fair fullness test.

COOK'S NOTEBOOK

1. Draw a popcorn kernel before and after popping. Label the hull, the starch and the bit of water inside that turns to steam.
2. Make a chart of your fullness test: popcorn day and chips day, with hunger ratings before, right after and 20 minutes later.
3. Write your own popcorn seasoning recipe and give it a name.

From history. Popcorn has been grown and eaten in the Americas for a very long time; archaeologists have found ancient popped kernels in caves in New Mexico and Peru. In the late 1800s, Charles Cretors of Chicago built one of the first popcorn machines, and popcorn carts became a common sight at fairs and parks.

COMMON MISTAKES

- Eating straight from a big bag. It is hard to notice how much you have eaten; pour one serving into a bowl.
- Thinking that a food is bad, or that a person is bad for liking it. Learn how the food works, then choose wisely.
- Lifting the popcorn lid toward your face. Steam and hot kernels shoot out; lift it away from you.

Make it a game • Bliss Point Detective. Spread out three snack labels. For each, find the sugar, salt, and fat, and circle them. Guess which one makes a person keep eating, then tell why. Explain what Howard Moskowitz meant by the bliss point. Name three ways fiber, protein and water help you feel satisfied. Compare your list with your parent's.

6.3 READING THE LABEL FOR ADDED SUGAR

OBJECTIVES

- Tell the history of the Nutrition Facts label (the 1990 law, labels on packages in 1994, and the Added Sugars line added in 2016).
- Find the serving size and added sugars on a label, and change grams of sugar into teaspoons (4 grams $\approx$ 1 teaspoon).
- Make real lemonade with less sugar and sparkling fruit water, and taste-test three sugar levels.

Warm-up. Find three drinks in your home or at the store (juice, a sports drink, chocolate milk, a soda, a juice box). Without looking at the labels, line them up from least sugar to most sugar. Write down your guess. You will check it during the lesson.

WATCH

Reading the Food Label

Health and Human Sciences Extension and Outreach • 2:15

<https://www.youtube.com/watch?v=s5zroZfMn0I>

WHEN TO WATCH

After the story. Pause on the label each time it appears and find the line the narrator is talking about on a real package from your pantry.

Note: From Iowa State University Extension and Outreach.

BACKUP VIDEO

Added Sugar on the Nutrition Facts Label? Sweet!

U.S. Food and Drug Administration • 1:30

<https://www.youtube.com/watch?v=I5a7E8HCvG4>

A short explanation from the FDA of the Added Sugars line and how it differs from Total Sugars.

KEY TERMS

Nutrition Facts label

The black-and-white box on packaged foods that tells the serving size and the nutrients in one serving.

gram

A small unit of weight in the metric system. About 4 grams of sugar make 1 teaspoon.

ingredients list

The list of everything in a food, in order from the most (by weight) to the least.

added sugars

Sugars put into a food when it is made or prepared, such as table sugar, honey and syrups, as opposed to sugar that is naturally in fruit or milk.

Daily Value (%DV)

A number on the label that shows how much of a day's recommended amount of a nutrient one serving gives. 5% or less is low; 20% or more is high.

CORE IDEAS

The story. A hundred years ago, a can or box of food often told you very little about what was inside. Over time, families and doctors wanted to know more. In 1990 the United States Congress passed the Nutrition Labeling and Education Act, and by 1994 most packaged foods had to carry the new **Nutrition Facts label**, the same black-and-white box on every package. It listed the serving size and nutrients like fat, sodium, carbohydrates, sugars and protein. In 2016 the U.S. Food and Drug Administration updated the label. The serving size got bigger, bolder type, and a new line was added: **Added Sugars**.

How they figured it out. The old label showed only “Sugars,” which mixed together the sugar that is naturally in fruit and milk with the sugar a company added. A glass of milk and a glass of sweetened drink could look the same. Nutrition scientists pointed out that most Americans were getting far more added sugar than was good for them, much of it from sweetened drinks. The new line lets you see exactly how much sugar was added. The FDA set the Daily Value for added sugars at 50 grams. The American Heart Association recommends that children have less than 25 grams of added sugar a day, about 6 teaspoons.

The kitchen science. Here is the trick that turns label numbers into something you can see: **4 grams of sugar is about 1 teaspoon.** Divide the grams by 4. A 12-ounce can of regular cola has about 39 grams of added sugar, or almost 10 teaspoons. Always check the **serving size** first: if a bottle holds 2 servings and you drink it all, double every number. Sugar in a drink goes down fast and does not fill you up, because there is no fiber to slow it. The sugar in a whole orange comes packed with fiber and water. And here is good news about taste buds: when people eat and drink less added sugar for a few weeks, very sweet foods start to taste *too* sweet. Your taste buds adjust.

Let's cook. You will squeeze real lemons to make lemonade with about half the sugar of many recipes, then make a sparkling fruit water with no added sugar at all. The skill to do well is **cutting and juicing citrus**: roll the lemon firmly on the counter to loosen the juice, cut it in half across the middle with the bridge grip and an adult beside you, and squeeze it over a strainer to catch the seeds.

PICTURE STUDY



Still Life with Watermelons and Apples in a Landscape, Luis Egidio Meléndez, 1770s · Oil on canvas ·
Museo del Prado, Madrid

Image: [Wikimedia Commons](#), public domain

Luis Meléndez usually painted food on a kitchen table, but here he set his fruit outdoors, on a hillside under a dramatic sky. The cut watermelon is so juicy you can almost hear it drip. This is sweetness the way God packed it: with water, fiber and color all together.

Look closely

- Find the cut watermelon. How can you tell it is juicy?
- Count the seeds you can see in one slice. What were seeds for?
- Find the small apples. How are they different from the apples in our stores?
- Look at the sky. What kind of weather is coming?

Talk about it

1. Watermelon tastes sweet, but its sugar comes with lots of water and some fiber. How is that different from the same sweetness in a soda?
2. Which would fill you up more: a big slice of watermelon or a glass of sweetened drink? Why?
3. Why do you think Meléndez painted fruit outside instead of in a kitchen?

Safety first. Cut lemons and limes only with an adult right beside you, on a board that cannot slide, using the bridge grip. Citrus juice stings small cuts and eyes, so keep your hands away from your face and wash them afterward. Heat the water for the syrup in the microwave with an adult nearby, and let it cool before stirring.

Sugar Spoons and Real Lemonade

First you will turn the sugar on drink labels into piles of teaspoons you can see. Then you will make a pitcher of real lemonade with less sugar, run a blind taste test of three sweetness levels, and make a sparkling fruit water with no added sugar.

You will need

- Three to five drink containers with Nutrition Facts labels (empty is fine)
- Clear glasses or small plates, a teaspoon and a bag of sugar (or sugar cubes) for the display
- A cutting board, a small serrated knife and a citrus juicer or fork
- A fine strainer, a large pitcher, measuring cups and spoons
- A microwave-safe 2-cup measuring cup
- Three small cups per taster for the taste test

REAL LEMONADE WITH LESS SUGAR, AND SPARKLING FRUIT WATER

Serves 6 (1 cup each) of lemonade, plus 4 glasses of fruit water · Prep 20 min · Chill 1 hr

Ingredients

- **Lemonade:** 6–8 lemons (enough for 1 cup / 240 mL of juice)
- ½ cup (100 g) sugar
- 1 cup (240 mL) hot water, plus 4 cups (950 mL) cold water
- Ice
- **Sparkling fruit water:** 1 cup fresh or frozen berries, or orange or cucumber slices
- A few fresh mint leaves (optional)
- 1 liter (about 4 cups) plain sparkling water or club soda, chilled

Method

1. Wash your hands and the lemons. Roll each lemon firmly on the counter under your palm.

2. With an adult right beside you, cut each lemon in half across the middle using the bridge grip. Squeeze the juice through a strainer into a measuring cup until you have 1 cup.
3. Make the syrup: put the sugar and 1 cup of hot water in the microwave-safe measuring cup. With an adult nearby, heat 1 minute and stir until the sugar dissolves completely. Let it cool.
4. In the pitcher, stir together the lemon juice, the cooled syrup and 4 cups cold water. Taste. Add a little more cold water if it is too tart. Chill and serve over ice.
5. For the sparkling fruit water, put a few berries or slices and a mint leaf in each glass. Mash them gently with a spoon. Add ice and pour in sparkling water.
6. Clean up: compost or throw away the lemon rinds, wash the juicer, strainer and pitcher, and wipe up sticky spots.

Allergy check: Contains none of the nine major allergens.

Steps

1. **Sugar-spoon display.** For each drink, find the serving size and the Added Sugars line. Divide the grams by 4 and round to the nearest teaspoon. Measure that many level teaspoons of sugar onto a plate or into a clear glass in front of each container. Line them up. Was your warm-up guess right?
2. Check servings per container. If one bottle is 2 servings, add a second pile. Write the totals.
3. Make the lemonade. Figure out the added sugar per cup: $\frac{1}{2}$ cup sugar is about 100 grams, divided into 6 cups, is about 17 grams per cup, or about 4 teaspoons.
4. **Blind taste test.** Pour three small cups for each taster: plain lemonade from your recipe; the same with 1 extra teaspoon of syrup stirred in; and the same with 2 extra teaspoons. Number the cups so tasters do not know which is which. Ask each person to rate them from 1 to 5 and say which tastes “just right.”
5. Taste the sparkling fruit water. Does it need sugar? What gives it flavor instead?

6. **Improve it.** Write the sugar level your family liked best. Plan to try a little less sugar next time and see whether anyone notices.
7. Clean up: pour the sugar from the display back into its bag (it is still clean) and wash the plates.

Tips

- Room-temperature lemons give more juice than cold ones.
- Dissolving the sugar in hot water first (a simple syrup) keeps it from sinking to the bottom of the pitcher.
- Freeze leftover lemonade in an ice-cube tray and drop the cubes into plain water.

Check your work

- ☐ I can find the serving size and added sugars on a Nutrition Facts label.
- ☐ I can turn grams of sugar into teaspoons by dividing by 4.
- ☐ I made lemonade with less sugar and ran a fair blind taste test.

COOK'S NOTEBOOK

1. Draw a Nutrition Facts label from a food in your pantry and circle the serving size and the Added Sugars line in two colors.
2. Make a bar graph of the teaspoons of added sugar in each drink from your display.
3. Copy your lemonade recipe and write the family's "just right" sugar level.

From history. Before the Nutrition Facts label, some foods had labels only if they made a health claim. The 1990 law also set rules for words like "low fat" and "light," so that every company used them the same way. Canada uses a similar Nutrition Facts table, printed in both English and French.

COMMON MISTAKES

- Forgetting the serving size. A bottle or bag may hold two or more servings; multiply.
- Thinking all sugar on the label is added. The Total Sugars line includes sugar that is naturally in milk and fruit; look at the Added Sugars line.
- Thinking fruit juice is the same as fruit. Juice has the sugar of the fruit but little of the fiber, so it does not fill you up the same way.

Make it a game • Sugar Teaspoon Count. Find five labels in the pantry. Race to find the added sugars line, then divide grams by four to get teaspoons. Pile real teaspoons of sugar beside the box to see the amount, or use paper chips. Highest total wins a point. Then retell when the label began in 1994 and when Added Sugars appeared.

6.4 TREATS IN THEIR PLACE

OBJECTIVES

- Explain from Scripture that feasts and sweet things are good gifts when enjoyed with thanks, generosity and self-control.
- Make a weekly plan for everyday foods and sometimes foods.
- Bake a batch of from-scratch oatmeal cookies with an adult beside you, and give most of them away.

Warm-up. Think about the last birthday or holiday feast your family had. What special foods were there? Who made them, and who shared them? Write down three things that made it a happy meal. How many of them were about the food, and how many were about the people?

WATCH

The Best Recipe for Chewy Oatmeal Cookies is Not on the Back of the Oat Canister

America's Test Kitchen • 8:31

<https://www.youtube.com/watch?v=nfn0O25aDaU>

WHEN TO WATCH

Before you bake. Watch how the test cook measures and mixes. Our recipe is simpler, but notice why she melts and browns the butter, and how she knows when the cookies are done.

Note: The test kitchen's recipe uses browned butter and a stainless skillet. Our lesson recipe uses softened butter and is easier for a first batch.

KEY TERMS

everyday foods

Foods that give the body lots of what it needs and belong in most meals: fruits, vegetables, whole grains, protein foods and dairy.

sometimes foods

Treats like cookies, cake, candy and sweet drinks, which are good gifts to enjoy now and then, in their place.

self-control

Choosing what is good and wise even when you want something else. The King James Bible calls it temperance.

feast

A special meal of celebration and thanks, often shared with family, friends and neighbors.

creaming

Beating soft butter and sugar together until light and fluffy, which traps tiny air bubbles that help cookies rise.

CORE IDEAS

The story. In the days of Nehemiah, about 445 years before Christ, the people of Israel gathered in Jerusalem to hear God’s law read aloud. When they understood how far they had fallen short, they began to weep. But Nehemiah and Ezra told them that this was a holy day, a day for a feast. They were to go and eat, and to “*send portions unto them for whom nothing is prepared*” (Nehemiah 8:10). A feast in Scripture is never just about eating. It is about thanking God, celebrating together and giving to those who have less.

How they figured it out. God’s people kept many feasts through the year, like the Passover and the Feast of Tabernacles, each with special foods. And Scripture also teaches balance. Proverbs says, “Hast thou found honey? eat so much as is sufficient for thee.” Honey is good, and too much of a good thing can make you sick. Paul lists **temperance**, or self-control, among the fruit of the Spirit (Galatians 5:22-23). Christians have long kept this pattern: ordinary days of plain, good meals, and special days of feasting, so that the feasts feel like feasts.

The kitchen science. Treats are neither something to fear nor a prize. A cookie gives you energy and joy, but not much fiber, protein, vitamins or minerals for its size, so it does not take the place of a meal. A good plan is to fill most of your meals with **everyday foods** and to choose **sometimes foods** on purpose: dessert after dinner on Sunday, cake at a birthday, cookies baked for a neighbor. When treats are planned, shared and eaten slowly, you enjoy them more. In baking, sugar does more than sweeten. It makes cookies tender, helps them spread, and browns at the edges. Oats add chewiness and some fiber. **Creaming** the butter and sugar traps air for a lighter cookie.

Let's cook. You will bake oatmeal raisin cookies from scratch and give most of them away. The skills to do well are **creaming** butter and sugar, scooping even cookies so they bake evenly, and using oven mitts to move the hot pans with an adult beside you. Never taste the cookie dough before it is baked: uncooked flour and eggs can carry germs.

PICTURE STUDY



Still Life with Pomegranates, Apples, Jars and Boxes of Sweets, Luis Egidio Meléndez, 1760s–1770s • Oil on canvas • Museo del Prado, Madrid
Image: [Wikimedia Commons](#), public domain

In Spain in the 1700s, sweets like candied fruit and thick fruit paste (called *dulce*) were packed in thin wooden boxes, and preserves were kept in covered jars, saved for special days. Meléndez painted them here beside fresh pomegranates and apples. Some treats are put away for a feast; the fruit is for every day.

Look closely

- Find the tall glass jar with the cloth tied over its top. What golden sweet might be inside?
- Find the wooden boxes of sweets. One has numbers painted on it. What might the numbers mean?
- Find the pomegranates. One has a crack. What is inside a pomegranate?
- Find the apples. Which one looks ripest? How did Meléndez show its bumps and spots?

Talk about it

1. Which foods on this table are “everyday foods,” and which are “sometimes foods”?

2. Why might a family keep sweets in boxes and jars on a high shelf instead of on the table every day?
3. If a neighbor came to this table, what would you give away?

Safety first. Never taste unbaked cookie dough: uncooked flour and eggs can carry germs. An adult stands beside you at the oven; use oven mitts, set hot pans on a trivet or rack, and let cookies cool before moving them. Check for allergies before giving cookies away, and tell people what is in them.

KITCHEN PROJECT

Cookies to Share and a Sometimes-Foods Plan

You will bake a batch of oatmeal raisin cookies, test one change to see what it does, and give most of the batch away. Then you will make a simple plan for the week that shows where treats fit.

You will need

- Two baking sheets and parchment paper
- A large bowl and a medium bowl, a wooden spoon or hand mixer
- Measuring cups and spoons
- A cookie scoop or tablespoon
- Oven mitts, a spatula and a cooling rack
- A plate or tin, and a card for a note to go with the cookies you give away

CHEWY OATMEAL RAISIN COOKIES

Serves About 24 cookies • Prep 20 min • Bake 10–12 min per pan

Ingredients

- ½ cup (1 stick, 113 g) butter, softened
- ½ cup (100 g) packed brown sugar
- ¼ cup (50 g) granulated sugar
- 1 large egg
- 1 teaspoon vanilla extract
- 1 cup (125 g) all-purpose flour
- ½ teaspoon baking soda
- ½ teaspoon ground cinnamon
- ¼ teaspoon salt
- 1½ cups (135 g) old-fashioned rolled oats
- ¾ cup (110 g) raisins (or chopped dried apricots)

Method

1. An adult heats the oven to 350 °F (175 °C). Line two baking sheets with parchment. Wash your hands.
2. In the large bowl, beat the butter, brown sugar and granulated sugar until light and fluffy, about 2 minutes with a mixer or 4 with a spoon (creaming).
3. Beat in the egg and vanilla. Wash your hands after cracking the egg.
4. In the medium bowl, whisk the flour, baking soda, cinnamon and salt. Stir the flour mixture into the butter mixture just until no dry flour shows. Stir in the oats and raisins.
5. Scoop the dough into balls about 1½ tablespoons each and set them 2 inches apart on the sheets.
6. With an adult beside you, bake one sheet at a time for 10–12 minutes, until the edges are golden and the centers look just set. They firm up as they cool.
7. Using oven mitts, set the pan on a rack for 5 minutes, then move the cookies to the rack to cool completely.
8. Clean up: wash the bowls and tools, and wipe the counter where the egg and flour were.

Allergy check: Contains wheat, milk and eggs. Oats are often processed with wheat; use certified gluten-free oats and a gluten-free flour blend if needed. For egg-free cookies, use 3 tablespoons of unsweetened applesauce instead of the egg. For milk-free cookies, use a plant-based butter.

Steps

1. **One-change test.** Bake the first 4 cookies as the recipe says. Then flatten the next 4 dough balls with the bottom of a glass before baking. Compare thickness, chewiness and edges. Write what changed and why you think so.
2. Bake the rest of the batch.
3. **Taste test.** Each person in your family tries one cookie slowly, at the table, after a meal. Rate it for chewiness, sweetness and flavor from 1 to 5.
4. **Share.** Pack most of the cookies on a plate or in a tin with a handwritten note and the list of ingredients, and give them to a neighbor, a grandparent, or someone who could use some cheer.

5. **Sometimes-foods plan.** With a parent, make a simple chart of next week. Mark the days and meals when your family will enjoy a treat (for example, Sunday dessert, a birthday). Fill the rest with everyday foods you like.
6. **Improve it.** Write one change for next time (less sugar, more cinnamon, a different dried fruit) and what you expect it to do.
7. Clean up: wash, dry and put everything away.

Tips

- Butter should be soft enough to dent with a finger but not melted, or the cookies spread flat.
- Pull the cookies out when the centers still look a little soft. They keep baking on the hot pan.
- Unbaked dough balls freeze well. Bake a few at a time for a treat, straight from the freezer, adding 1–2 minutes.

Check your work

- ☐ I can explain how Scripture teaches both feasting and self-control.
- ☐ I baked cookies with an adult beside me, used oven mitts, and never tasted the unbaked dough.
- ☐ I shared my cookies and made a sometimes-foods plan with my family.

COOK'S NOTEBOOK

1. Draw your two test cookies side by side, flat and round, and write what the one change did.
2. Write a short thank-you prayer you could say before a family feast.
3. Copy your week's sometimes-foods plan into your notebook.

From history. Oats were long thought of as plain food for horses and for porridge. Beginning in the late 1800s, oat millers in America sold rolled oats in boxes and later printed recipes on them, and oatmeal cookies became a favorite home-baked treat. Many families still use the recipe from their oat box.

COMMON MISTAKES

- Calling treats “bad” and feeling guilty for enjoying them. Treats are good gifts in their place; enjoy them with thanks.

- Eating treats without planning, a little here and a little there, until they crowd out everyday foods.
- Tasting the dough. Wait for the baked cookie; uncooked flour and eggs can carry germs.

Make it a game • Everyday or Sometimes. Write ten foods on slips and sort them into everyday and sometimes piles as fast as you can. Defend any food your parent challenges. Then plan one week on paper with both kinds of foods, and say one verse or idea about feasts, gratitude and self-control. Trade papers and find one thing to praise.

Scripture. “Hast thou found honey? eat so much as is sufficient for thee” (Proverbs 25:16, KJV)

Honey is a good gift, and so is knowing when you have had enough. Self-control lets us enjoy sweet things without letting them rule us.

CRAVINGS, REWARD & A BALANCED DIET

God made us able to enjoy food. A ripe strawberry tastes sweet, salty popcorn tastes wonderful, and a warm cookie smells like home. He also made our bodies to tell us when we need food and when we have had enough. In this unit you will learn how that works: how your stomach and brain talk to each other, and how a messenger chemical in the brain called **dopamine** helps us *want* things that have been good to us before.

You will also learn why it is so easy to eat a whole bag of chips, how food makers test recipes to hit a “bliss point” of sugar, salt and fat, and how to read the Nutrition Facts label to find added sugar. None of this is about good or bad people, or good or bad bodies. It is about understanding the gifts God gave us, using them with thankfulness and self-control, and enjoying treats in their place. You will make banana “nice cream,” seasoned popcorn, real lemonade and a batch of oatmeal cookies to share.

PREREQUISITES

- Knows the five food groups and how to build a balanced plate (Unit 2)
- Knows the five basic tastes and that tastes can change with practice (Unit 3)
- Can measure with cups, spoons and a scale, and use the stove and oven with an adult beside (Units 1–5)

MASTERY CHECKLIST

- ☐ I can explain, simply and correctly, that dopamine is a brain messenger connected with wanting and learning what is rewarding.
- ☐ I can explain why the stomach needs about 20 minutes to signal fullness, and how fiber, protein and water help us feel satisfied.
- ☐ I can tell what the “bliss point” is and why some packaged snacks are easy to keep eating past full.
- ☐ I can read a Nutrition Facts label, find the added sugars, and change grams to teaspoons (4 grams $\approx$ 1 teaspoon).
- ☐ I can plan where “sometimes foods” fit in my week, and share treats with thankfulness and self-control.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **FDA: Added Sugars on the Nutrition Facts Label**: Free. A clear page from the U.S. Food and Drug Administration explaining the Added Sugars line and the Daily Value. Useful for Lesson 6.3.
- **FDA: How to Understand and Use the Nutrition Facts Label**: Free. A labeled picture of the whole Nutrition Facts label with an explanation of each part, for parents and older students.
- **A set of clear glasses and a box of sugar cubes**: Inexpensive. For the sugar-spoon display in Lesson 6.3: one sugar cube is about 4 grams, or 1 teaspoon, of sugar.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

6.1 Your Brain's Reward System	2 sessions of 45–60 minutes
6.2 Sugar, Salt and Fat: The Bliss Point	2 sessions of 45–60 minutes
6.3 Reading the Label for Added Sugar	2 sessions of 45–60 minutes
6.4 Treats in Their Place	2 sessions of 45–60 minutes

UNIT 6 REVIEW

Answer each question. Use complete sentences for explanations and show your work for calculations. The review is worth 50 points.

1. 5 pts

What is dopamine, and what is it mostly connected with: liking a food while we eat it, or wanting it?

2. 5 pts

Why does it help to eat slowly?

3. 5 pts

Name three things in food that help us feel full and satisfied.

4. 5 pts

What is the “bliss point,” and how did Howard Moskowitz find it?

5. 5 pts

Predict: you eat a whole bag of chips while watching a show, and then a bowl of popcorn with a glass of water at the table. Which will leave you feeling full longer, and why?

6. 5 pts

A sweetened drink has 32 grams of added sugar per serving. How many teaspoons is that?

7. (5 pts)

A bottle has 2 servings. Each serving has 24 grams of added sugar. If you drink the whole bottle, how many grams and teaspoons of added sugar is that?

8. (5 pts)

What is the difference between Total Sugars and Added Sugars on the label?

9. (5 pts)

What happens to your taste buds when you eat less added sugar for a few weeks?

10. (5 pts)

Name two ways Scripture teaches us to enjoy treats and feasts rightly.

ANSWER KEY

1. Dopamine is a messenger chemical in the brain. It is mostly connected with wanting and motivation, and with learning what is rewarding, not with the enjoyment itself.
2. Fullness signals from the stomach and intestines take about 20 minutes to reach the brain. Eating slowly gives them time, so we notice we have had enough before we eat past full.
3. Fiber, protein and water.
4. The amount of sugar (or another ingredient) that the most people like best, not too little and not too much. He made many versions of a food, had many people taste them, and recorded which one most people preferred.
5. The popcorn with water. Popcorn is a whole grain with more fiber and fills a big bowl; the water fills the stomach too; eating at the table, slowly, lets fullness signals arrive. Chips have little fiber and are easy to eat quickly while distracted.
6. $32 \div 4 = 8$ teaspoons.
7. $24 \times 2 = 48$ grams. $48 \div 4 = 12$ teaspoons.
8. Total Sugars includes sugar naturally in foods like milk and fruit plus any added sugar. Added Sugars shows only the sugar put in when the food was made, such as table sugar, honey or syrup.
9. They adjust: foods with less sugar start to taste sweet enough, and very sweet foods may taste too sweet.
10. Give thanks to God; share with others, especially those who have less (Nehemiah 8:10); practice self-control or temperance (Proverbs 25:16, Galatians 5:22-23); keep feasts for special days. Any two.

UNIT CHALLENGE: A ONE-WEEK DRINK AND SNACK SWAP

For one week, swap one sweetened drink or packaged snack each day for something you make or choose yourself: water with fruit, your less-sugar lemonade, popcorn you popped, nice cream, fruit, or vegetables with dip.

Keep a daily log: what you swapped, how full and how energetic you felt (1 to 5), and what your taste buds noticed. At the end of the week, write a paragraph about what changed, add up the teaspoons of added sugar you skipped, and share one swap your family wants to keep.

LOOK FOR	WHAT IT MEANS
Daily log	Seven days recorded honestly, with the swap, the ratings and a note on taste.
Label math	Grams of added sugar correctly turned into teaspoons, with the week's total shown.
Homemade swaps	At least three swaps made in the kitchen, safely and with cleanup.
Reflection	A thoughtful paragraph on what changed, written without calling foods or people good or bad.

UNIT 7

FIRE, THE GRILL & SPICE

This is the fun unit. People have cooked over open fire since the very beginning, and there is still nothing quite like the smell of food on a grill. You will learn the fire triangle, how a grill cooks with direct and indirect heat, and the safety rules every griller follows. At your age, **an adult does the lighting and the grilling**; you plan, prepare the food, season it, watch from 3 feet back, and check the temperature with the adult. Every recipe also has an **indoor way**, under the oven broiler or in a grill pan with an adult, for families without a grill.

Then you will sit by the Sea of Galilee, where Jesus cooked fish and bread on a fire of coals for His tired disciples. You will sail with Vasco da Gama to India in search of pepper, learn where cinnamon, cloves and nutmeg come from, and mix your own spice rub. Finally you will learn how cooks balance flavors that go together, salt with sweet, acid with fat, heat with cool, herb with citrus, and finish with grilled corn and caramelized fruit.

PREREQUISITES

- Knows the safe internal temperatures: poultry 165 °F, fish 145 °F, ground meat 160 °F (Unit 1)
- Keeps raw meat separate from ready-to-eat food and washes hands after handling it (Unit 1)
- Knows how heat moves by conduction, convection and radiation, and what broiling is (Unit 4)
- Knows the Maillard reaction and the five basic tastes (Units 3 and 5)

MASTERY CHECKLIST

- ☐ I can name the three sides of the fire triangle and explain how a lid puts out a flare-up.
- ☐ I can explain direct and indirect heat, and list the grill safety rules, including that only adults light and run the grill.
- ☐ I can check meat and fish with a food thermometer and name their safe temperatures (chicken 165 °F, fish 145 °F).
- ☐ I can tell the story of the spice trade and Vasco da Gama, and name where pepper, cinnamon, cloves and nutmeg come from.
- ☐ I can balance a dish using complementary flavors, and make my own spice rub.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **NFPA: Grilling safety:** Free. Grilling safety tips and a printable tip sheet from the National Fire Protection Association. Good to read together before Lesson 7.1.
- **An instant-read food thermometer:** If you did not get one in Unit 1, this is the unit that needs it. Check every piece of chicken and fish in its thickest part.
- **For the adult griller: long-handled tongs and a chimney starter:** Long tongs keep hands away from the heat. A chimney starter lights charcoal with crumpled newspaper or a fire-starter cube, so no liquid starter is needed. A gas grill needs neither. Not required: every recipe also works under the oven broiler.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

7.1	Fire Safety and the Grill	2 sessions of 45–60 minutes
7.2	A Fire of Coals by the Sea	2 sessions of 45–60 minutes
7.3	The Spice Trade	2 sessions of 45–60 minutes
7.4	Flavors That Go Together	2 sessions of 45–60 minutes

UNIT 7 REVIEW

Answer each question. Use complete sentences for explanations. The review is worth 50 points.

1. 5 pts

Name the three parts of the fire triangle. Which part does a grill lid take away when it smothers a flare-up?

2. 5 pts

Predict: a pan of oil on the stove catches fire and someone pours water on it. What will happen, and what should be done instead?

3. 5 pts

What is the difference between direct and indirect heat? Give a food for each.

4. **5 pts**

List four grill safety rules.

5. **5 pts**

What are the safe internal temperatures for chicken and for fish? Where do you put the thermometer?

6. **5 pts**

Why does cooked fish flake, and why does it cook faster than beef?

7. **5 pts**

What happened when Vasco da Gama reached Calicut in 1498, and why did it matter?

8. **5 pts**

Match each spice with its plant part: cinnamon, cloves, black pepper, nutmeg, ginger.

9. **5 pts**

Predict: you taste your soup and it is flat and a little too rich. Which two kinds of ingredients could you add, and why?

10. **5 pts**

Give an example of each pair: salt + sweet, heat + cool, herb + citrus.

ANSWER KEY

1. Heat, fuel and oxygen. The lid takes away oxygen.
2. The water will sink, boil instantly and spray the burning grease outward, spreading the fire. Instead, turn off the heat and cover the pan with a lid or pour on baking soda; if the fire grows, get out and call 911.
3. Direct heat cooks food right over the fire, for small, quick-cooking foods like kebabs, burgers or corn. Indirect heat cooks food beside the fire with the lid closed, like an oven, for bigger pieces like a whole chicken or a large roast.
4. Any four: only adults light and run the grill; grill outdoors away from the house, railings and dry leaves; children stay 3 feet back; use long tongs; never use liquid starter on a lit fire (we use none); keep a lid and a hose or extinguisher ready; never leave a lit grill alone; let coals cool 24–48 hours before disposal in a metal can.
5. Chicken 165 °F; fish 145 °F. Put the thermometer in the thickest part of the food, not touching bone or the pan.
6. Fish muscle is made of short flakes held together by very thin connective tissue that softens and separates when cooked. Fish do not need strong muscles to hold themselves up in water, so the flesh is tender and cooks quickly.
7. He became the first European to reach India by sailing around Africa, with the help of a pilot from Malindi. It opened a direct sea route for spices like pepper between Asia and Europe, changing world trade.
8. Cinnamon: bark. Cloves: flower buds. Black pepper: berries. Nutmeg: seed. Ginger: root.
9. Salt, which brings out the flavors, and an acid like lemon juice or vinegar, which brightens the taste and cuts through richness.
10. Examples: salted caramel or salted watermelon; chili with yogurt or sour cream; parsley or dill with lemon, cilantro with lime, mint with orange. Other good examples accepted.

UNIT CHALLENGE: A FAMILY GRILLED (OR BROILED) DINNER WITH A HOMEMADE RUB

Plan and prepare a family dinner from the grill or the broiler. Choose a main dish (chicken, fish or kebabs) and at least one grilled vegetable or fruit. Make your own spice rub and write the recipe. You prepare, season and set out everything; an adult lights the grill and does the grilling while you watch from 3 feet back and check the temperatures together.

Make a flavor-pairing chart for the meal showing at least three complementary pairs you used. Record the safe temperature of each meat or fish, and after dinner ask each person to rate the meal and tell you one thing they liked.

LOOK FOR	WHAT IT MEANS
Planning	A written menu, a shopping list and a simple timeline for prepping and cooking.
Safety	Raw meat kept separate, hands and boards washed, adult at the grill, temperatures checked and recorded.
Spice rub and flavor chart	Rub recipe measured and written so it can be made again; at least three flavor pairs named and used.
Cleanup and service	Kitchen cleaned, table set, meal served with thanks.
Reflection	Family ratings recorded and one honest improvement planned for next time.

7.1 FIRE SAFETY AND THE GRILL

OBJECTIVES

- Name the three parts of the fire triangle and use it to explain how to put out a flare-up or grease fire.
- Explain direct and indirect heat on a grill, and tell how George Stephen invented the Weber kettle grill in 1952.
- Prepare chicken and vegetable kebabs, watch an adult grill or broil them, and check them with a thermometer to 165 °F.

Warm-up. With an adult in charge, the adult lights a candle on a plate, then sets a clear glass jar upside down over it. Watch closely and time how long the flame lasts. Why did it go out? What did the flame need that it could not get?

WATCH

Learn Some Grilling Safety Tips from NFPA

National Fire Protection Association • 3:27

<https://www.youtube.com/watch?v=-AYBZzLDO04>

WHEN TO WATCH

After the fire-triangle paragraph and before cooking. Answer each quiz question out loud before the video gives the answer.

Note: From the National Fire Protection Association. It shows a gas grill; the same safety rules apply to charcoal.

BACKUP VIDEO

The Science of Fire

NFPA Kids • 3:50

<https://www.youtube.com/watch?v=ZaitJzeqFrc>

A clear explanation of the fire triangle and how firefighters remove heat, fuel or oxygen to put out a fire.

KEY TERMS

fire triangle

The three things a fire needs: heat, fuel and oxygen. Take away any one and the fire goes out.

direct heat

Cooking food right over the flames or hot coals. Best for small, thin foods that cook quickly, like kebabs, burgers and vegetables.

indirect heat

Cooking food beside the fire, not over it, with the lid closed, so hot air cooks it slowly like an oven. Best for bigger pieces.

flare-up

A sudden burst of flame when fat or oil drips onto the hot coals or burners.

marinade

A seasoned liquid, often with oil and an acid like lemon juice, that food soaks in before cooking for flavor.

CORE IDEAS

The story. In 1952 George Stephen worked at Weber Brothers Metal Works near Chicago, a company that made metal buoys, the big floating balls that mark channels for boats. On weekends he grilled in his backyard on an open brazier, a flat pan of coals with no cover. Wind blew ashes on his food, and rain put out the fire. One day at work he had an idea: he cut a buoy in half, used the bottom half as a bowl for the coals, added three legs and air vents, and used the top half as a lid with a handle. Neighbors who tasted his cooking wanted grills of their own, and the round “kettle” grill became one of the most popular grills in the world.

How he figured it out. Stephen tried his grill again and again. The lid kept wind and rain out, and it trapped hot air so the food cooked from above as well as below, like an oven. The vents in the bottom and lid let him control the fire: open them, and more air rushes in to make the coals hotter; close them, and the fire slows down. He was using the **fire triangle** without naming it. A fire needs **heat**, **fuel** (charcoal, wood or gas) and **oxygen** (from the air). Take away any one and the fire goes out. That is why closing the lid smothers a flare-up, and why a lid or baking soda, *never water*, puts out a grease fire in a pan.

The kitchen science. A grill cooks by all three kinds of heat transfer from Unit 4. Glowing coals send out **radiation** you can feel on your face. The hot grate cooks by **conduction** and makes the dark grill marks. With the lid closed, hot air circulates by **convection**. Cooks use **direct heat**, right over the fire, for small, thin foods that cook fast, and **indirect heat**, beside the fire with the lid down, for big pieces that need longer. A smart griller sets up both zones, so food that is browning too fast can be moved to the cooler side. Chicken is safe when the thickest piece reaches **165 °F** (74 °C) on a food thermometer.

Let's cook. You will make chicken and vegetable kebabs with a lemon-herb marinade. At your age, **an adult lights the grill and does the grilling**. Your skills are preparing the vegetables, threading the skewers, keeping raw chicken separate, standing 3 feet back while the adult grills, and reading the thermometer with the adult. No grill? An adult cooks them under the oven broiler instead.

PICTURE STUDY



Camp Fire, Winslow Homer, 1880 · Oil on canvas · The Metropolitan Museum of Art, New York

Image: [Wikimedia Commons](#), public domain

Winslow Homer loved the outdoors. He painted this scene in the Adirondack Mountains of New York, where he went fishing with local guides. Night has fallen, and two men rest by a campfire in front of their bark shelter. The fire is their stove, their light and their warmth.

Look closely

- Find the brightest part of the painting. What is the fire made of?
- Find the sparks rising in the air. Where are they going? Why is it important to clear dry leaves and branches away from a fire?
- Find the shelter. How far is it from the fire? Why not closer?
- Look at how the light fades into darkness. How far does the fire's heat and light reach?

Talk about it

1. Point to the heat, the fuel and the oxygen in this picture.
2. How could these men cook their supper on this fire? Would they use direct or indirect heat?
3. What safety rules for a campfire are the same as the rules for a backyard grill?

Safety first. Only an adult lights and runs the grill. Grill outdoors only, on a flat spot well away from the house, railings, overhangs and dry leaves; children stay 3 feet back; use long tongs; keep a lid ready to smother flare-ups and a hose or fire extinguisher nearby; never leave a lit grill alone; and never use any liquid charcoal starter. Cook chicken to 165 °F, and wash hands, boards and knives after touching raw chicken.

KITCHEN PROJECT

Chicken and Vegetable Kebabs on the Grill (or Under the Broiler)

You will make a lemon-herb marinade, thread colorful kebabs, and help an adult grill them using direct heat, checking the chicken with a thermometer. You will also map the hot and cool zones of the grill with your hand held safely high above it.

You will need

- Two cutting boards: one for raw chicken (adult) and one for vegetables (you)
- A small serrated or paring knife, and a damp towel under your board
- Two bowls or zip-top bags for marinating
- Measuring cups and spoons and a whisk
- 10–12 metal skewers, or wooden skewers soaked in water for 30 minutes
- An instant-read thermometer, long tongs, oven mitts and a clean platter
- A grill (charcoal or gas), or a broiler pan or foil-lined rimmed baking sheet for the indoor way

LEMON-HERB CHICKEN AND VEGETABLE KEBABS

Serves 4–6 (10–12 kebabs) · Prep 30 min · Marinate 30 min–2 hr · Cook 10–14 min

Ingredients

- 1½ pounds (680 g) boneless, skinless chicken breasts or thighs
- 1 red and 1 yellow or green bell pepper
- 1 medium zucchini
- 1 small red onion
- 1 cup cherry tomatoes
- **Marinade:** ⅓ cup (80 mL) olive oil
- 3 tablespoons lemon juice (1 lemon) and 1 teaspoon grated lemon zest
- 2 cloves garlic, minced, or ½ teaspoon garlic powder
- 1 teaspoon dried oregano
- 1 teaspoon salt and ½ teaspoon black pepper

Method

1. Wash your hands. Whisk the marinade ingredients together. Pour half into a bowl or bag for the chicken and half into another for the vegetables.
2. An adult cuts the chicken into 1¼-inch cubes on the raw-meat board and puts it in the chicken marinade. Everyone washes hands, and the adult washes that board and knife in hot, soapy water. Refrigerate the chicken 30 minutes to 2 hours (never on the counter).
3. With an adult beside you, cut the peppers, zucchini and onion into 1¼-inch pieces on the vegetable board using the claw and bridge grips. Toss them in the vegetable marinade.
4. Thread the chicken onto its own skewers and the vegetables onto separate skewers (vegetables cook faster). Wash your hands after touching raw chicken. Throw away the used chicken marinade; never brush it on cooked food.
5. **Grill:** An adult heats the grill to medium-high (about 400–450 °F) with a cooler zone on one side, then grills the kebabs over direct heat with the lid closed, turning every 3 minutes with long tongs: vegetables 8–10 minutes, chicken 10–12 minutes. You watch from 3 feet back.
6. **Indoor way:** An adult sets the oven rack about 5 inches below the broiler and heats the broiler. Lay the kebabs on a foil-lined rimmed pan. The adult broils them 5–7 minutes per side, until browned.
7. With the adult, check the thickest piece of chicken: it must read 165 °F. Put cooked kebabs on a *clean* platter, never the one that held raw chicken.
8. Serve with rice or warm flatbread. Clean up: wash boards, bowls and tongs, and let the adult clean the grill once it has cooled.

Allergy check: Contains none of the nine major allergens. Serve with rice for a wheat-free meal, or with flatbread, which contains wheat.

Steps

1. **Fire triangle.** After the warm-up, write how a grill lid, a pot lid on a grease fire, and the vents on a kettle grill each use the fire triangle.

2. **Grill tour.** Before the grill is lit, have the adult show you the parts: the grate, the vents or knobs, the lid, the ash catcher or grease tray. Draw and label them.
3. **Hot zones.** When the grill is hot, the adult holds a hand about 5 inches above the grate and counts how many seconds until it is too hot: 2–4 seconds is high heat, 5–7 is medium. Try it over the hot side and the cool side and record the counts. (You watch; the adult does the hand test.)
4. Prepare the kebabs as the recipe says, keeping raw chicken separate and washing hands every time.
5. **Thermometer check.** With the adult, check three chicken pieces. Record each temperature. Were any under 165 °F? What did you do?
6. **Taste test.** Rate the chicken and vegetables for juiciness, char and flavor from 1 to 5. Which vegetable did your family like best?
7. **Improve it.** Plan one change: a different vegetable, a longer marinade, or cutting the pieces more evenly.
8. Clean up: wash and put away everything. Coals must cool 24–48 hours before an adult empties them into a metal can.

Tips

- Cut all the pieces the same size so they finish at the same time.
- Leave a little space between pieces on the skewer so the heat can reach every side.
- Chicken thighs stay juicier than breasts and are harder to overcook.

Check your work

- ☐ I can explain the fire triangle and how to smother a flare-up or grease fire.
- ☐ I can explain direct and indirect heat.
- ☐ I prepared kebabs safely, kept raw chicken separate, and checked the chicken to 165 °F with an adult.

COOK'S NOTEBOOK

1. Draw the fire triangle and write one way to take away each side.
2. Draw a grill from above with a hot zone and a cool zone, and show where you would put kebabs and where you would move one that is browning too fast.

3. Write the grill safety rules in your own words as a poster for your family's back door.

From history. Charcoal briquettes became popular in America after Henry Ford's company began making them from the wood scraps left over from building car bodies in the 1920s. The business later took the name of Edward Kingsford, a relative of Ford who helped find the site for the factory in Michigan.

COMMON MISTAKES

- Throwing water on a grease fire. Water makes burning grease explode outward; cover it with a lid or baking soda and turn off the heat.
- Putting cooked food back on the platter that held raw chicken. Use a clean one.
- Judging chicken by its color. Grill marks can make chicken look done outside when it is not; use a thermometer.

Make it a game · Fire Triangle Rescue. Draw a triangle and label heat, fuel and oxygen. Your parent describes a flare-up on the grill and you say which side to remove. Show the fix: lid on to cut off air, fuel turned off by the adult, and never water on grease. Then explain direct and indirect heat and who invented the Weber kettle.

7.2 A FIRE OF COALS BY THE SEA

OBJECTIVES

- Retell John 21:1-13, when Jesus cooked fish and bread on a fire of coals for His disciples.
- Explain how fish cooks, why it flakes, and why it is safe at 145 °F.
- Assemble lemon-herb foil-pocket fish, have an adult cook it on the grill or in the oven, and make fish tacos.

Warm-up. Imagine you have been fishing all night in a cold boat and caught nothing. As the sun comes up, you smell smoke and food cooking on the shore. What would you want to eat? Write three words for how you would feel when you saw someone had made you breakfast.

WATCH

Wegmans Grilled Foil Packet Halibut

Wegmans · 3:38

<https://www.youtube.com/watch?v=fm61hgElqpl>

WHEN TO WATCH

Before you build your packets. Watch how the chef layers lemon and herbs and how tightly he seals the foil.

Note: A short demonstration by a grocery chain's executive chef. He uses halibut; any firm white fish works.

BACKUP VIDEO

How To Grill Salmon | Weber Grills

Weber Grills · 1:17

https://www.youtube.com/watch?v=A_UftY9ssXM

For families who want to grill fish directly on the grate. Notice how the cook waits until the fish lets go of the grate before turning it.

KEY TERMS

fillet

A boneless piece of fish (or meat) cut away from the bones.

flake

To separate easily into thin layers when pressed with a fork. Cooked fish flakes.

en papillote

French for “in paper”: food sealed in a packet of parchment or foil so it steams in its own juices. Say it “ahn pah-pee-YOTE.”

opaque

Not see-through. Raw fish is shiny and partly see-through; cooked fish turns opaque white or pink.

carryover cooking

The way food keeps cooking for a few minutes from its own heat after it comes off the fire.

CORE IDEAS

The story. After Jesus rose from the dead, seven of His disciples went back to the Sea of Galilee. Peter said, “I go a fishing,” and the others went with him. They fished all night and caught nothing. At dawn a man on the shore called out to cast the net on the right side of the boat. They did, and the net filled with 153 large fish. John said, “It is the Lord!” When they came to land, they saw a fire of coals with fish laid on it, and bread. Jesus said, “Come and dine,” and He served them breakfast (John 21:1-13).

How they knew how to cook it. Fishermen on the Sea of Galilee knew how to cook fish simply and well: over glowing coals, not leaping flames. Coals give steady, even heat. Bread could be baked on the same coals, the way Elijah’s cake was baked on the coals (1 Kings 19:6). Jesus did not just feed His friends with a miracle; He built a fire and cooked for them. Luke tells us that after His resurrection Jesus also ate a piece of broiled fish in front of His disciples (Luke 24:42), so they would know He truly was alive in His body.

The kitchen science. Fish muscle is built differently from chicken or beef. It is made of short, thin flakes held together by very thin, delicate layers of connective tissue. Fish do not need strong muscles to hold themselves up in water, so their flesh is tender and cooks quickly. As fish heats, its proteins unfold and set (denaturation and coagulation again), the shiny, see-through flesh turns **opaque**, and the thin

connective layers soften so the fish **flakes**. Fish is safe at **145 °F** (63 °C). Cooked much past that, it dries out. A **foil packet** traps steam from the lemon and the fish's own juices, so the fish cooks gently and stays moist, on a grill or in an oven.

Let's cook. You will build lemon-herb fish packets and turn them into fish tacos. The skill to do well is **sealing a packet**: fold the foil edges over twice and crimp them tight so the steam stays in. An adult cooks the packets on the grill or in the oven and opens them, because the steam that rushes out is hot enough to burn.

PICTURE STUDY



Meal of Our Lord and the Apostles, James Tissot, 1886–1894 · Opaque watercolor over graphite on paper · Brooklyn Museum, New York

Image: [Wikimedia Commons](#), public domain

James Tissot, a French painter, traveled to the Holy Land to see its hills, lakes and villages for himself. He then spent years painting hundreds of pictures of the life of Christ. Here Jesus sits with His disciples on the shore of the Sea of Galilee after the great catch of fish.

Look closely

- Find the thin line of smoke. Where is the fire? Why is the smoke so thin?
- Find the round flat loaves and the fish near the fire. How do you think they were cooked?
- Find the boat at the edge of the water. What happened in that boat earlier that morning?
- Find Jesus. How did Tissot make Him stand out from the others?

Talk about it

1. Why would a fire of glowing coals be better than a tall, roaring fire for cooking fish and bread?
2. Jesus cooked breakfast for tired friends. Who could you cook a meal for this week?

3. Tissot went to the Holy Land to paint the real places. How does that change the way you look at this picture?

Safety first. An adult runs the grill or oven and opens the packets, tearing the foil away from faces, because escaping steam burns. Fish is done at 145 °F in the thickest part. Wash your hands, board and tools after touching raw fish, and check for fish allergies before you cook.

KITCHEN PROJECT

Lemon-Herb Fish Packets and Fish Tacos

You will build foil packets of fish, lemon and herbs, have an adult cook them over coals or in the oven, check them with a thermometer, and serve them in warm tortillas with a crunchy cabbage slaw.

You will need

- Heavy-duty aluminum foil
- A cutting board, a small serrated knife and a damp towel
- Measuring cups and spoons, a small bowl and a fork
- An instant-read thermometer
- Long tongs, oven mitts and a rimmed baking sheet
- A grill (with an adult), or the oven

LEMON-HERB FOIL-PACKET FISH TACOS

Serves 4 (8 tacos) · Prep 20 min · Cook 12–20 min

Ingredients

- 4 firm white fish fillets, such as cod, haddock, tilapia or halibut, about 5–6 oz (140–170 g) each and 1 inch thick
- 2 tablespoons olive oil or melted butter
- 1 lemon, half thinly sliced and half for juice
- ½ teaspoon salt, ¼ teaspoon black pepper and ½ teaspoon garlic powder
- 4 sprigs fresh dill or parsley, or 1 teaspoon dried dill
- **Tacos:** 8 small corn or flour tortillas
- 2 cups very thinly sliced cabbage (or bagged coleslaw mix)
- 2 tablespoons lime juice (1 lime) and a pinch of salt
- ½ cup plain yogurt or sour cream mixed with 1 tablespoon lime juice (optional)
- 1 avocado, sliced, and salsa (optional)

Method

1. Wash your hands. Tear off four 12-inch squares of foil. Pat the fish dry with a paper towel and set one fillet in the middle of each square. Wash your hands again.
2. Drizzle each fillet with oil, sprinkle with salt, pepper and garlic powder, squeeze on a little lemon juice, and lay 2 lemon slices and a sprig of herbs on top.
3. Fold the foil over the fish and crimp the edges, folding them twice, to make a tightly sealed packet with a little room inside for steam.
4. **Grill:** An adult sets the packets on the grill over medium heat (about 375–400 °F), closes the lid, and cooks them 12–15 minutes. **Oven:** An adult heats the oven to 400 °F (200 °C), sets the packets on a rimmed baking sheet, and bakes them 15–20 minutes.
5. An adult moves a packet to a plate and carefully opens it away from faces. Together, check the thickest part: it should read 145 °F and flake with a fork. If not, reseal and cook a few minutes more.
6. While the fish cooks, toss the cabbage with lime juice and a pinch of salt. Warm the tortillas in a dry skillet with an adult beside you, or wrapped in foil on the grill.
7. Flake the fish into large pieces. Fill each tortilla with fish and slaw, and add the lime-yogurt sauce, avocado and salsa if you like.
8. Clean up: throw away the foil, wash the board and tools that touched raw fish in hot, soapy water, and wipe the counter.

Allergy check: Contains fish. Flour tortillas contain wheat; corn tortillas are wheat-free. The optional butter, yogurt and sour cream contain milk; use olive oil and leave out the sauce for a milk-free meal.

Steps

1. **Read John 21:1-13** aloud with your family before you cook.
2. **Look closely at raw fish.** Before you season it, draw a fillet. Is it shiny? Can you see light through the thin edge? Can you see the lines where the flakes meet?
3. Build and cook the packets as the recipe says.
4. **Before and after.** When the fish comes out, compare it with your raw drawing: color, shine, firmness, flakes. Write three differences.

5. **Thermometer test.** Record the temperature of two packets. If you cook one packet 5 minutes longer on purpose, how does its texture compare?
6. **Taste test.** Rate the tacos for flavor, moisture and crunch from 1 to 5. Ask your family to rate them too.
7. **Improve it.** Plan one change: a different fish, more lemon, a spice like cumin, or adding thin zucchini slices to the packet.
8. Clean up: wash, dry and put everything away.

Tips

- Thin fillets cook faster than thick ones. Fold a thin tail end under so the fillet is even.
- Frozen fish fillets work well; thaw them overnight in the refrigerator, not on the counter.
- Fish with skin? Cook it skin side down; the skin slides off easily after cooking.

Check your work

- ☐ I can retell how Jesus cooked breakfast on a fire of coals.
- ☐ I can explain why fish flakes and why it is safe at 145 °F.
- ☐ I sealed foil packets well and checked the fish with an adult and a thermometer.

COOK'S NOTEBOOK

1. Draw the scene on the shore from John 21: the boat, the net, the fire of coals, the fish and the bread.
2. Draw your raw fillet and your cooked fillet side by side with labels.
3. Copy your taco recipe and add a picture of how you would set it on a plate.

From history. The fish of the Sea of Galilee include a kind of tilapia that people there still call “St. Peter’s fish.” Fishermen on the lake have used nets for thousands of years. In 1986, during a drought, the remains of a wooden fishing boat from about the time of Christ were found in the mud on its shore. It is now kept in a museum near the lake.

COMMON MISTAKES

- Opening a hot foil packet toward your face. The steam burns; an adult opens it away from everyone.
- Cooking fish until it is dry and stringy. Fish is done at 145 °F; check early.
- Using the same board for raw fish and for the slaw or tortillas. Keep raw fish separate.

Make it a game • Fish on the Shore. Retell John 21:1-13 as a three-minute play, with you as Peter and your parent as Jesus. Include the fire of coals, the fish, and the bread. Then pause the play and explain how fish cooks, why it flakes, what opaque means, and why 145 degrees is the safe temperature. Trade roles.

Scripture. “As soon then as they were come to land, they saw a fire of coals there, and fish laid thereon, and bread.” (John 21:9, KJV)

The risen Lord made breakfast for His tired friends. Serving others with a simple, well-cooked meal is a way to follow Him.

7.3 THE SPICE TRADE

OBJECTIVES

- Tell how Vasco da Gama reached India by sea in 1498, and why spices like pepper, cinnamon, cloves and nutmeg were so precious.
- Explain the difference between herbs and spices and name the part of the plant each spice comes from.
- Mix a homemade spice rub, smell-test its spices, and use it on oven-roasted chickpeas (and grilled chicken, if you like).

Warm-up. Open five jars from the spice cabinet (for example: black pepper, cinnamon, cumin, paprika, oregano). Smell each one with your eyes closed while a helper holds it. Can you name it? Then guess: is it a leaf, a seed, a bark, a root or a flower bud?

WATCH

The Spice Of Empires

Townsend's · 16:44

<https://www.youtube.com/watch?v=BPCpLm-as-Y>

WHEN TO WATCH

After the story of Vasco da Gama. Watch for where black pepper grows, how it is picked and dried, and why it was worth so much. Watch it in two parts if you like.

Note: From Townsend's, a channel about 18th-century American life and cooking. A historian tells the story of black pepper across history.

KEY TERMS

spice

A dried seed, berry, bark, root or flower bud used to flavor food, such as pepper, cinnamon, ginger, nutmeg and cloves.

herb

The leaves of a plant used to flavor food, fresh or dried, such as parsley, basil, oregano, mint and dill.

spice rub

A mix of dried spices, herbs, salt and sometimes sugar, rubbed onto food before cooking.

aroma

A smell, especially a pleasant one.
Most of a spice's flavor is in its aroma.

trade route

A path by land or sea that merchants travel to buy and sell goods.

CORE IDEAS

The story. Five hundred years ago, the pepper on your table would have been a treasure. Black pepper grew on vines on the Malabar coast of southwest India. Cinnamon came from the bark of trees on the island of Ceylon (now Sri Lanka). Cloves and nutmeg grew on a few small islands far to the east, the Moluccas, sometimes called the Spice Islands. To reach Europe, spices passed through many hands, by ship, by camel and by ship again, and each merchant raised the price. Kings of Portugal wanted to find a sea route straight to India. In July 1497, Vasco da Gama sailed from Lisbon with four ships.

How they figured it out. Ten years earlier, another Portuguese captain, Bartolomeu Dias, had sailed around the southern tip of Africa, the Cape of Good Hope, and proved it could be done. Da Gama followed his path, sailing far out into the Atlantic to catch the winds, then around the Cape and up the east coast of Africa. In the town of Malindi, in what is now Kenya, he found a skilled pilot who knew the monsoon winds that blow across the Indian Ocean. With the pilot's help, da Gama crossed the ocean and reached the port of Calicut (now Kozhikode), India, in May 1498. He returned home in 1499 with pepper and other spices. The voyage was long and hard, but it opened a sea route between Europe and Asia that changed the world's trade.

The kitchen science. Spices come from many parts of a plant. **Pepper** is a dried berry. **Cinnamon** is the inner bark of a tree, rolled into quills as it dries. **Cloves** are dried flower buds. **Nutmeg** is a seed. **Ginger** and turmeric are roots. Cumin, coriander and mustard are seeds. **Herbs** are leaves. Most of the flavor of a spice is in its **aroma**, tiny molecules that float out and reach your nose. Those molecules are stored in oils inside the spice. Grinding releases them, and so does heat, which is why spices smell stronger when they are toasted or cooked in a little oil. It is also

why whole spices last much longer than ground ones: a jar of ground spice slowly loses its aroma into the air.

Let's cook. You will smell-test the spices one by one, mix your own spice rub, and roast crunchy chickpeas with it. The skill to do well is **measuring small amounts exactly**, leveling each teaspoon, so you can make the same rub again next time, and **tasting and adjusting** with care.

PICTURE STUDY



Calicut, Georg Braun and Frans Hogenberg, 1572 · Hand-colored engraving, from the atlas *Civitates Orbis Terrarum* · Published in Cologne, Germany

Image: [Wikimedia Commons](#), public domain

This is one of the earliest European pictures of Calicut, the Indian port where Vasco da Gama landed in 1498. It comes from a great atlas of the cities of the world made in Germany by Georg Braun and Frans Hogenberg. The Latin title at the top calls Calicut a famous market of India.

Look closely

- Find the tall sailing ships. Where have they come from, and what will they carry home?
- Find the small boats near the shore. What job might they do for the big ships?
- Find the elephant. What does it tell you about this place?
- Look at the green hills behind the town. Pepper vines grew on the hills of this coast.

Talk about it

1. A sack of pepper had to travel from these hills to a ship, across two oceans, and into a shop in Europe. How many people might have handled it on the way?
2. Why would spices be worth so much more in Lisbon than in Calicut?
3. Which spice in your kitchen do you think came the farthest to reach you?

Safety first. Smell spices by wafting them toward your nose with your hand; do not sniff powder up close, because it can make you sneeze or cough. Chili powder and pepper sting the eyes, so wash your hands after mixing the rub. An adult stands beside you at the oven, and the hot chickpeas should cool before you taste them.

KITCHEN PROJECT

Smell Test and Homemade Spice Rub

You will smell-test and sort the spices in your kitchen, mix a smoky taco-style spice rub in a jar, and roast a pan of crunchy chickpeas with it. If your family is grilling, the same rub is wonderful on chicken.

You will need

- Measuring spoons and a small bowl
- A small clean jar with a lid and a label
- A can opener, a colander and clean kitchen towels
- A rimmed baking sheet and a spatula
- Oven mitts
- Small dishes or paper cups for the smell test

SMOKY TACO SPICE RUB AND CRUNCHY ROASTED CHICKPEAS

Serves Rub: about $\frac{1}{3}$ cup · Chickpeas: 4–6 snack servings · Prep 15 min · Roast 25–35 min

Ingredients

- **Spice rub:** 2 tablespoons chili powder
- 1 tablespoon ground cumin
- 2 teaspoons smoked or sweet paprika
- 1 teaspoon garlic powder
- 1 teaspoon onion powder
- 1 teaspoon dried oregano
- 1 teaspoon brown sugar
- $1\frac{1}{2}$ teaspoons salt
- $\frac{1}{2}$ teaspoon black pepper
- **Chickpeas:** 2 cans (15 oz / 425 g each) chickpeas (garbanzo beans)
- 2 tablespoons olive oil
- 2–3 teaspoons of your spice rub

Method

1. Wash your hands. Level each spoonful with the back of a knife and stir all the rub ingredients together in the bowl. Spoon the rub into the jar, label it with the name and date, and close it tightly.
2. An adult heats the oven to 400 °F (200 °C).
3. Open the cans (an adult can help with sharp lids). Drain and rinse the chickpeas in the colander. Spread them on a towel and pat them very dry. Pick off any loose skins.
4. Toss the chickpeas with the olive oil on the baking sheet and spread them in one layer.
5. With an adult beside you, roast 25–35 minutes, shaking the pan with oven mitts every 10 minutes, until deep golden and crunchy.
6. As soon as they come out, sprinkle on 2–3 teaspoons of the rub and toss. Let them cool on the pan; they get crunchier as they cool.
7. **Grilled chicken (optional):** Rub 1 tablespoon of the mix onto each pound of chicken thighs. An adult grills them over medium heat, or roasts them at 425 °F, until 165 °F inside.
8. Clean up: wash the bowl, spoons and pan, and wipe up spice dust with a damp cloth.

Allergy check: Contains none of the nine major allergens. Chickpeas are legumes, like peanuts; most people with a peanut allergy can eat them, but ask your doctor if you are unsure. Some spice blends are made in factories with allergens, so check labels.

Steps

1. **Smell test.** Put a pinch of each of five to eight spices in separate dishes. Waft and smell each one. Describe it in your own words (warm, sharp, smoky, sweet, earthy).
2. **Sort them.** Using the jar labels or a book, sort the spices by plant part: seed, berry, bark, root, flower bud, leaf (herb). Make a chart.
3. **Heat test.** With an adult, warm ½ teaspoon of cumin in a dry skillet over low heat for 1 minute, stirring. Smell it next to cold cumin from the jar. Which is stronger? Why?
4. Mix the rub and roast the chickpeas.

5. **Taste test.** Taste a few chickpeas with the rub. Is it too salty? Too spicy? Not smoky enough? Rate it from 1 to 5.
6. **Improve it.** Write your own version of the rub (more paprika, less chili, a pinch of cinnamon) and give it a name. You will use a rub again in the unit challenge.
7. Clean up: put all the spices back where they belong, tightly closed.

Tips

- Dry chickpeas get crunchy; wet chickpeas steam. Pat them as dry as you can.
- Add the spice rub after roasting so the spices do not burn in the hot oven.
- Store spices in a cool, dark cupboard, away from the stove. Heat and light fade their aroma.

Check your work

- ☐ I can tell the story of Vasco da Gama's voyage and why spices were so precious.
- ☐ I can explain the difference between an herb and a spice and name the plant part of four spices.
- ☐ I measured a spice rub exactly and roasted chickpeas with an adult beside me.

COOK'S NOTEBOOK

1. Draw a map showing Lisbon, the Cape of Good Hope, Malindi and Calicut, and trace Vasco da Gama's route.
2. Make a spice chart: the name, a little drawing, the plant part and a smell word for each spice you tested.
3. Copy your spice rub recipe, with your improvement, and design a label for the jar.

From history. Pepper was so valuable in the Middle Ages that it was sometimes used almost like money: rents and taxes were occasionally paid in peppercorns. Today black pepper is the most traded spice in the world, and India and Vietnam are among its largest growers.

COMMON MISTAKES

- Thinking all spices are hot. Most spices are warm and fragrant, not fiery; only a few, like chili and black pepper, are hot.

- Keeping spices for many years. Ground spices lose most of their aroma after a year or two; smell them to check.
- Sniffing powdered spice up close. Waft it toward your nose instead.

Make it a game · Spice Route Riddles. Take turns giving riddles about spices, such as, I come from the bark of a tree and I am sweet. The other person guesses cinnamon. Cover pepper, cloves, nutmeg and ginger. Then retell how Vasco da Gama sailed to India in 1498 and why these spices were so precious. Whoever guesses more wins.

7.4 FLAVORS THAT GO TOGETHER

OBJECTIVES

- Name and explain complementary flavor pairs: salt + sweet, acid + fat, heat + cool, herb + citrus, and fat + bitter.
- Taste and adjust a dish, using salt, acid, sweetness or fat to balance it.
- Prepare grilled corn with lime and chili and caramelized pineapple or peaches with cinnamon, cooked by an adult on the grill or under the broiler.

Warm-up. Taste a slice of apple. Now sprinkle a tiny pinch of salt on another slice and taste it. Then squeeze a drop of lemon on a third. How did each one change the apple? Write one word for each.

WATCH

Grilled Mexican Corn with Chile Lime Sauce

Cowboy Kent Rollins • 8:06

https://www.youtube.com/watch?v=QP7LM_sZn1k

WHEN TO WATCH

Before you cook. Notice how the sauce balances salty cheese, tangy lime, rich mayonnaise and warm chili on sweet corn.

Note: Kent Rollins is a cowboy cook from Oklahoma who cooks outdoors. His sauce uses sour cream, mayonnaise and Parmesan; our recipe is simpler.

KEY TERMS

complementary flavors

Flavors that make each other taste better together, like salt and sweet, or acid and fat.

acid

A sour ingredient such as lemon, lime or vinegar. Acid makes food taste brighter and cuts through richness.

balance

When no one taste is too strong and the flavors work together.

caramelize

To heat food until its sugars turn golden brown and taste nutty and rich.

season to taste

To taste a dish near the end and add a little salt, acid or another seasoning until it tastes just right.

CORE IDEAS

The story. All over the world, cooks have discovered the same pairs of flavors that go together. Cooks in Mexico sprinkle lime, salt and chili on fruit and on roasted corn. Cooks in England put mint with lamb, and in France, lemon with butter on fish. In the American South, a slice of salty ham goes with sweet biscuits and honey. These pairings were not invented in a laboratory; generations of cooks found them by tasting, adjusting and tasting again, and passed them down to their children.

How they figured it out. Scientists later explained some of what cooks already knew. In your taste buds, salt and sweet are sensed by different receptors, but a little salt makes sweet foods taste sweeter and hides bitterness, which is why salted caramel and salted watermelon taste so good. Acid and fat balance each other: fat coats the tongue, and acid makes the mouth water and feels clean and bright, so lemon on fried fish or vinegar in a rich dressing tastes just right. Chili's heat comes from a substance called capsaicin, and cool, creamy foods like yogurt soothe it. Herbs and citrus both have bright aromas that wake up a dish.

The kitchen science. Here are the pairs to remember. **Salt + sweet:** a pinch of salt makes fruit and desserts taste sweeter. **Acid + fat:** lime or lemon lightens butter, oil and rich meats. **Fat + bitter:** cheese or olive oil softens bitter greens like broccoli rabe or kale. **Heat + cool:** chili with cool yogurt, sour cream or cucumber. **Herb + citrus:** parsley, cilantro, dill or mint with lemon, lime or orange. On the grill, heat also **caramelizes** the natural sugars in corn and fruit, adding deep, toasty sweetness that pairs beautifully with a little salt or spice. A good cook always **tastes and adjusts:** Is it flat? Add salt or acid. Too sour? Add a little sweet or fat. Too spicy? Add something cool.

Let's cook. You will make grilled corn with lime, butter and chili powder, and caramelized pineapple (or peaches) with cinnamon and a pinch of salt. An adult does the grilling (or the broiling indoors). Your skills are **preparing and seasoning** the corn and fruit and **tasting and adjusting** the flavors at the end.

PICTURE STUDY



Still Life with Salmon, a Lemon and Three Vessels, Luis Egidio Meléndez, 1772 · Oil on canvas · Museo del Prado, Madrid

Image: [Wikimedia Commons](#), public domain

Meléndez placed just a few things on his table: a thick slice of salmon, a lemon, and the pots a cook would use. Even in the 1700s, cooks knew that lemon and rich fish belong together.

Look closely

- Find the lemon. Why do you think Meléndez put it right next to the salmon?
- Look at the shine on the salmon. What does the shine tell you about this fish?
- Find the three vessels. Which one would you use to cook the salmon? Which might hold water?
- Look at the colors: orange, yellow, copper and brown. How do they go together, like flavors that go together?

Talk about it

1. Salmon is a rich, oily fish, and lemon is an acid. Which flavor pair does this painting show?
2. What herb would you add to this salmon and lemon? Why?
3. Meléndez painted only a few things. Why might a simple picture, or a simple dish, sometimes be the best?

Safety first. An adult does all the grilling or broiling while you stay 3 feet back. Grilled fruit and corn are very hot inside; let them cool a few minutes before biting. Cut fruit and limes with an adult right beside you, using the claw and bridge grips, and wash your hands after touching chili powder.

Flavor Pairs: Grilled Corn and Caramelized Fruit

You will run a flavor-pairing tasting, then prepare grilled corn with lime and chili and caramelized pineapple or peaches with cinnamon. At the end you will taste and adjust each dish, the way real cooks do.

You will need

- A cutting board, a small serrated knife and a damp towel
- Small bowls, measuring spoons and a pastry brush
- Long tongs and oven mitts (for the adult)
- A grill, or a broiler pan or foil-lined rimmed baking sheet for the indoor way
- Small plates and toothpicks for the tasting

GRILLED CORN WITH LIME AND CHILI, AND CARAMELIZED PINEAPPLE WITH CINNAMON

Serves 6 • Prep 20 min • Cook 15–20 min

Ingredients

- **Corn:** 6 ears fresh corn, husks and silk removed
- 2 tablespoons butter, melted (or olive oil)
- 1 lime, cut into wedges
- ½ teaspoon chili powder (or less for mild)
- ½ teaspoon salt
- 2 tablespoons crumbled cotija or grated Parmesan cheese (optional)
- **Fruit:** 1 fresh pineapple, peeled, cored and cut into 1-inch-thick spears (or 4 ripe peaches, halved and pitted)
- 1 tablespoon honey or brown sugar
- ½ teaspoon ground cinnamon
- 1 small pinch of salt
- Plain or vanilla yogurt, for serving (optional)

Method

1. Wash your hands, and rinse the corn and fruit. An adult cuts the pineapple (its tough skin needs a big knife), or you halve the peaches along the seam with an adult beside you and twist out the pits.
2. Brush the corn lightly with melted butter. Stir the honey and cinnamon together and brush it on the cut sides of the fruit.
3. **Grill:** An adult heats the grill to medium-high and grills the corn over direct heat, turning every 2–3 minutes with tongs, 10–12 minutes, until spotted with brown. Then the adult grills the fruit 2–4 minutes per side, until it has golden grill marks. You watch from 3 feet back.
4. **Indoor way:** An adult heats the broiler with the rack about 5 inches below it. Broil the corn on a foil-lined pan 10–14 minutes, turning every 3 minutes, then the fruit 3–5 minutes, until caramelized. A grill pan on the stove over medium-high heat also works, with an adult.
5. Let everything cool for a few minutes. Squeeze lime over the corn and sprinkle with the chili powder, salt and cheese.
6. Sprinkle the warm fruit with a tiny pinch of salt. Serve with a spoonful of cool yogurt if you like.
7. Taste and adjust: more lime? more salt? a little more cinnamon?
8. Clean up: wash the bowls, brushes and board, and compost the corn husks and cobs.

Allergy check: Contains milk (butter, cheese, yogurt). For a milk-free version, use olive oil and leave out the cheese and yogurt. Honey is not for babies under one year; use brown sugar instead.

Steps

1. **Flavor-pair tasting.** With your family, taste each pair and rate how well it goes together from 1 to 5: watermelon or apple with a pinch of salt (salt + sweet); a cucumber slice with lemon and olive oil (acid + fat); a corn chip with salsa, then with a spoon of yogurt (heat + cool); a parsley leaf with an orange segment (herb + citrus). Check for allergies first.
2. Prepare the corn and fruit and help the adult cook them.
3. **Taste before and after.** Taste a bite of corn plain, then with butter, then with lime, then with chili and salt. What did each one add? Do the same with the

fruit plain and with a pinch of salt.

4. **Fix-it test.** Taste a spoonful of plain yogurt with a pinch of chili powder. Too hot? Add a little honey. Too flat? Add a squeeze of lime. Record what each change did.
5. **Taste test.** Rate both dishes from 1 to 5 with your family.
6. **Improve it.** Invent one new flavor pair to try (for example, strawberries with a little black pepper, or carrots with orange and dill) and plan when to try it.
7. Clean up: wash, dry and put everything away.

Tips

- Add salt and acid a little at a time and taste each time. You can always add more, but you cannot take it out.
- Ripe fruit with plenty of natural sugar caramelizes best.
- Leftover grilled corn is good cut off the cob into salads, soups and tacos.

Check your work

- ☐ I can name five complementary flavor pairs and give an example of each.
- ☐ I tasted and adjusted a dish using salt, acid, sweet or fat.
- ☐ I prepared grilled corn and caramelized fruit safely while an adult did the grilling or broiling.

COOK'S NOTEBOOK

1. Make a flavor-pairing chart: each pair, an example, and your family's rating.
2. Draw a plate with your grilled corn and caramelized fruit, and label each flavor on it.
3. Write a "fix-it guide" for a cook: if a dish is flat, too sour, too sweet or too spicy, what do you add?

From history. Corn was first grown by the peoples of Mexico and Central America, and lime and chili have been served with it there for a very long time. Pineapples are native to South America. When Christopher Columbus brought pineapples back to Spain, Europeans were amazed by them, and the pineapple became a popular sign of welcome and hospitality, carved and painted on furniture and buildings in early America.

COMMON MISTAKES

- Adding a lot of salt or lime at once. Add a little, taste, then add more if needed.
- Thinking spicy food can only be fixed with water. A cool, creamy food like yogurt soothes chili heat better.
- Biting into fruit right off the grill. The sugar inside is much hotter than it looks.

Make it a game • Balance It Back. Your parent stirs a pinch of salt, lemon juice, sugar, or oil into a small bowl of plain rice and you taste with a clean spoon, deciding what to add to balance it. Name the flavor pair each time: salt and sweet, acid and fat, heat and cool. Practice saying season to taste. Switch and let your parent taste.

Scripture. “Let your speech be alway with grace, seasoned with salt, that ye may know how ye ought to answer every man.” (Colossians 4:6, KJV)

Salt brings out the best in food. Paul says our words should do the same for the people around us: gracious, wise and well seasoned.

UNIT 7

FIRE, THE GRILL & SPICE

This is the fun unit. People have cooked over open fire since the very beginning, and there is still nothing quite like the smell of food on a grill. You will learn the fire triangle, how a grill cooks with direct and indirect heat, and the safety rules every griller follows. At your age, **an adult does the lighting and the grilling**; you plan, prepare the food, season it, watch from 3 feet back, and check the temperature with the adult. Every recipe also has an **indoor way**, under the oven broiler or in a grill pan with an adult, for families without a grill.

Then you will sit by the Sea of Galilee, where Jesus cooked fish and bread on a fire of coals for His tired disciples. You will sail with Vasco da Gama to India in search of pepper, learn where cinnamon, cloves and nutmeg come from, and mix your own spice rub. Finally you will learn how cooks balance flavors that go together, salt with sweet, acid with fat, heat with cool, herb with citrus, and finish with grilled corn and caramelized fruit.

PREREQUISITES

- Knows the safe internal temperatures: poultry 165 °F, fish 145 °F, ground meat 160 °F (Unit 1)
- Keeps raw meat separate from ready-to-eat food and washes hands after handling it (Unit 1)
- Knows how heat moves by conduction, convection and radiation, and what broiling is (Unit 4)
- Knows the Maillard reaction and the five basic tastes (Units 3 and 5)

MASTERY CHECKLIST

- ☐ I can name the three sides of the fire triangle and explain how a lid puts out a flare-up.
- ☐ I can explain direct and indirect heat, and list the grill safety rules, including that only adults light and run the grill.
- ☐ I can check meat and fish with a food thermometer and name their safe temperatures (chicken 165 °F, fish 145 °F).
- ☐ I can tell the story of the spice trade and Vasco da Gama, and name where pepper, cinnamon, cloves and nutmeg come from.
- ☐ I can balance a dish using complementary flavors, and make my own spice rub.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **NFPA: Grilling safety:** Free. Grilling safety tips and a printable tip sheet from the National Fire Protection Association. Good to read together before Lesson 7.1.
- **An instant-read food thermometer:** If you did not get one in Unit 1, this is the unit that needs it. Check every piece of chicken and fish in its thickest part.
- **For the adult griller: long-handled tongs and a chimney starter:** Long tongs keep hands away from the heat. A chimney starter lights charcoal with crumpled newspaper or a fire-starter cube, so no liquid starter is needed. A gas grill needs neither. Not required: every recipe also works under the oven broiler.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

7.1	Fire Safety and the Grill	2 sessions of 45–60 minutes
7.2	A Fire of Coals by the Sea	2 sessions of 45–60 minutes
7.3	The Spice Trade	2 sessions of 45–60 minutes
7.4	Flavors That Go Together	2 sessions of 45–60 minutes

UNIT 7 REVIEW

Answer each question. Use complete sentences for explanations. The review is worth 50 points.

1. 5 pts

Name the three parts of the fire triangle. Which part does a grill lid take away when it smothers a flare-up?

2. 5 pts

Predict: a pan of oil on the stove catches fire and someone pours water on it. What will happen, and what should be done instead?

3. 5 pts

What is the difference between direct and indirect heat? Give a food for each.

4. **5 pts**

List four grill safety rules.

5. **5 pts**

What are the safe internal temperatures for chicken and for fish? Where do you put the thermometer?

6. **5 pts**

Why does cooked fish flake, and why does it cook faster than beef?

7. **5 pts**

What happened when Vasco da Gama reached Calicut in 1498, and why did it matter?

8. **5 pts**

Match each spice with its plant part: cinnamon, cloves, black pepper, nutmeg, ginger.

9. **5 pts**

Predict: you taste your soup and it is flat and a little too rich. Which two kinds of ingredients could you add, and why?

10. **5 pts**

Give an example of each pair: salt + sweet, heat + cool, herb + citrus.

ANSWER KEY

1. Heat, fuel and oxygen. The lid takes away oxygen.
2. The water will sink, boil instantly and spray the burning grease outward, spreading the fire. Instead, turn off the heat and cover the pan with a lid or pour on baking soda; if the fire grows, get out and call 911.
3. Direct heat cooks food right over the fire, for small, quick-cooking foods like kebabs, burgers or corn. Indirect heat cooks food beside the fire with the lid closed, like an oven, for bigger pieces like a whole chicken or a large roast.
4. Any four: only adults light and run the grill; grill outdoors away from the house, railings and dry leaves; children stay 3 feet back; use long tongs; never use liquid starter on a lit fire (we use none); keep a lid and a hose or extinguisher ready; never leave a lit grill alone; let coals cool 24–48 hours before disposal in a metal can.
5. Chicken 165 °F; fish 145 °F. Put the thermometer in the thickest part of the food, not touching bone or the pan.
6. Fish muscle is made of short flakes held together by very thin connective tissue that softens and separates when cooked. Fish do not need strong muscles to hold themselves up in water, so the flesh is tender and cooks quickly.
7. He became the first European to reach India by sailing around Africa, with the help of a pilot from Malindi. It opened a direct sea route for spices like pepper between Asia and Europe, changing world trade.
8. Cinnamon: bark. Cloves: flower buds. Black pepper: berries. Nutmeg: seed. Ginger: root.
9. Salt, which brings out the flavors, and an acid like lemon juice or vinegar, which brightens the taste and cuts through richness.
10. Examples: salted caramel or salted watermelon; chili with yogurt or sour cream; parsley or dill with lemon, cilantro with lime, mint with orange. Other good examples accepted.

UNIT CHALLENGE: A FAMILY GRILLED (OR BROILED) DINNER WITH A HOMEMADE RUB

Plan and prepare a family dinner from the grill or the broiler. Choose a main dish (chicken, fish or kebabs) and at least one grilled vegetable or fruit. Make your own spice rub and write the recipe. You prepare, season and set out everything; an adult lights the grill and does the grilling while you watch from 3 feet back and check the temperatures together.

Make a flavor-pairing chart for the meal showing at least three complementary pairs you used. Record the safe temperature of each meat or fish, and after dinner ask each person to rate the meal and tell you one thing they liked.

LOOK FOR	WHAT IT MEANS
Planning	A written menu, a shopping list and a simple timeline for prepping and cooking.
Safety	Raw meat kept separate, hands and boards washed, adult at the grill, temperatures checked and recorded.
Spice rub and flavor chart	Rub recipe measured and written so it can be made again; at least three flavor pairs named and used.
Cleanup and service	Kitchen cleaned, table set, meal served with thanks.
Reflection	Family ratings recorded and one honest improvement planned for next time.

UNIT 8

MEAL PLANNING & THE FAMILY TABLE

A good cook does more than follow a recipe. She reads it carefully, measures exactly, plans ahead, shops wisely and wastes nothing. In this unit you will meet Fannie Farmer, the Boston teacher who taught America to measure with level cups and spoons, and you will double a muffin recipe. You will learn from Joseph, who planned for seven years of famine, how to plan meals for a week and turn one big pot of soup into two dinners. You will walk into the first self-service grocery store, Piggly Wiggly, and learn to compare unit prices and keep to a budget.

Everything you have learned this year comes together in the last lesson: **the family feast**. Like Abraham, who hurried to welcome three guests with fresh bread and a good meal, you will plan a balanced menu, shop with a parent, cook several dishes with an adult beside you, set the table, and gather your family to give thanks. Food is God's good gift, and the table is where we share it.

PREREQUISITES

- Can measure with cups, spoons and a scale (Units 1–7)
- Knows how to build a balanced plate with the five food groups (Unit 2)
- Knows the 2-hour rule and safe temperatures for leftovers (Unit 1)
- Can read a Nutrition Facts label (Unit 6)

MASTERY CHECKLIST

- ☐ I can read a recipe all the way through before I start, measure with level cups and spoons, and double or halve a recipe.
- ☐ I can plan balanced meals for a day and a week, using leftovers wisely and safely.
- ☐ I can write a shopping list, find the unit price of a food, and figure the cost per serving of a meal.
- ☐ I can set a family table, serve guests with hospitality, and lead or join in a grace before the meal.
- ☐ I can plan, shop for and cook a family feast with an adult, on a timeline.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- ***The Boston Cooking-School Cook Book* by Fannie Merritt Farmer (1896), free at Project Gutenberg:** Free to read online. Look at her chapter on measuring and her tables of weights and measures for Lesson 8.1. Some old recipes use ingredients this course leaves out, so families may want to read it together.
- **MyPlate Kitchen (USDA):** Free. Search “MyPlate Kitchen” for the USDA’s collection of budget-friendly recipes and its meal-planning and shopping-list tools. Useful for Lessons 8.2–8.4.
- **A simple calculator and a notebook for the grocery store:** For comparing unit prices and keeping a running total while you shop in Lesson 8.3 and the unit challenge.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

8.1 Fannie Farmer and the Level Cup	2 sessions of 45–60 minutes
8.2 Joseph Plans for the Famine	2 sessions of 45–60 minutes
8.3 At the Grocery Store	2 sessions of 45–60 minutes
8.4 The Family Feast	2 sessions of 60–90 minutes

UNIT 8 REVIEW

Answer each question. Show your work for calculations and use complete sentences for explanations. The review is worth 50 points.

1. 5 pts

What did Fannie Farmer change about recipes, and why did it matter?

2. 5 pts

Predict: you scoop flour straight from the bag and pack it into the cup for a muffin recipe. What will happen to the muffins?

3. (5 pts)

Double these amounts: $\frac{3}{4}$ cup sugar, $1\frac{1}{2}$ teaspoons baking powder, $\frac{1}{3}$ cup oil.
Then halve 1 cup flour.

4. (5 pts)

How did Joseph plan for the famine, and how is a family meal plan like his?

5. (5 pts)

Give the three rules for safe leftovers.

6. (5 pts)

What did Clarence Saunders invent in 1916, and why did it lower prices?

7. (5 pts)

A 24-ounce jar of peanut butter costs \$4.80. A 16-ounce jar costs \$3.52. Find each unit price. Which is the better buy?

8. (5 pts)

A pot of soup costs \$10.80 to make and serves 8. What is the cost per serving?

9. (5 pts)

Describe a simple place setting.

10. (5 pts)

Name three ways Abraham showed hospitality to his guests in Genesis 18.

ANSWER KEY

1. She insisted on standard measuring cups and spoons and level measurements, instead of vague amounts like “a teacup” or “butter the size of an egg.” It meant a recipe would turn out the same in any kitchen, so anyone could learn to cook it.
2. They will have too much flour (as much as a quarter more), so they will be dry, dense or tough. Spoon and level the flour, or weigh it.
3. $1\frac{1}{2}$ cups sugar; 3 teaspoons (1 tablespoon) baking powder; $\frac{2}{3}$ cup oil. Half of 1 cup flour is $\frac{1}{2}$ cup.
4. In the seven good years he gathered a fifth of the harvest and stored it in the cities, keeping records, so there was food in the seven years of famine. A meal plan also prepares ahead, uses food wisely, avoids waste and cares for people.
5. Refrigerate within 2 hours (1 hour above 90°F), in shallow containers; eat within 3–4 days or freeze; reheat to 165°F .
6. Piggly Wiggly, the first self-service grocery store, in Memphis. Shoppers took items from the shelves themselves, so the store needed fewer clerks to fetch things, and prices were marked so shoppers could compare.
7. $\$4.80 \div 24 = \$0.20$ per ounce. $\$3.52 \div 16 = \$0.22$ per ounce. The 24-ounce jar is the better buy.
8. $\$10.80 \div 8 = \$1.35$ per serving.
9. Plate in the center; napkin and fork on the left; knife (blade facing the plate) and spoon on the right; glass above the knife.
10. Any three: he ran to meet them and bowed; he invited them to rest in the shade; he hurried to have bread baked and a meal prepared; he gave them his best (a tender calf, butter and milk); he served them himself and stood by them while they ate.

UNIT CHALLENGE: THE FAMILY FEAST

Plan, shop for, cook and serve a family feast with an adult, as in Lesson 8.4. Include at least three dishes from this year and all five food groups.

Put together a feast folder: the menu card, the grocery list with the budget and the receipt total, the cost per person, the timeline with each step checked off, a photo or drawing of the table, and a thank-you note or a written grace. Finish with a one-page reflection on what you learned this year as a cook and what you want to learn next.

LOOK FOR	WHAT IT MEANS
Planning	A balanced menu with all five food groups, a grocery list grouped by store section, a budget and a realistic timeline.
Cooking and safety	Dishes cooked with an adult beside you; raw meat kept separate; temperatures checked and recorded; leftovers stored within 2 hours.
Table and hospitality	Table set neatly, guests welcomed and served first, grace said or sung.
Cleanup and teamwork	Cleaned as you went, worked kindly with helpers, and finished with a clean kitchen.
Reflection	An honest look back at the feast and the year, with family ratings and one goal for next year.

8.1 FANNIE FARMER AND THE LEVEL CUP

OBJECTIVES

- Tell how Fannie Farmer's 1896 cookbook taught level, standard measurements.
- Read a recipe all the way through, measure dry and liquid ingredients correctly, and double or halve a recipe.
- Bake a double batch of banana muffins with an adult beside you, measuring every ingredient level.

Warm-up. Scoop a cup of flour straight from the bag and pack it down. Weigh it, or pour it onto a plate. Then spoon flour lightly into the cup and level it with the back of a knife. Weigh or pour that one too. Are they the same? How much difference could that make in a cake?

WATCH

Author of the Cookbook that Changed the World: Fannie Farmer - Freedom's Way NHA Heritage Stories

Freedom's Way National Heritage Area • 6:38

<https://www.youtube.com/watch?v=L7R2bEAo7KI>

WHEN TO WATCH

After the story. Look for the old photographs of Fannie Farmer's cooking classes and the pages of her cookbook.

Note: From the Freedom's Way National Heritage Area, a partner of the National Park Service in Massachusetts and New Hampshire.

BACKUP VIDEO

How to Properly Measure Baking Ingredients | Sally's Baking

Sally's Baking Recipes • 4:15

<https://www.youtube.com/watch?v=Ohswpt6fhh4>

Before you bake. Practice each method alongside her: spoon and level, scoop and level, and measuring liquids at eye level.

KEY TERMS

level measurement

Filling a measuring cup or spoon and scraping off the extra with a straight edge, so it holds exactly the right amount.

dry measuring cup

A cup filled to the top and leveled off, used for flour, sugar and other dry ingredients.

liquid measuring cup

A clear cup with a spout and lines on the side, read at eye level on a flat counter.

yield

How much a recipe makes, such as 12 muffins or 6 servings.

scale a recipe

To make more or less of a recipe by multiplying or dividing every ingredient by the same number.

CORE IDEAS

The story. Fannie Merritt Farmer was born in Boston in 1857. When she was a teenager, a serious illness left her unable to walk for a time, and she walked with a limp all her life. She could not finish school as she had hoped, so she helped at home and grew to love cooking. At about thirty she enrolled at the Boston Cooking School, did so well that she stayed on as a teacher, and in 1891 became its principal. In 1896 she published *The Boston Cooking-School Cook Book*. The publisher was not sure it would sell, so she paid for the first printing of 3,000 copies herself. It sold so well that it was printed again and again for over a hundred years.

How she figured it out. In older cookbooks, recipes said things like “a teacup of sugar,” “butter the size of an egg” or “flour enough to make a stiff batter.” Every teacup and every egg was a different size, so a recipe that worked in one kitchen failed in the next. Fannie Farmer insisted on standard measuring cups and spoons and on **level** measurements. Her book says that correct measurements are absolutely necessary to insure the best results. She explained how to fill a cup, scrape it level with a knife, and divide a spoonful exactly. People called her “the mother of level measurements.” Her book made cooking something anyone could learn and repeat.

The kitchen science. Baking is chemistry, and chemistry needs exact amounts. Too much flour makes muffins dry and tough; too much baking soda makes them taste bitter and soapy; too little makes them dense. Flour packs down, so a scooped and packed cup can hold a quarter more flour than a spooned and leveled cup. That is why bakers **spoon and level** flour, or weigh it on a scale: a level cup of all-purpose flour weighs about 125 grams. To **scale** a recipe, multiply or divide every ingredient by the same number. Doubling means $\times 2$: $\frac{1}{2}$ cup becomes 1 cup and $\frac{3}{4}$ teaspoon becomes $1\frac{1}{2}$ teaspoons. Halving means $\div 2$: 1 cup becomes $\frac{1}{2}$ cup, and 1 egg becomes about 2 tablespoons of beaten egg. Bigger pans and bigger batches may need a few more minutes in the oven.

Let's cook. You will bake a double batch of banana muffins. The skills to do well are **reading the whole recipe first**, setting out every ingredient before you start, **measuring level**, and doubling correctly. Use the oven with an adult beside you and oven mitts on.

PICTURE STUDY



Fannie Merritt Farmer, Unknown photographer, about 1900 · Photograph · Boston Public Library
Image: [Wikimedia Commons](#), public domain

This is Fannie Farmer at about the time she opened her own cooking school, Miss Farmer's School of Cookery, in Boston in 1902. Besides teaching homemakers and future teachers, she taught cooking for people who were ill, and lectured to nurses and doctors about feeding patients well.

Look closely

- Look at her face and eyes. What kind of teacher do you think she was: careful, cheerful, strict?
- Look at her clothes and collar. What do they tell you about the time when she lived?
- Find her eyeglasses. Why might a cook who measured carefully need good eyes?
- Notice how still and straight she sits. Why did people sit very still for photographs then?

Talk about it

1. Fannie Farmer could not finish school as she planned, but she became a famous teacher. What does her story teach about hard times?
2. If she visited your kitchen today, what would she say about the way you measure flour?

3. Why would a cookbook with exact measurements be a gift to a new cook?

Safety first. Use the oven only with an adult beside you, with oven mitts on and the hot pan set on a trivet or cooling rack. Never taste unbaked batter: uncooked flour and eggs can carry germs. Wash your hands after cracking eggs.

KITCHEN PROJECT

Double the Batch: Banana Muffins

You will read a recipe and double it, then bake a double batch of banana muffins, measuring every ingredient level. You will check your measuring with a scale and compare one muffin made with scooped flour to the rest.

You will need

- Two 12-cup muffin tins and paper liners (or one tin used twice)
- A large bowl, a medium bowl, a fork or potato masher and a whisk
- Dry measuring cups, a liquid measuring cup, measuring spoons and a table knife for leveling
- A kitchen scale (optional)
- A rubber spatula, a $\frac{1}{4}$ -cup measure or large scoop, oven mitts and a cooling rack
- A toothpick

DOUBLE-BATCH BANANA MUFFINS

Serves 24 muffins (a single batch makes 12) • Prep 20 min • Bake 18–22 min

Ingredients

- 6 very ripe bananas, mashed (about 3 cups) • single batch: 3 bananas
- $\frac{2}{3}$ cup (150 g) butter, melted and cooled • single: $\frac{1}{3}$ cup
- 1 cup (200 g) packed brown sugar • single: $\frac{1}{2}$ cup
- 2 large eggs • single: 1
- 2 teaspoons vanilla extract • single: 1 teaspoon
- 2 teaspoons baking soda • single: 1 teaspoon
- $\frac{1}{2}$ teaspoon salt • single: $\frac{1}{4}$ teaspoon
- 1 teaspoon ground cinnamon • single: $\frac{1}{2}$ teaspoon
- 3 cups (375 g) all-purpose flour, spooned and leveled • single: $1\frac{1}{2}$ cups

Method

1. Read the whole recipe. Set out every ingredient and tool. An adult heats the oven to 350 °F (175 °C). Put liners in the muffin cups. Wash your

hands.

2. In the large bowl, mash the bananas with a fork until almost smooth. Stir in the melted butter.
3. Stir in the brown sugar, eggs and vanilla until well mixed. Wash your hands after cracking the eggs.
4. Sprinkle the baking soda, salt and cinnamon over the batter and stir them in well.
5. Spoon the flour into the cup, level it, and add it 1 cup at a time, stirring gently with the spatula just until no dry flour shows. A few lumps are fine; overmixing makes tough muffins.
6. Fill each liner about three-quarters full (a $\frac{1}{4}$ -cup measure works well).
7. With an adult beside you, bake 18–22 minutes, until the tops spring back when touched and a toothpick in the center comes out clean. Using oven mitts, set the pans on the rack. Cool 5 minutes, then lift out the muffins.
8. Clean up: wash the bowls and tools, and wipe the counter. Freeze extra muffins in a bag for up to 3 months.

Allergy check: Contains wheat, eggs and milk. For egg-free muffins, use $\frac{1}{2}$ cup unsweetened applesauce in place of the 2 eggs (double batch). For milk-free muffins, use a neutral oil instead of butter. A gluten-free 1-to-1 flour blend can replace the wheat flour.

Steps

1. **Read and double.** Before you cook, copy the single-batch amounts into your notebook and write the doubled amount beside each. Check your answers against the recipe card.
2. **Measuring check.** If you have a scale, weigh one cup of flour spooned and leveled, and one cup scooped and packed. Record both weights. How much more flour was in the packed cup?
3. **Fair test.** Before you add all the flour, have an adult help you set aside batter for 2 muffins and stir in 1 extra tablespoon of flour (as if you had packed your cups). Bake them with the rest, marked with a toothpick flag. Compare height, texture and moistness.
4. Bake the full double batch.

5. **Taste test.** Rate the muffins for moistness, rise and flavor from 1 to 5, and compare them with the extra-flour muffins.
6. **Improve it.** Write one change for next time (chopped walnuts, blueberries, less sugar, whole-wheat flour for half) and how you would measure it.
7. **Clean up:** wash, dry and put everything away. Share a plate of muffins with a neighbor or freeze some for the family feast.

Tips

- The blacker the banana peel, the sweeter and more flavorful the muffins.
- Measure baking soda and salt with care: level spoons, not heaping.
- If you double a recipe and bake it in one big pan instead of muffin tins, it will need more time. Muffin tins keep the time the same.

Check your work

- ☐ I can tell how Fannie Farmer changed the way Americans cook.
- ☐ I can measure flour by spooning and leveling, and read a liquid measuring cup at eye level.
- ☐ I doubled a recipe correctly and baked it with an adult beside me.

COOK'S NOTEBOOK

1. Make a two-column table: single batch and double batch, for every ingredient in the muffins.
2. Draw the right way to measure flour, brown sugar (packed) and milk (eye level), with arrows and labels.
3. Halve the muffin recipe in your notebook. Which ingredient was hardest to halve? How did you solve it?

From history. Fannie Farmer's book included one of the first printed instructions for measuring with level spoons and cups and offered careful tables of measures, such as 3 teaspoons to 1 tablespoon and 16 tablespoons to 1 cup. Those same equivalents are printed inside many kitchen cupboards today.

COMMON MISTAKES

- Starting to cook before reading the whole recipe, then discovering a missing ingredient or a step that takes an hour.
- Scooping flour straight from the bag and packing it, which adds too much flour.

- Doubling some ingredients and forgetting others. Check every line.

Make it a game · Level Cup Contest. Measure a cup of flour the wrong way, scooping heaped, then the right way, leveled with a knife back. Weigh or compare the amount and say which is correct. Then double a recipe on paper for banana muffins and halve it. Race to finish. Tell how Fannie Farmer made recipes dependable.

8.2 JOSEPH PLANS FOR THE FAMINE

OBJECTIVES

- Retell how Joseph stored grain in seven good years to feed people through seven years of famine (Genesis 41).
- Plan balanced meals for a day and a week, including planned leftovers, and store and reheat leftovers safely.
- Cook a big pot of chicken-and-rice soup with an adult beside you, planned to feed the family twice.

Warm-up. Open your refrigerator with a parent. Find three foods that need to be used up in the next few days. What meal could you make from them? Then ask: how does our family decide what to cook each night?

WATCH

How to Make the Best Chicken and Rice Soup at Home | One-Pot Recipe

MOMables - Laura Fuentes · 4:01

<https://www.youtube.com/watch?v=fa-PTXLTFCk>

WHEN TO WATCH

Before you cook. Watch the order she adds the vegetables, the broth, the rice and the chicken, and compare it with our recipe.

Note: A home cook and cookbook author. Her version uses cooked rotisserie chicken; ours simmers raw chicken in the broth and checks it with a thermometer.

KEY TERMS

meal plan

A written plan of the meals for a day or a week, made before shopping.

planned leftovers

Extra food cooked on purpose to be eaten at another meal.

famine

A time when there is not enough food for the people of a land, often after failed harvests.

shallow container

A wide, low container that lets hot food cool quickly in the refrigerator.

simmer

To cook in liquid just below boiling, with small, gentle bubbles.

CORE IDEAS

The story. Joseph's jealous brothers sold him to traders, who took him to Egypt, but God was with him. Years later, Pharaoh had two troubling dreams: seven fat cows eaten by seven thin cows, and seven full ears of grain swallowed by seven thin ones. Joseph explained that God was warning Pharaoh: seven years of plenty were coming, and then seven years of famine. He gave wise advice: in the good years, gather a fifth of the harvest and store it in the cities. Pharaoh put Joseph in charge of the whole plan (Genesis 41).

How he figured it out. Joseph planned before the need came. He collected grain during the seven good years until there was so much that people stopped counting it. When the famine came, there was bread in Egypt, and people came from other lands to buy grain, including Joseph's own brothers, who did not recognize him. Because of his planning, his family was saved and forgiven. Joseph knew that what you have today must be made to last for tomorrow, and that careful planning is a way to care for people.

The kitchen science. Planning meals works the same way. A **meal plan** for the week means fewer trips to the store, less money spent, less food thrown away and more balanced meals. Start with what you already have, then plan meals with all five food groups. Cook once, eat twice: a big pot of soup, a pan of roasted vegetables or a batch of rice can become a second meal. But leftovers must be handled safely. Refrigerate cooked food within **2 hours** (1 hour if it is above 90 °F outside). Hot food cools quickly in **shallow containers**, not one deep pot. Eat leftovers within 3–4 days, or freeze them. Reheat leftovers to **165 °F (74 °C)**, and bring soup to a full boil. Rice soaks up broth as it sits, so add a splash of water or broth when reheating soup.

Let's cook. You will cook a big pot of chicken-and-rice soup for two dinners. The skills to do well are **chopping vegetables evenly** with the claw grip and an adult beside you, **simmering** instead of boiling hard, checking the chicken with a thermometer, and **cooling and storing** the leftovers safely.

PICTURE STUDY



Joseph, Overseer of Pharaoh's Granaries, Lawrence Alma-Tadema, 1874 · Oil painting · Dahesh Museum of Art, New York

Image: [Wikimedia Commons](#), public domain

Lawrence Alma-Tadema, a Dutch-born painter who lived in England, studied ancient Egyptian objects in museums so he could paint them correctly. Here Joseph sits as Pharaoh's chief officer. A scribe reads him the records of how much grain has been stored.

Look closely

- Find the scribe and his scroll. What do you think is written there?
- Find the grain on the floor. Why would someone bring grain to show Joseph?
- Look at the painted walls and Joseph's chair. What do they tell you about how important his job was?
- Find Joseph's staff. What does it show about his authority?

Talk about it

1. Joseph kept careful records of the grain. Why would writing it down matter in a plan that lasted fourteen years?
2. How is a family meal plan like Joseph's plan for Egypt? How is it different?
3. What foods in your kitchen keep a long time, the way grain keeps? What foods must be used quickly?

Safety first. An adult stands beside you at the stove: turn pot handles in, lower food into the broth with a ladle so it does not splash, and lift the lid away from your face. Cut raw chicken only on its own board (an adult may do this), wash up afterward, and cook the chicken to 165 °F. Cool leftovers in shallow containers and refrigerate within 2 hours.

KITCHEN PROJECT

Cook Once, Eat Twice: Soup and a Week's Plan

You will make a meal plan for one week with your family, then cook a big pot of chicken-and-rice soup planned to feed everyone twice. You will cool and store the leftovers safely and reheat them later in the week.

You will need

- A large soup pot (6 quarts or more) with a lid
- Two cutting boards (one for raw chicken), a small serrated or paring knife and a damp towel
- A ladle, a wooden spoon, two forks, tongs and a plate
- Measuring cups and spoons
- An instant-read thermometer
- Shallow storage containers with lids, masking tape and a marker

BIG-POT CHICKEN AND RICE SOUP

Serves 8–10 (two family dinners) · Prep 25 min · Cook 50 min

Ingredients

- 2 tablespoons olive oil
- 1 large onion, chopped
- 3 carrots, peeled and sliced into coins
- 3 stalks celery, sliced
- 3 cloves garlic, minced
- 10 cups (2.4 L) low-sodium chicken broth
- 2 pounds (900 g) boneless, skinless chicken breasts or thighs, left whole
- 1 teaspoon dried thyme and 1 bay leaf
- 1 cup (185 g) long-grain white rice (or 1¼ cups brown rice)
- 1½ cups frozen peas or chopped spinach
- 1 tablespoon lemon juice
- Salt and black pepper to taste, and chopped fresh parsley

Method

1. Wash your hands and the vegetables. With an adult beside you, chop the onion, carrots and celery into even pieces with the claw grip. An adult or you (with the adult beside you) minces the garlic.
2. With an adult beside you, heat the oil in the pot over medium heat. Add the onion, carrots and celery and cook, stirring, 6–8 minutes, until the onion is soft. Add the garlic and cook 1 minute.
3. Add the broth, thyme and bay leaf. Turn the heat up until it boils, then lower it to a simmer.
4. Using tongs, lower the whole chicken pieces gently into the broth. Wash your hands and the tongs. Cover and simmer 15–20 minutes, until the thickest piece reads 165 °F.
5. An adult lifts the chicken onto a clean plate. Stir the rice into the simmering soup and cook, partly covered, 15 minutes (brown rice 30 minutes), until tender.
6. When the chicken is cool enough to handle, shred it with two forks and return it to the pot with the peas. Simmer 3 minutes. Remove the bay leaf.
7. Stir in the lemon juice, then taste and add salt and pepper as needed. Sprinkle with parsley and serve.
8. Clean up: wash the raw-chicken board, the knife and the tongs in hot, soapy water, and wipe the stove when it has cooled.

Allergy check: Contains none of the nine major allergens. Some boxed broths contain soy or wheat; check the label. For a wheat-free meal, serve with rice crackers or corn tortillas instead of bread.

Steps

1. **Plan a day.** On paper, plan breakfast, lunch and dinner for one day with all five food groups. Use what is already in your kitchen as much as you can.
2. **Plan a week.** With a parent, fill in a 7-day dinner chart. Mark which night is the soup and which night is “soup again” (planned leftovers). Plan one more leftover meal, such as rice made into fried rice or roasted vegetables in a frittata.

3. Cook the soup, checking the chicken with the thermometer. Record the temperature.
4. **Cool it right.** After dinner, ladle the leftover soup into shallow containers no more than 2 inches deep. Label them with the name and date. Put them in the refrigerator within 2 hours. Record the time.
5. **Reheat it right.** On “soup again” night, with an adult beside you, bring the soup to a full boil (165 °F or more), adding a splash of water or broth because the rice will have soaked some up. Did the soup taste the same the second night? Better? Thicker?
6. **Taste test.** Rate the soup both nights from 1 to 5.
7. **Improve it.** Write one change for next time (more vegetables, noodles instead of rice, cooking the rice separately so it does not soak up the broth).
8. Clean up: wash and put away everything.

Tips

- Cut carrots, celery and onion about the same size so they cook evenly.
- Freeze some soup without the rice if you can; rice turns soft in the freezer.
- A soup pot holds heat for a long time. Never put the whole hot pot in the refrigerator; divide it into shallow containers.

Check your work

- ☐ I can retell how Joseph planned for the famine.
- ☐ I helped plan a week of balanced meals that uses leftovers.
- ☐ I cooked soup with an adult beside me, checked the chicken to 165 °F, and cooled and reheated the leftovers safely.

COOK'S NOTEBOOK

1. Copy your family's 7-day dinner plan and color-code each meal for the food groups it includes.
2. Draw a refrigerator with your labeled soup containers and write the three leftover rules: 2 hours, 3–4 days, 165 °F.
3. Write how Joseph's plan and your plan are alike.

From history. Families once kept root cellars, smokehouses and pantries full of canned and dried food to last through the winter, much as Joseph stored grain. During the World Wars, the U.S. government asked families to plan meals carefully and waste nothing so that more food could be sent to soldiers and to hungry people overseas.

COMMON MISTAKES

- Putting a big, deep pot of hot soup in the refrigerator. The middle stays warm in the danger zone for hours; use shallow containers.
- Keeping leftovers too long. Eat them within 3–4 days or freeze them.
- Shopping without a plan, then wasting food that spoils before it is used.

Make it a game · Seven Good Years. Tell the story of Joseph and the famine from Genesis 41, one sentence at a time with your parent. Then plan one day of balanced meals on paper and mark which food is a planned leftover. Pretend to store food in shallow containers. Your parent names a leftover and you tell how to reheat it safely.

Scripture. “And let them gather all the food of those good years that come, and lay up corn under the hand of Pharaoh, and let them keep food in the cities. And that food shall be for store to the land against the seven years of famine, which shall be in the land of Egypt; that the land perish not through the famine.” (Genesis 41:35-36, KJV)

In the King James Bible, “corn” means grain of any kind. Joseph’s wise plan saved many lives. Planning meals is a small way to be faithful with what God gives.

8.3 AT THE GROCERY STORE

OBJECTIVES

- Tell how Clarence Saunders opened Piggly Wiggly, the first self-service grocery store, in Memphis in 1916.
- Find and compare unit prices, write a shopping list, and stay within a budget.
- Cook a budget rice-and-beans dinner with an adult beside you and figure its cost per serving.

Warm-up. Find two sizes of the same food in your pantry (for example, a small and a large box of oatmeal or rice). Look at the weight on each. If your family paid twice as much for the big one, was it a better deal? How could you tell?

WATCH

Understanding Unit Price

Texas EFNEP • 6:28

https://www.youtube.com/watch?v=X_3ka4quxGQ

WHEN TO WATCH

After the story, before the store trip. Pause each time she finds a unit price on a shelf tag and say which item is the better buy.

Note: From the Expanded Food and Nutrition Education Program of Texas A&M AgriLife Extension, filmed in a grocery store.

BACKUP VIDEO

How Piggly Wiggly Created The First Modern Grocery Store | Southern Living

Southern Living • 1:28

<https://www.youtube.com/watch?v=nsd7U1l-1vY>

A short history of Piggly Wiggly with old photographs. Good to watch right after the story.

KEY TERMS

self-service

A store where customers take what they want from the shelves themselves instead of asking a clerk to get it.

unit price

The price for one unit, such as one ounce or one pound. Find it by dividing the price by the number of units.

budget

A plan for how much money you will spend.

cost per serving

The total cost of a recipe divided by the number of servings it makes.

store brand

A product sold under the grocery store's own name. It is often just as good and costs less.

CORE IDEAS

The story. Before 1916, shopping for groceries was slow. You handed your list to a clerk behind a counter, and the clerk walked around the store gathering each item, weighing out beans and sugar and wrapping them. If the store was busy, you waited. Clarence Saunders, a grocer in Memphis, Tennessee, had a new idea. On September 11, 1916, he opened a store called Piggly Wiggly. Shoppers walked in through a turnstile, picked up a basket, and walked down aisles where every item was on a shelf with its price clearly marked. They chose their own groceries and paid at a checkout counter on the way out.

How he figured it out. Saunders noticed that clerks spent most of their time fetching items, and that the cost was passed on to shoppers. If customers served themselves, the store needed fewer clerks and could sell for less. Clearly marked prices let shoppers compare for themselves. He also arranged the aisles so shoppers passed by every item in the store. People liked it so much that he received a patent for his “self-serving store” in 1917, and within a few years there were hundreds of Piggly Wiggly stores. Almost every grocery store today follows his plan.

The kitchen science. A smart shopper uses arithmetic. The **unit price** tells you which package is the better deal: divide the price by the amount. For example, a 16-ounce bag of rice for \$2.00 costs $\$2.00 \div 16 = \$0.125$, or about 12½ cents an ounce. A

32-ounce bag for \$3.20 costs $\$3.20 \div 32 = \$0.10$, or 10 cents an ounce, so the bigger bag is the better buy, if you will use it all before it goes stale. Most stores print the unit price in small type on the shelf tag. Other money-saving habits: shop with a list and a **budget**, eat before you shop (remember the reward system in Unit 6!), compare store brands, buy fruits and vegetables in season, and choose low-cost, nutrient-rich foods like beans, rice, oats, eggs, frozen vegetables, carrots, cabbage, potatoes and bananas.

Let's cook. You will cook a skillet of black beans and rice, a dish eaten in many lands for its good taste, low cost and strong nourishment. Beans and rice together make a satisfying meal with protein and fiber. The skills to do well are cooking rice with the lid on and no peeking, sautéing vegetables in a thin film of oil with an adult beside you, and figuring the **cost per serving**.

PICTURE STUDY



The Original Piggly Wiggly Store, Memphis, Photograph published by Clarence Saunders, 1918 · Black-and-white photograph · Memphis, Tennessee

Image: [Wikimedia Commons](#), public domain

This photograph shows the inside of the first Piggly Wiggly store in Memphis in 1918, two years after it opened. It was taken to show people this strange new way of shopping.

Look closely

- Find the white turnstile and railings. Which way do shoppers go in, and which way out?
- Find the cash register at the checkout. Why is it in the middle?
- Look at the shoppers. Are they waiting for a clerk or helping themselves?
- Look at the shelves. How is this store like the grocery store where your family shops? How is it different?

Talk about it

1. Why would letting shoppers serve themselves make groceries cost less?
2. With prices marked on every item, how could a shopper in 1918 compare prices?
3. What do you think shoppers in 1918 said the first time they saw this store?

Safety first. At the store, stay with your parent, and keep raw meat in a separate bag from fresh fruits and vegetables. Bring cold foods home and into the refrigerator within 2 hours. In the kitchen, an adult stands beside you at the stove; lift the rice lid away from your face because of the steam.

KITCHEN PROJECT

Unit Prices and a Budget Dinner

You will compare unit prices at a real store or online, write a shopping list for a family dinner with a budget, cook a skillet of black beans and rice, and figure out how much each serving cost.

You will need

- A notebook, a pencil and a calculator
- Your family's grocery receipt for the ingredients (or the store's website for prices)
- A medium saucepan with a tight lid
- A large skillet, a wooden spoon, a cutting board, a small serrated or paring knife and a damp towel
- A colander and a can opener
- Measuring cups and spoons

SKILLET BLACK BEANS AND RICE

Serves 6 • Prep 15 min • Cook 25 min

Ingredients

- 1½ cups (280 g) long-grain white rice
- 3 cups (710 mL) water and ½ teaspoon salt for the rice
- 1 tablespoon vegetable or olive oil
- 1 medium onion, chopped
- 1 green or red bell pepper, chopped
- 2 cloves garlic, minced
- 2 cans (15 oz / 425 g each) black beans, drained and rinsed
- 1 can (14.5 oz / 411 g) diced tomatoes, with their juice
- 1½ teaspoons ground cumin
- 1 teaspoon chili powder
- ½ teaspoon dried oregano

- Salt and pepper to taste
- **Toppings (optional):** grated cheese, plain yogurt or sour cream, salsa, chopped cilantro and lime wedges

Method

1. Wash your hands. Rinse the rice in a strainer under cold water until the water runs mostly clear.
2. With an adult beside you, bring the water and salt to a boil in the saucepan. Stir in the rice, cover with the lid, and turn the heat to low. Cook 18 minutes without lifting the lid. Turn off the heat and let it stand, covered, 5 minutes.
3. Meanwhile, with an adult beside you, chop the onion and pepper with the claw grip.
4. Heat the oil in the skillet over medium heat. Add the onion and pepper and cook, stirring, 5–6 minutes, until soft. Add the garlic, cumin, chili powder and oregano and stir 1 minute until fragrant.
5. Add the beans and the tomatoes with their juice. Simmer 8–10 minutes, stirring now and then, until slightly thickened. Taste and add salt and pepper.
6. Fluff the rice with a fork. Serve the beans over the rice with toppings.
7. Clean up: rinse the cans for recycling, wash the pans and tools, and wipe the counter.

Allergy check: The beans and rice contain none of the nine major allergens. The optional cheese, yogurt and sour cream contain milk; leave them out or use avocado instead.

Steps

1. **Unit-price hunt.** At the store with a parent (or on the store's website), find two sizes of rice, two brands of canned beans, and two sizes of oats. Write each price and amount, divide to find the unit price, and circle the better buy. Check your answer against the shelf tag.
2. **List and budget.** Write a shopping list for the recipe, grouped by store section (produce, canned goods, grains, dairy). Your parent gives you a budget. Keep a running total as you shop.
3. Cook the recipe.

4. **Cost per serving.** Using the receipt, figure what each ingredient cost *for the amount you used* (for example, half a bag of rice is half its price). Add them up for the total, then divide by 6. Write it like this: total cost $\div$ 6 servings = cost per serving.
5. **Taste test.** Rate the dinner from 1 to 5 with your family. Was it worth the cost? What would make it even better?
6. **Improve it.** Find one way to make the meal cost less (dried beans instead of canned, store-brand tomatoes) and one way to add more vegetables. Write both.
7. Clean up: put away the groceries, cold foods first.

Tips

- Dried beans cost much less than canned. Soak them overnight and simmer until tender; one pound of dried beans makes about as much as four cans.
- Do not lift the lid while rice cooks. The steam is doing the cooking.
- Leftover beans and rice make good burritos the next day.

Check your work

- ☐ I can tell how Piggly Wiggly changed the way we shop.
- ☐ I can find a unit price by dividing the price by the amount, and choose the better buy.
- ☐ I cooked a budget dinner with an adult beside me and figured the cost per serving.

COOK'S NOTEBOOK

1. Make a unit-price table from your store hunt: item, price, amount, unit price, better buy.
2. Show your cost-per-serving math for the beans and rice, step by step.
3. Draw a map of your family's grocery store and number the sections in the order of your shopping list.

From history. Clarence Saunders also tried to build a fully automatic store called the Keedoozle in the 1930s and 1940s, where shoppers used a key to choose items from glass cases and a machine delivered them. It did not catch on. His Memphis mansion, built of pink marble, later became part of the city's Museum of Science and History, which displays a model of the first Piggly Wiggly.

COMMON MISTAKES

- Thinking the bigger package is always cheaper. Check the unit price; sometimes it is not, and sometimes food spoils before you use it.
- Shopping hungry or without a list, and coming home with snacks you did not plan.
- Forgetting the cost of small things like oil and spices. They add up too, though by only a little per serving.

Make it a game • Unit Price Showdown. Pick two versions of the same food from the cupboard. Divide the price by the amount to find the unit price, then compare. Your parent picks a second pair and you race. Write a shopping list for a dinner within a pretend budget. Then tell how Clarence Saunders opened the first self-service grocery store in 1916.

Scripture. “For which of you, intending to build a tower, sitteth not down first, and counteth the cost, whether he have sufficient to finish it?” (Luke 14:28, KJV)

Jesus said a wise builder counts the cost before he starts. A wise cook does too, with a list, a budget and a plan.

8.4 THE FAMILY FEAST

OBJECTIVES

- Plan a balanced three-part feast menu using dishes from this year, with a grocery list, a budget and a timeline.
- Cook the feast with an adult, setting the table and serving with hospitality, as Abraham welcomed his guests.
- Lead or join in a grace before the meal, and give thanks to God and to those who helped.

Warm-up. Look back through your cook's notebook from the whole year. Which three recipes did your family like best? Which skill are you proudest of? Make a short list of dishes you could make for a feast.

WATCH

How to Set a Table - Life Skills with Griffin Churchill

[GriffinsLifeSkills](https://www.youtube.com/watch?v=hpKYnvcx1Ao) · 1:51

<https://www.youtube.com/watch?v=hpKYnvcx1Ao>

WHEN TO WATCH

Before you set your table. A 9-year-old boy shows how to set a simple family table. See if you can set yours faster and just as neatly.

Note: A small channel, chosen because a child shows an everyday family table setting clearly and simply.

KEY TERMS

hospitality

Welcoming guests and taking care of them with kindness, food and a place at the table.

menu

The list of dishes to be served at a meal.

timeline

A schedule that works backward from the time you will eat, showing when to start each dish.

place setting

The plate, napkin, fork, knife, spoon and glass set at each person's seat.

grace

A short prayer of thanks to God before (or after) a meal.

CORE IDEAS

The story. One hot afternoon, Abraham sat at the door of his tent by the oaks of Mamre. He looked up and saw three men standing nearby. He ran to meet them, bowed, and begged them to rest in the shade while he brought them a little bread. Then he hurried into the tent and told Sarah to quickly bake cakes from fine flour. He ran to the herd, chose a tender calf, and gave it to a young man to prepare. He set butter, milk and the meat before his guests, and stood by them under the tree while they ate (Genesis 18:1-8). The guests were messengers of the Lord, bringing the news that Sarah would have a son.

How he did it. Notice how Abraham served: he *hurried*, he gave his *best*, he worked *together* with his household, and he *stayed with* his guests while they ate. The New Testament reminds Christians not to forget to welcome strangers, “for thereby some have entertained angels unawares.” In 1740 the French painter Jean-Siméon Chardin painted a mother setting soup on the table while her little child folds small hands to say grace before eating. Feasts and family meals are a gift from God, and the table is a place for thanks, kindness and conversation.

The kitchen science. A feast takes everything you learned this year. **Plan** a balanced menu with all five food groups. **Choose** dishes that do not all need the oven or stove at the same moment. **Shop** with a list and a budget. **Work backward** from dinnertime to make a timeline: the crisp bakes while the chicken rests; the rolls were made and frozen ahead. **Keep food safe:** chicken to 165 °F, separate boards, and leftovers in the refrigerator within 2 hours. **Measure** level, **taste and adjust**, and **clean as you go**, so the kitchen is not a mountain of dishes when the meal is over.

Let's cook. You will plan and cook a family feast with an adult beside you at the oven and stove. A model menu is below: herb-roasted chicken, roasted vegetables, dinner

rolls from Lesson 5.4, a green salad with your vinaigrette from Lesson 5.2, and an apple crisp. You may change it to your family's favorites. The skills to do well are **following a timeline, working as a team, and serving others first.**

PICTURE STUDY



Saying Grace (Le Bénédicité), Jean-Siméon Chardin, 1740 · Oil on canvas · Musée du Louvre, Paris

Image: [Wikimedia Commons](#), public domain

Jean-Siméon Chardin painted quiet scenes of ordinary French homes. In this one, a mother is serving the midday meal. Before anyone eats, the youngest child must say grace, and the mother waits patiently, listening. Chardin showed this painting at the Salon in Paris in 1740 and presented it to King Louis XV.

Look closely

- Find the youngest child. What are the child's hands doing?
- Find the mother. What is she carrying to the table, and why has she paused?
- Find the older girl. How is she waiting?
- Find the small stove on the floor and the toy drum on the chair. What do they tell you about this family's home?

Talk about it

1. Why do you think the mother waits for the little one to finish before she serves?
2. What is set on the table? Is it a fancy feast or a simple meal? Can a simple meal be a feast?
3. What grace will your family say at your feast?

Safety first. An adult is beside you for every oven and stove step and for carving the chicken. Use separate boards for raw chicken, cook it to 165 °F, and wash hands and tools afterward. Refrigerate leftovers within 2 hours, and check the menu against every guest's food allergies before you plan.

KITCHEN PROJECT

Plan, Cook and Serve the Family Feast

This is your final project. You will plan a menu, a grocery list with a budget, and a timeline; shop with a parent; cook the feast with an adult; set the table; welcome your family; and give thanks.

You will need

- Your cook's notebook and a pencil
- A large rimmed baking sheet or roasting pan, and a second rimmed baking sheet for vegetables
- An 8 × 8-inch or 9 × 9-inch baking dish for the crisp
- Two cutting boards (one for raw chicken), knives, measuring cups and spoons, bowls
- An instant-read thermometer, oven mitts and trivets
- A tablecloth or placemats, plates, napkins, cutlery, glasses, and a few flowers or a candle for the table (with an adult)

MODEL FAMILY FEAST MENU: HERB-ROASTED CHICKEN, ROASTED VEGETABLES AND APPLE CRISP (WITH ROLLS AND SALAD)

Serves 6 • Prep 1 hr • Cook about 1 hr 15 min (dishes overlap)

Ingredients

- **Herb-roasted chicken:** 3½–4 pounds (1.6–1.8 kg) bone-in chicken thighs and drumsticks
- 2 tablespoons olive oil, 1 teaspoon salt, ½ teaspoon pepper, 1 teaspoon garlic powder, 1 teaspoon dried thyme and 1 teaspoon dried rosemary (or 1 tablespoon each fresh, chopped)
- 1 lemon, cut into wedges
- **Roasted vegetables:** 1½ pounds (680 g) small potatoes, halved
- 4 carrots, cut into 2-inch sticks
- 1 red onion, cut into wedges

- 2 tablespoons olive oil, $\frac{3}{4}$ teaspoon salt and $\frac{1}{4}$ teaspoon pepper
- **Apple crisp:** 6 medium apples (about 6 cups sliced), 2 tablespoons sugar, 1 teaspoon cinnamon and 1 tablespoon lemon juice
- **Topping:** $\frac{3}{4}$ cup (70 g) old-fashioned oats, $\frac{1}{2}$ cup (65 g) all-purpose flour, $\frac{1}{2}$ cup (100 g) packed brown sugar, $\frac{1}{2}$ teaspoon cinnamon, a pinch of salt and 6 tablespoons (85 g) cold butter, cut into small pieces
- **Also:** Easy Soft Dinner Rolls (Lesson 5.4), baked ahead and warmed
- Garden salad with honey-mustard vinaigrette (Lesson 5.2)

Method

1. **The day before:** Shop with your parent. Bake the rolls (or thaw frozen ones). Make the vinaigrette. Wash the salad greens and roll them in a towel in the refrigerator.
2. **2 hours before dinner:** Wash your hands. Peel and slice the apples with an adult beside you, toss them with sugar, cinnamon and lemon juice, and spread them in the baking dish. Rub the butter into the oats, flour, brown sugar, cinnamon and salt with your fingertips until crumbly, and sprinkle it over the apples. Refrigerate.
3. **1½ hours before:** An adult heats the oven to 425 °F (220 °C). Cut the vegetables with the claw and bridge grips, with an adult beside you. Toss them with oil, salt and pepper on a baking sheet.
4. **1 hour 15 minutes before:** Pat the chicken dry. Rub it with oil, salt, pepper, garlic powder and herbs, and arrange it skin side up on the other pan with the lemon wedges. Wash your hands, the board and the tools. With an adult beside you, put the chicken and vegetables in the oven.
5. **35–45 minutes later:** Stir the vegetables halfway through. With an adult, check the thickest pieces of chicken: they must read 165 °F (thighs are even better at 175–185 °F). When done, take out the chicken and let it rest. Turn the oven down to 375 °F (190 °C).
6. **45 minutes before dessert:** Put the crisp in the oven and bake 35–40 minutes, until bubbling and golden. It can bake during dinner. Warm the rolls in the oven for the last 5 minutes before dinner, wrapped in foil.

7. Just before dinner: Toss the salad with dressing. Set everything on the table. Gather the family, say grace, and serve your guests first.

8. After dinner: Serve the warm crisp. Put leftovers in shallow containers in the refrigerator within 2 hours. Wash up together.

Allergy check: Chicken and vegetables: none of the nine major allergens. Apple crisp contains wheat and milk (use a gluten-free flour blend and certified gluten-free oats, and a plant-based butter or coconut oil, to avoid them). Rolls contain wheat, milk and eggs. Salad dressing: see Lesson 5.2. Check every dish against every guest's allergies.

Steps

- 1. Plan the menu.** Choose a main dish, one or two vegetables or a salad, a grain or bread, and a dessert, using recipes from this year. Check that all five food groups are at the table (milk with the meal counts for dairy).
- 2. List and budget.** Write the grocery list by store section, estimate the cost with your parent, and keep the receipt. Figure the cost per person.
- 3. Timeline.** Write a timeline working backward from dinnertime, like the one in the recipe. Post it on the refrigerator.
- 4. Cook.** Follow your timeline with an adult beside you. Check off each step as you finish. Clean as you go.
- 5. Set the table.** Set a place for each person: plate in the center, napkin and fork on the left, knife (blade facing the plate) and spoon on the right, glass above the knife. Add something beautiful: flowers, a candle (with an adult) or a handwritten place card.
- 6. Serve and give thanks.** Welcome your family to the table. Lead or join in a grace. Serve others before yourself. Ask each person to tell one thing they are thankful for.
- 7. Rate and reflect.** After the meal, ask each person to rate one dish. Write what went well, what you would change, and what you learned this year as a cook.
- 8. Clean up together:** food stored safely, dishes washed, counters wiped, table cleared.

Tips

- Choose at least one dish you can make ahead. It makes the feast day much calmer.

- Bone-in chicken thighs and drumsticks are easier to roast well than a whole bird, and they stay juicy.
- Ask a brother or sister to be your kitchen helper and give them a job they can do well.

Check your work

- ☐ I planned a balanced menu with a grocery list, a budget and a timeline.
- ☐ I cooked a feast with an adult beside me, kept the food safe, and cleaned as I went.
- ☐ I set the table, served my family with hospitality, and gave thanks.

COOK'S NOTEBOOK

1. Write your feast menu neatly, like a menu card, with a small drawing of each dish.
2. Draw a place setting from above and label each piece.
3. Write a letter to yourself about this year in the kitchen: your favorite recipe, your hardest lesson, and what you want to learn to cook next.

From history. In many Christian homes, a short grace is said before meals. A well-known grace is a simple one: “Bless us, O Lord, and these thy gifts, which we are about to receive from thy bounty.” Many families also sing the Doxology, “Praise God, from whom all blessings flow,” written by the English bishop Thomas Ken in the 1670s.

COMMON MISTAKES

- Planning a menu where every dish needs the oven at a different temperature at the same time. Check your timeline.
- Leaving all the washing up for the end. Clean as you go.
- Being so busy in the kitchen that you forget the guests. The meal is for the people; sit down and enjoy them.

Make it a game • Hospitality Plan. Plan a three-part feast on paper: a main dish, a side, and a dessert, with a grocery list, a pretend budget and a timeline. Set a table with a place setting and explain where each item goes. Your parent plays a guest who arrives early, and you welcome them as Abraham welcomed his guests.

Scripture. “And Abraham hastened into the tent unto Sarah, and said, Make ready quickly three measures of fine meal, knead it, and make cakes upon the hearth. And Abraham ran unto the herd, and fetcht a calf tender and good, and gave it unto a young man; and he hasted to dress it. And he took butter, and milk, and the calf which he had dressed, and set it before them; and he stood by them under the tree, and they did eat.” (Genesis 18:6-8, KJV)

Abraham gave his guests his best, quickly and gladly, and stayed with them while they ate. That is the heart of hospitality, and of a family feast.

UNIT 8

MEAL PLANNING & THE FAMILY TABLE

A good cook does more than follow a recipe. She reads it carefully, measures exactly, plans ahead, shops wisely and wastes nothing. In this unit you will meet Fannie Farmer, the Boston teacher who taught America to measure with level cups and spoons, and you will double a muffin recipe. You will learn from Joseph, who planned for seven years of famine, how to plan meals for a week and turn one big pot of soup into two dinners. You will walk into the first self-service grocery store, Piggly Wiggly, and learn to compare unit prices and keep to a budget.

Everything you have learned this year comes together in the last lesson: **the family feast**. Like Abraham, who hurried to welcome three guests with fresh bread and a good meal, you will plan a balanced menu, shop with a parent, cook several dishes with an adult beside you, set the table, and gather your family to give thanks. Food is God's good gift, and the table is where we share it.

PREREQUISITES

- Can measure with cups, spoons and a scale (Units 1–7)
- Knows how to build a balanced plate with the five food groups (Unit 2)
- Knows the 2-hour rule and safe temperatures for leftovers (Unit 1)
- Can read a Nutrition Facts label (Unit 6)

MASTERY CHECKLIST

- ☐ I can read a recipe all the way through before I start, measure with level cups and spoons, and double or halve a recipe.
- ☐ I can plan balanced meals for a day and a week, using leftovers wisely and safely.
- ☐ I can write a shopping list, find the unit price of a food, and figure the cost per serving of a meal.
- ☐ I can set a family table, serve guests with hospitality, and lead or join in a grace before the meal.
- ☐ I can plan, shop for and cook a family feast with an adult, on a timeline.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- ***The Boston Cooking-School Cook Book* by Fannie Merritt Farmer (1896), free at Project Gutenberg:** Free to read online. Look at her chapter on measuring and her tables of weights and measures for Lesson 8.1. Some old recipes use ingredients this course leaves out, so families may want to read it together.
- **MyPlate Kitchen (USDA):** Free. Search “MyPlate Kitchen” for the USDA’s collection of budget-friendly recipes and its meal-planning and shopping-list tools. Useful for Lessons 8.2–8.4.
- **A simple calculator and a notebook for the grocery store:** For comparing unit prices and keeping a running total while you shop in Lesson 8.3 and the unit challenge.

Not required. Every recipe in this unit works in an ordinary home kitchen.

School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

8.1 Fannie Farmer and the Level Cup	2 sessions of 45–60 minutes
8.2 Joseph Plans for the Famine	2 sessions of 45–60 minutes
8.3 At the Grocery Store	2 sessions of 45–60 minutes
8.4 The Family Feast	2 sessions of 60–90 minutes

UNIT 8 REVIEW

Answer each question. Show your work for calculations and use complete sentences for explanations. The review is worth 50 points.

1. 5 pts

What did Fannie Farmer change about recipes, and why did it matter?

2. 5 pts

Predict: you scoop flour straight from the bag and pack it into the cup for a muffin recipe. What will happen to the muffins?

3. (5 pts)

Double these amounts: $\frac{3}{4}$ cup sugar, $1\frac{1}{2}$ teaspoons baking powder, $\frac{1}{3}$ cup oil.
Then halve 1 cup flour.

4. (5 pts)

How did Joseph plan for the famine, and how is a family meal plan like his?

5. (5 pts)

Give the three rules for safe leftovers.

6. (5 pts)

What did Clarence Saunders invent in 1916, and why did it lower prices?

7. (5 pts)

A 24-ounce jar of peanut butter costs \$4.80. A 16-ounce jar costs \$3.52. Find each unit price. Which is the better buy?

8. (5 pts)

A pot of soup costs \$10.80 to make and serves 8. What is the cost per serving?

9. (5 pts)

Describe a simple place setting.

10. (5 pts)

Name three ways Abraham showed hospitality to his guests in Genesis 18.

ANSWER KEY

1. She insisted on standard measuring cups and spoons and level measurements, instead of vague amounts like “a teacup” or “butter the size of an egg.” It meant a recipe would turn out the same in any kitchen, so anyone could learn to cook it.
2. They will have too much flour (as much as a quarter more), so they will be dry, dense or tough. Spoon and level the flour, or weigh it.
3. $1\frac{1}{2}$ cups sugar; 3 teaspoons (1 tablespoon) baking powder; $\frac{2}{3}$ cup oil. Half of 1 cup flour is $\frac{1}{2}$ cup.
4. In the seven good years he gathered a fifth of the harvest and stored it in the cities, keeping records, so there was food in the seven years of famine. A meal plan also prepares ahead, uses food wisely, avoids waste and cares for people.
5. Refrigerate within 2 hours (1 hour above 90°F), in shallow containers; eat within 3–4 days or freeze; reheat to 165°F .
6. Piggly Wiggly, the first self-service grocery store, in Memphis. Shoppers took items from the shelves themselves, so the store needed fewer clerks to fetch things, and prices were marked so shoppers could compare.
7. $\$4.80 \div 24 = \$0.20$ per ounce. $\$3.52 \div 16 = \$0.22$ per ounce. The 24-ounce jar is the better buy.
8. $\$10.80 \div 8 = \$1.35$ per serving.
9. Plate in the center; napkin and fork on the left; knife (blade facing the plate) and spoon on the right; glass above the knife.
10. Any three: he ran to meet them and bowed; he invited them to rest in the shade; he hurried to have bread baked and a meal prepared; he gave them his best (a tender calf, butter and milk); he served them himself and stood by them while they ate.

UNIT CHALLENGE: THE FAMILY FEAST

Plan, shop for, cook and serve a family feast with an adult, as in Lesson 8.4. Include at least three dishes from this year and all five food groups.

Put together a feast folder: the menu card, the grocery list with the budget and the receipt total, the cost per person, the timeline with each step checked off, a photo or drawing of the table, and a thank-you note or a written grace. Finish with a one-page reflection on what you learned this year as a cook and what you want to learn next.

LOOK FOR	WHAT IT MEANS
Planning	A balanced menu with all five food groups, a grocery list grouped by store section, a budget and a realistic timeline.
Cooking and safety	Dishes cooked with an adult beside you; raw meat kept separate; temperatures checked and recorded; leftovers stored within 2 hours.
Table and hospitality	Table set neatly, guests welcomed and served first, grace said or sung.
Cleanup and teamwork	Cleaned as you went, worked kindly with helpers, and finished with a clean kitchen.
Reflection	An honest look back at the feast and the year, with family ratings and one goal for next year.