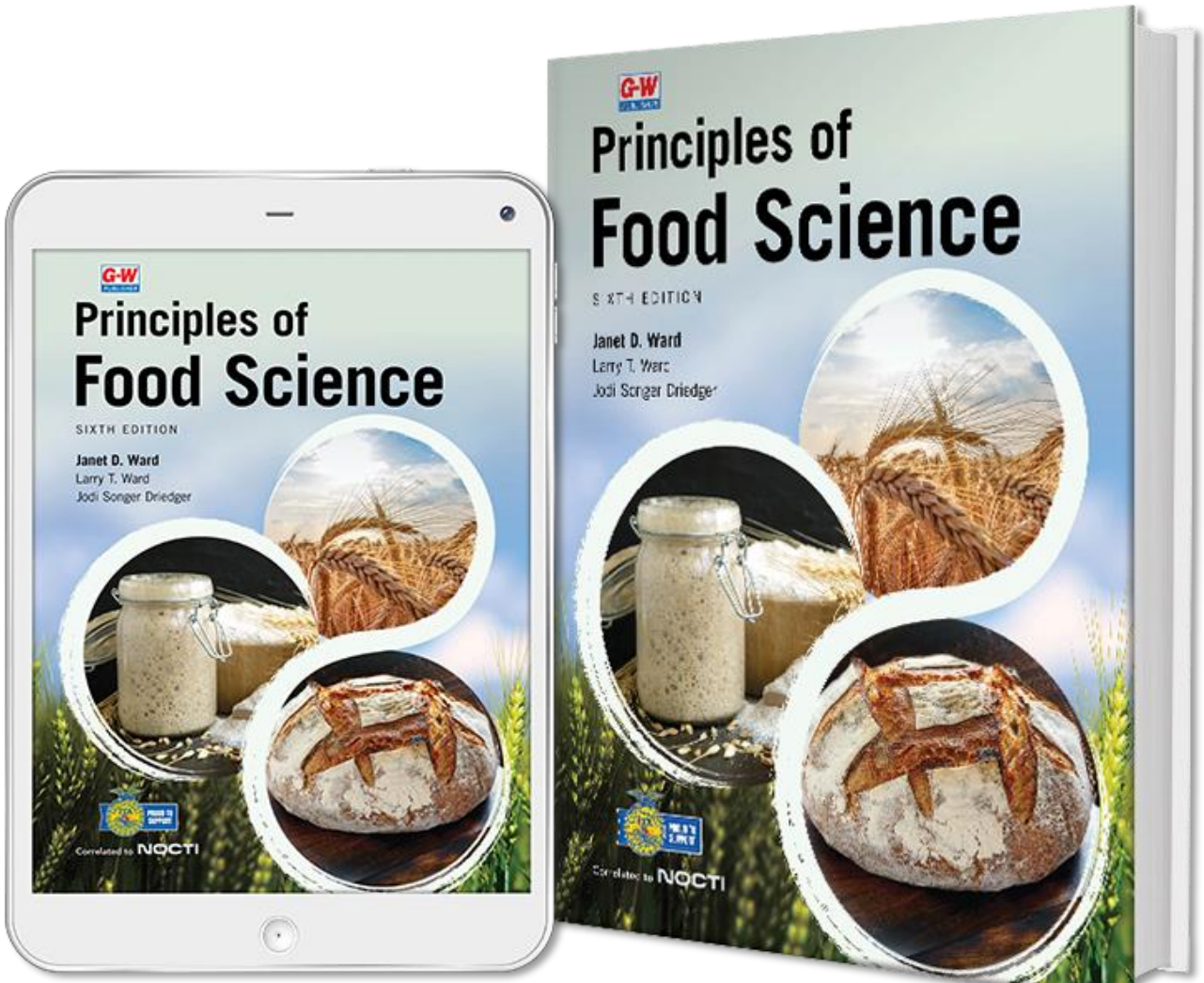

Principles of Food Science

Designed by Educators, Built for Educators

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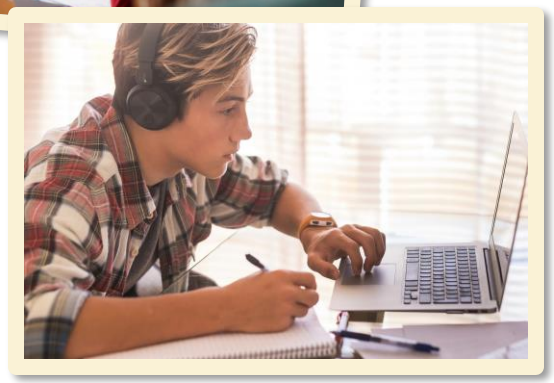
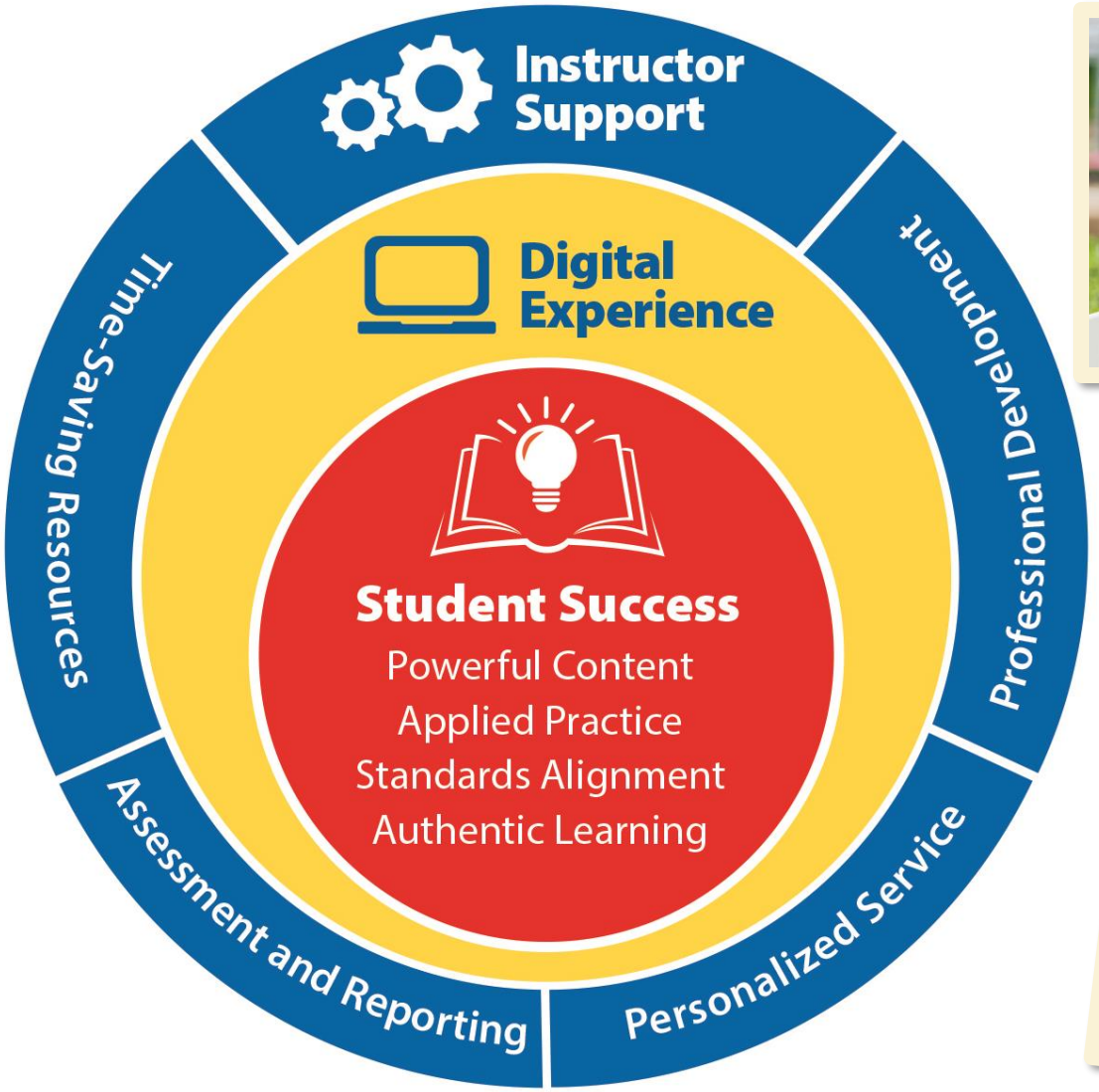




Aligned to Standards: Student Success Is At the Heart of What We Do

Principles of Food Science: Lesson Plan

Instructor: *Date:*
Course: *Unit:*

Chapter 1: Food Science: An Old but New Subject

Learning Outcomes

- 1.1 define what food science involves.
- 1.2 describe the three periods in the development of foods.
- 1.3 summarize how food products and processing methods have changed due to contributions of food scientists.
- 1.4 analyze how studying food science now can benefit you in the future.

Support Reading and Language Acquisition: Reading these outcomes aloud can aid in phonics and phonemic awareness.

Standards

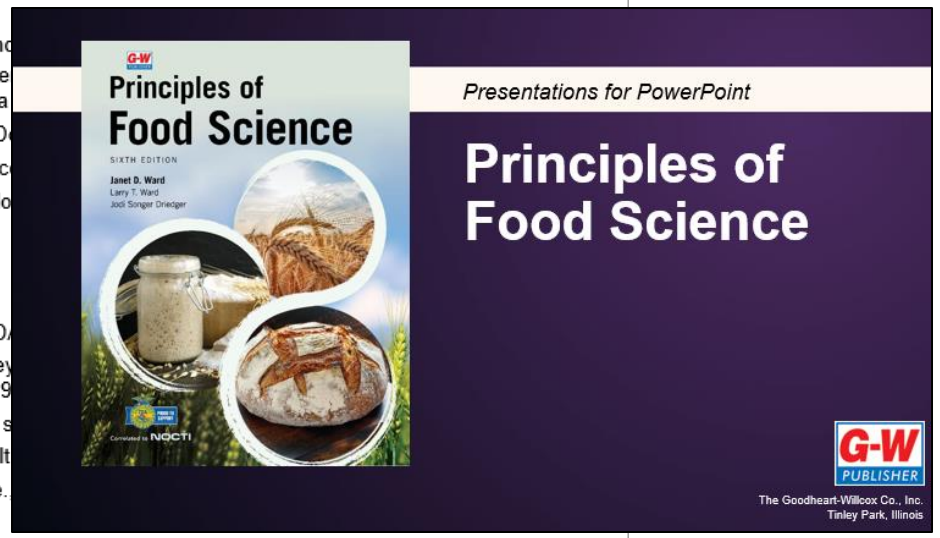
The following National Standards for Food Science, Dietetics, and Nutrition are addressed in this chapter:

- 9.1: Explain the roles and functions of individuals engaged in food science, food technology, dietetics, and nutrition careers.
- 9.1.4: Analyze the correlation between food science, dietetics, and nutrition occupations and local, state, national, and global economies.
- 9.6.3: Apply standards for food quality and
- 9.6.9: Utilize Food Code Points of time, te
  washing, and personal hygiene as criteria

This chapter meets the following Pre-PAC D

- 1.A.1: Definition and scope of food scienc
- 1.B.1: Jobs/careers that require a bachelo
- 1.C.1: Food scientists
- 2.B.1: The Food Code
- 2.B.2: HACCP
- 2.D.1: Government agencies, such as FD
- 2.D.2: Federal laws including, the Delaney
  and the Federal Meat Inspection Act of 19
- 6.B.5: Role of governmental regulations, s
- 6.D.2: Impact of food science on the healt
- 6.D.3: Recent/emerging technologies (i.e.

Key Terms



Lesson Plans, PowerPoint Presentations, and Answer Keys

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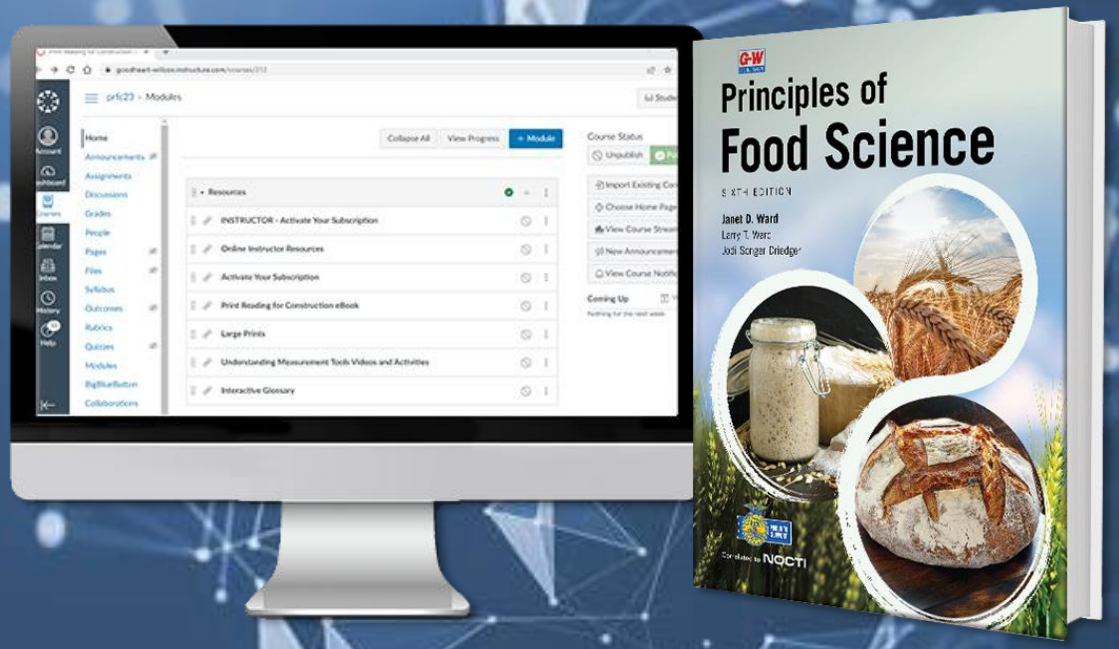

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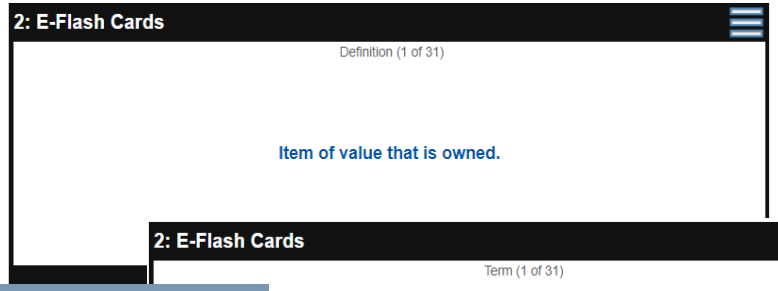
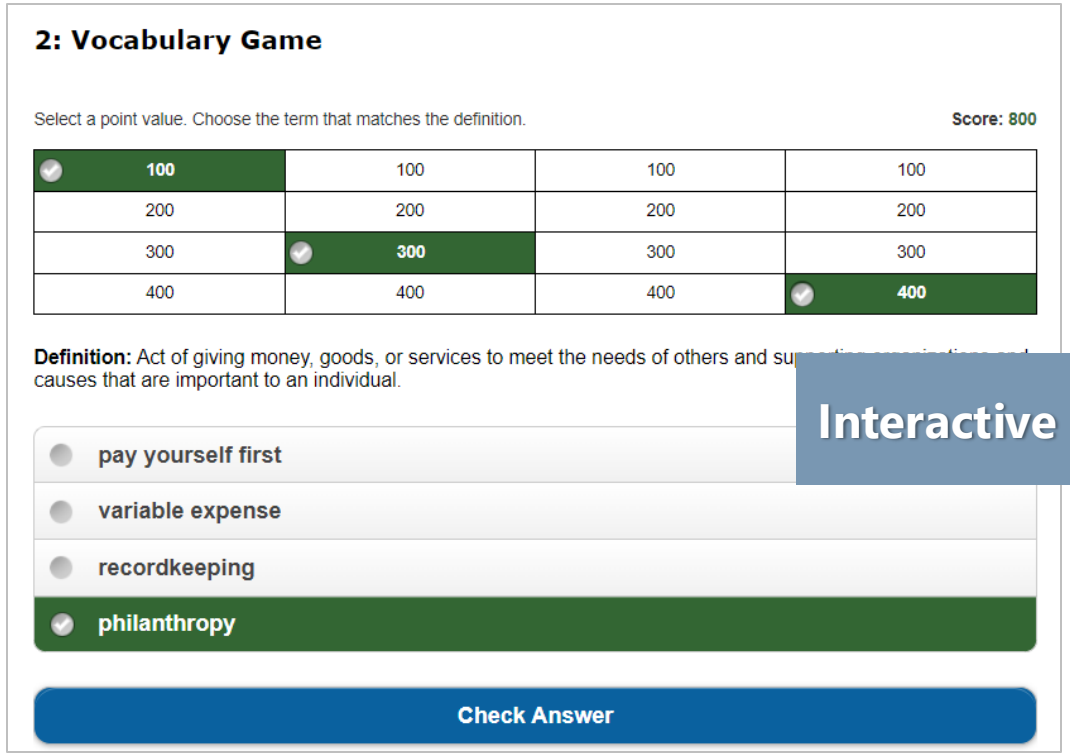
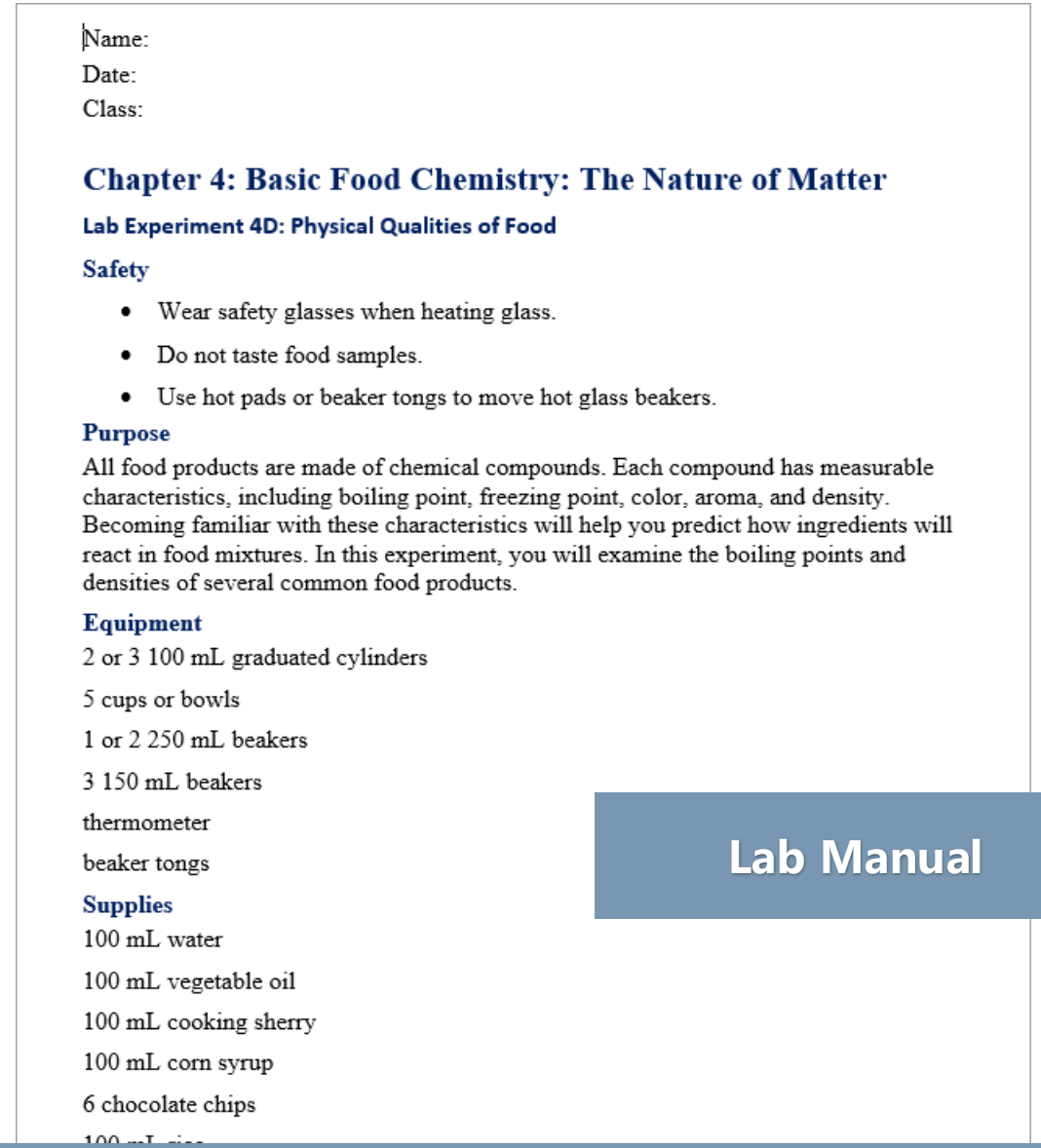


E-Flash Cards & Vocabulary Practice



Interactive Activities



Name:
Date:
Class:

Chapter 4: Basic Food Chemistry: The Nature of Matter

Lab Experiment 4D: Physical Qualities of Food

Safety

- Wear safety glasses when heating glass.
- Do not taste food samples.
- Use hot pads or beaker tongs to move hot glass beakers.

Purpose

All food products are made of chemical compounds. Each compound has measurable characteristics, including boiling point, freezing point, color, aroma, and density. Becoming familiar with these characteristics will help you predict how ingredients will react in food mixtures. In this experiment, you will examine the boiling points and densities of several common food products.

Equipment

2 or 3 100 mL graduated cylinders

5 cups or bowls

1 or 2 250 mL beakers

3 150 mL beakers

thermometer

beaker tongs

Supplies

100 mL water

100 mL vegetable oil

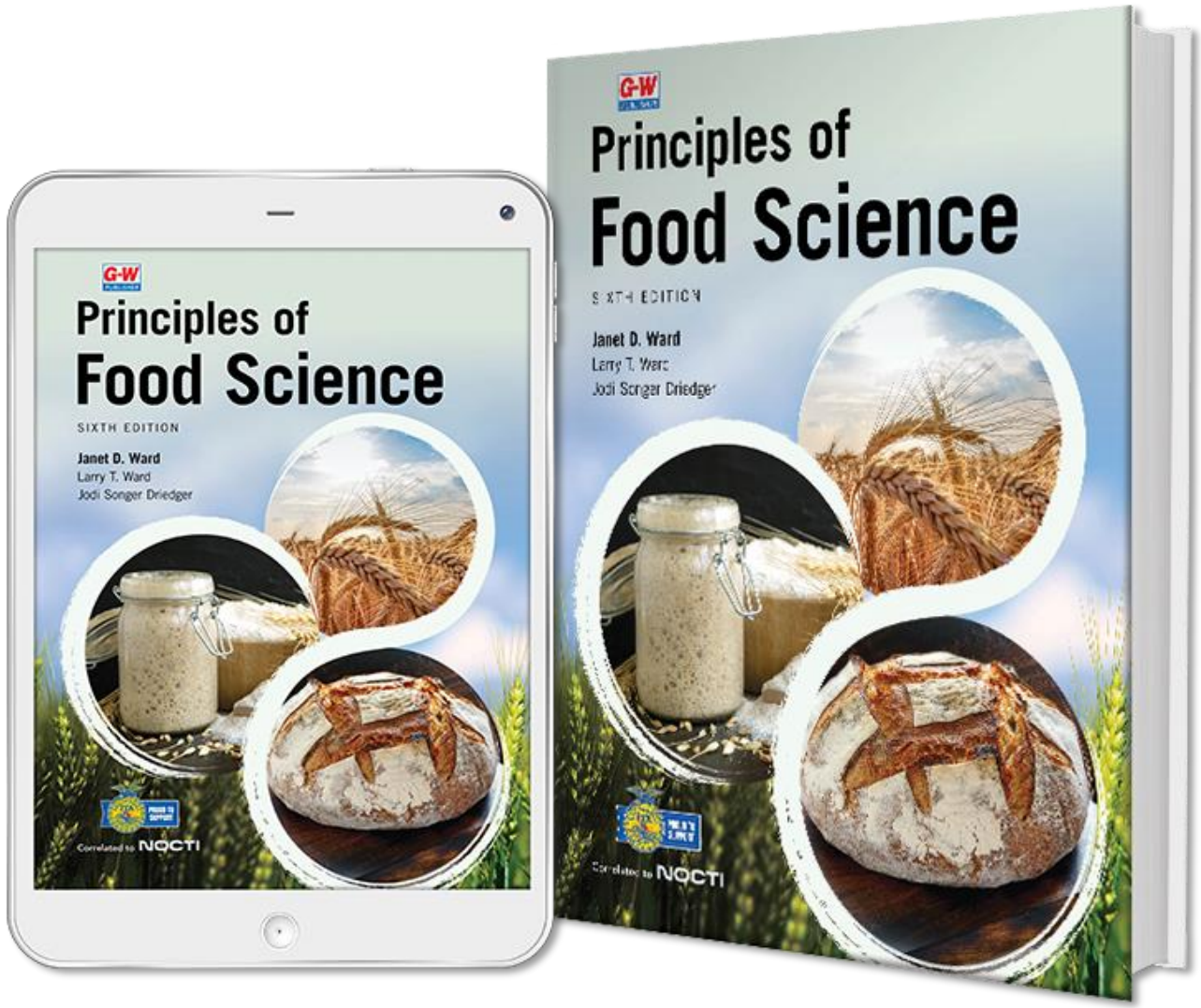
100 mL cooking sherry

100 mL corn syrup

6 chocolate chips

Lab Manual

Integrate G-W Digital Resources



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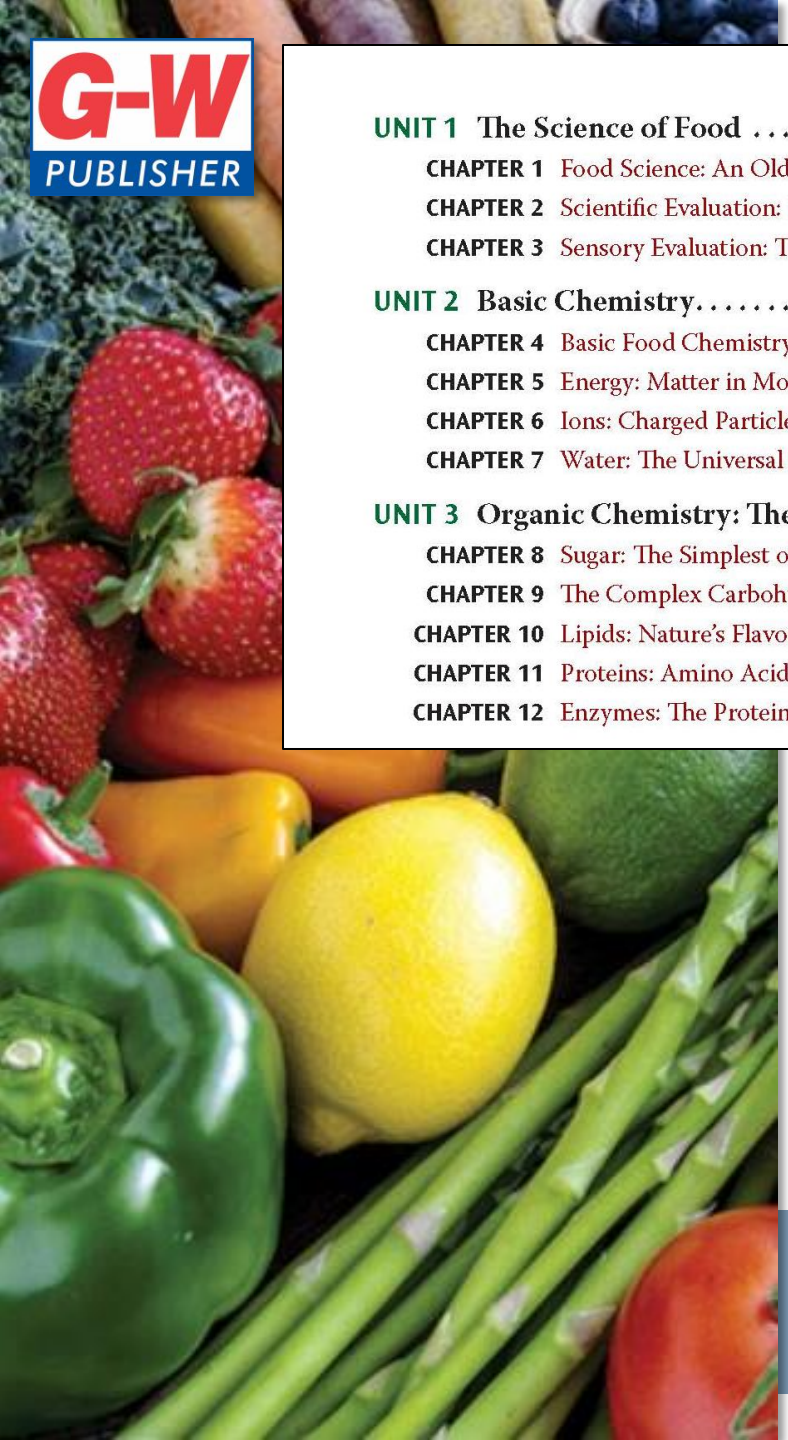
by Janet D. Ward, Larry Ward, & Jodi Songer Riedel



Student Textbook

UNIT 1

The Science of Food

Introduction

Food science is a rapidly changing field. It has grown along with the world's demands for safe, tasty, nutritious, convenient, mass-produced food. Food science applies basic principles of chemistry, physics, and biology to the processing and storage of food.

As you begin your study of food science, Chapter 1 traces some of the history of this field. You will explore recent contributions of food scientists and consider the benefits of this course of study.

Science involves experimentation, and experiments require measurements. Chapter 2 explores the types of measurements used in food science and the basic equipment you will work with in the lab. You will examine how the scientific method is applied in food science labs. You will also learn safe and proper laboratory procedures.

Chapter 3 explores how food scientists measure the human response to food. Considering what people like and dislike is an important factor in developing new food products. Measuring human preferences is a type of scientific evaluation that is unique to food science.

science photo/Shutterstock.com

Under the Microscope • • • • • • • • • • • • • Careers in Food Science

Flavor Chemist

Have you ever thought about the chemistry behind all the different flavors of food you enjoy? Many of the foods and beverages you eat result from the knowledge and rigorous testing of a *flavor chemist*, or flavorist. Not only do flavor chemists combine flavors to create better-tasting food products, some actually develop flavors for medications and such products as toothpaste and chewable vitamins.

The range of skills and knowledge this career requires is extensive. Great curiosity plus excellent math and communication skills are absolutes. Patience, perseverance, good recordkeeping, and innovative thinking are just a few more of the many traits a flavorist needs. Flavorists must also know how flavors change according to different combinations of substances and conditions.

If this sounds like a fascinating career, consider the following:

- ***Education and training.*** A bachelor's degree in chemistry or a related area is key. Some positions require an advanced degree. Prospective flavorists have an initial five-year training program working as lab assistants. They must pass an oral exam before becoming *junior flavorists*. An additional two-year apprenticeship and a second exam lead to certification as a *certified flavorist*.
- ***Work environment.*** Flavor chemists work in a lab and collaborate with research and marketing professionals to determine the desired taste profile. After many tests, the chemists submit their best samples for taste tests. Following several rounds of taste testing, the chemists examine the flavor of a winning s
Some flavorists work for companies that develop flavoring ager
developers who use flavoring agents.
- ***Job outlook.*** Because flavor chemists are few in number and t
will likely be steady.
- ***Wages or salary.*** The median salary for flavor chemists with a b
$89,000 annually and may depend on the area of the country

Interview: From Fine Arts to Flavor

Jeanine Davis, Associate Professor, NC State University

Dr. Jeanine Davis's artistic gifts helped her earn an associate's degree in fine arts. Using her degree to foster her career, however, proved to be difficult. When she became fascinated with the plants she cultivated and experimented with in the garden, she enrolled in a horticulture program that would lead her down a different career path in the sciences.

In Washington state, Dr. Davis earned a master's degree working with potatoes, and later earned a PhD experimenting with celery. She began working closely with farmers when she became an assistant professor and extension specialist in North Carolina. Through the extension system, she works statewide helping farmers use applied technologies and adopt new crops. Technology has helped extension evolve and put personnel on farms without being there physically. For example, she is able to work with farmers remotely as they submit images of problems or pests. She can often use the images to diagnose plant problems without actually going to the farm. With smartphones, the internet, and videoconferencing, her connections to farmers have grown greatly, as she is able to be all over her state in a moment's notice.

Today, Dr. Davis enhances her work with farmers to ultimately include the food science industry. She works to help plant breeders who are changing the genetics of crops such as the tomato to have higher nutritional impacts, improved flavor, unique colors, and overall varied aesthetics. She hosts taste tests at field days where farmers and breeders exchange information to help meet the changing needs of the market. Today's consumers are no longer satisfied with just a uniform-looking red tomato; they look for bumpy shoulders, varied colors, increased nutrition, and complex flavor profiles. The more variety and improvements that breeders can provide, the more growers can increase the diversity and quality of crops for their customers.

Dr. Davis urges today's students to explore and be visionary. She hopes that students will "push the envelope and status quo" to help them create solutions to a variety of problems, including those of feeding the world's population in 2050.

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Unit-Opening Materials

CHAPTER 1

Food Science: An Old but New Subject

Learning Outcomes

After studying this chapter, you will be able to

- 1.1 **define** what food science involves.
- 1.2 **describe** the three periods in the development of foods.
- 1.3 **summarize** how food products and processing methods have changed due to the contributions of food scientists.
- 1.4 **analyze** how studying food science now can benefit you in the future.

Reading Prep

Read the chapter title and tell a classmate what you have experienced or already know about the topic. Write a paragraph describing what you would like to learn about the topic. After reading the chapter, share two things you have learned with the classmate.

Key Terms

food science
nutrition
food processing
adulteration
organic
farm to table
farm to fork
food deserts
food scientists
hydroponic crops
food analogs
cryogenic liquids
food defense
food security

Chapter-Opening Materials

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Farm Futures

Engineering Automates Aspects of Farming

In 1890, John Froelich invented the first gas-powered tractor, which traveled at only three miles per hour. Today, the fastest tractor has been recorded at over 103 mph. What's next? It's a tractor that does not even need a driver!

In 2019, two farmers named Craig Rupp and Kyler Laird joined forces to plant 10,000 acres of soybeans without ever sitting behind the wheel of a tractor. The farmers employ driverless, automated technology tractors. Using computers to steer the tractors, the two can sit comfortably in their homes or at the mall while driving their tractors remotely. Today's automation in the field is changing the food industry.

Agricultural engineers work tirelessly to design technologies and equipment to help farmers. This equipment often costs hundreds of thousands to millions of dollars, but can ultimately save the farmer and consumer both time and money in the future. Some of these innovations for today and tomorrow's farmer include the following:

- ***On-board air inflation.*** These tires can be controlled to inflate or deflate to help reduce soil compaction or work with the unique profiles of the soil beneath them.
- ***Multichannel chemical sprayers.*** These sprayers can spray up to 24 specific chemicals in a unique zone application.
- ***Smart seeders.*** Specific applications of seeds and fertilizer are allowed for each square foot of planting.

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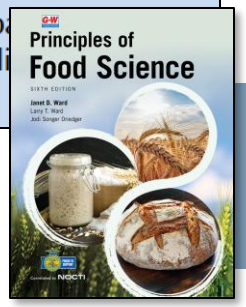
STEM Matters

3-D Food Printing

A new food production method currently being researched is 3-D food printing. The idea is to replace ink or plastic cartridges with refillable food ingredients. Developers hope to include selecting size and shape of the finished printed food. It may sound exciting, but there are some significant issues for engineers to solve. How small would food pieces have to be? How nutritious would the final product be compa
traditionally processed food? How would ingredients be kept safe regardi
and packaging?



Relevant Research

Is There a Link Between Taste-Bud Sensitivity and Weight?

In 1930, it was discovered that some people can taste a bitter compound called 6-n-propylthiouracil (PROP), while others cannot. The ability to taste PROP is inherited, scientists learned. These facts generated interest in researching relationships between the ability to taste PROP and food preferences.

A later study showed that PROP tasters rated dairy products as creamier than did the PROP nontasters. This caused some scientists to believe the PROP test could reveal more than people's tolerance to bitter flavors. Further research revealed the following:

- Caucasians are 25% nontasters, 50% medium tasters, and 25% supertasters.
- Nontasters prefer higher-fat salad dressings.
- PROP tasters taste sweetness more; are more aware of texture in dairy products; and are more sensitive to hotness in peppers.
- Tasters use more adjectives to describe what they taste than nontasters.
- Supertasters had an average BMI (Body Mass Index) of 23.5; medium tasters, 26.6; and nontasters, nearly 30.
- Most professional chefs are supertasters.

Regarding the link between the PROP test and body weight, there are important facts to keep in mind. First, the BMI relationships are true for women only. Second, other factors can override taster status. The ability to resist food urges can overrule the willingness to try new foods.

It is too early to know what role PROP research will play in weight management. However, it *is* clear that the PROP test can reveal risk factors. Scientists have now identified about two dozen genes linked to different types of bitterness. As more taste receptors are identified, registered dietitians may be able to more effectively custom design diets for improved health.

Special Features

Food Features

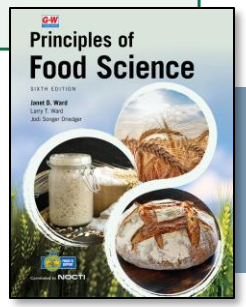
Healthful Grilling

Americans love grilling. Grilling has been considered a healthful cooking method because the fat drips away from the meat. Unfortunately, studies have found that possible cancer-causing substances, called carcinogens, are formed when meats are grilled. It is believed this risk is minimal, but there are steps you can take to reduce the production of these substances. The good news is that grilled fruits and vegetables do not appear to produce carcinogens. The following are tips to reduce these carcinogens in your diet:

- Grill no more than once or twice a week.
- Use gas rather than charcoal. (Gas burns cleaner with fewer carcinogen deposits.)
- Clean the grill before use.
- Grill meat and poultry with the bone-side down.
- Reduce grilling time by
  - precooking meats.
  - using marinades. The addition of lemon juice or vinegar speeds cooking. Marinades with 10% soy sauce and 1% sugar have been found to decrease the production of carcinogens during grilling by 60%.
  - turning foods with tongs rather than a fork to reduce drippings. Drippings cause flame flare-ups.

Food Fact

Fast food is following a pattern prevalent in high-end restaurants of offering seasonal foods for a limited time, mixing the familiar favorites with riskier choices. Examples include berry salads in the summer, pumpkin shakes and lattes in the fall, and specialty items for holidays. Customers are more likely to indulge in seasonal tastes … and pay extra for them.



Going Green

The Cost of Bottled Water

Bottled water quadrupled in sales between 1990 and 2005 to become the fastest-growing beverage of choice in the United States and is the largest bottled beverage category sold in the US. This market category includes carbonated soft drinks, energy drinks, fruit beverages, ready-to-drink coffee and tea, and sports beverages. Bottled water is the largest beverage category sold in the US.

Consumption of bottled water went from 16.7 gallons per person in 2000 to 42.1 gallons in 2017 surpassing soda sales for the first time. The increase in sales is related to consumer concerns about the safety of public water supplies and the perceived health value of bottled water. Other bottled waters that are growing in popularity include alkaline water, water with antioxidants and/or vitamins, fruit-flavored water, and carbonated water.

Is bottled water the best choice for consumers? What is the economic and environmental impact of bottled water consumption? What are healthy beverage choices? The following facts related to bottled water may help you find answers to these questions.

- Bottled water costs as much as $10 per gallon. Tap water costs less than one cent per gallon in many areas.
- Some bottled water comes from municipal sources, meaning that it is tap water. Public drinking water that undergoes an approved water treatment process can, when bottled, have a “purified water” label.
- The Food and Drug Administration (FDA) regulates bottled water, and the Environmental Protection Agency (EPA) regulates public water supplies.
- New testing methods have revealed that all types of foods sold in the US have far higher levels of plasticizers than previously thought. Tests run by *Consumer Reports* found the plasticizers (bisphenols, phthalates, and new phthalate replacers) in all types of processed foods and fresh foods wrapped in plastics. These plasticizers are endocrine disrupters, which can interfere with body

Special Features

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Historical Highlight

Enzymes and Insulin Production

In 1955, a team of chemists made a breakthrough for people who need insulin injections for their diabetes. The team identified the order of amino acids in the protein insulin. Frederick Sanger, an English chemist, led this team. He studied insulin's chemical makeup in different species of animals. This allowed him to determine the structure of insulin.

Sanger's work led to the development of a method to mass-produce insulin. The gene that produces the enzyme that makes insulin can be inserted into single-celled organisms. The organisms multiply rapidly and produce large volumes of pure insulin. This insulin is cheaper to produce and easier to obtain than the previous sources, which were oxen, sheep, and pigs.

Nutrition News

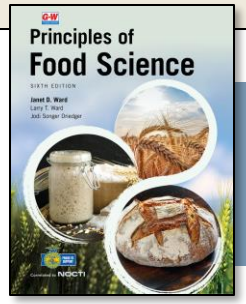
Diet Recommendations for Diabetes

The recommendations for people with diabetes are the same as for most other people. Eat a healthful, balanced diet. A key difference is that people who have diabetes need to be consistent in the amount of food consumed at each meal and the time the meals are served. Eating every four hours will help maintain blood sugar levels.

A health professional such as a dietitian can help create an eating plan based on an individual's needs. The Mayo Clinic and American Diabetes Association recommend the following guidelines:

- Choose a variety of fiber-rich carbohydrate sources, including vegetables, fruits, legumes, whole grains, and nuts. Avoid fruit juices.
- Limit portions of foods that raise blood sugar levels.
- Choose lean meat, heart-healthy fish, and full-fat dairy options.
- Choose mono- and polyunsaturated fat sources such as olive oil, canola oil, some kinds of nuts, and avocados. Studies show these fats are better for helping control blood sugar levels.
- Watch portion sizes and get regular physical activity. Excess body fat interferes with the work of insulin. Regular physical activity can help improve insulin sensitivity.
- Increase vitamins C and E. High blood sugar levels increase cell-damaging free radicals. Recent studies indicate that neutralizing free radicals may reduce the risk of diabetic complications.

Having access to healthy foods is a major factor in health. Programs that helps improve food insecurity can have a positive impact on health. There is no one "magic eating plan" to reduce risks of diabetes. Consumption of sugars and carbohydrates, weight, activity level, and genetic makeup are all factors that determine risk. Generally,



Special Features

CHAPTER 1

Review and Assess

Summary

1.1 Food science focuses on the production, processing, preservation, and packaging of food.

1.2 The three periods in the advancement of foods include the early discoveries of people by trial and error, the period of mass production which grew the food industry, and the addition of government regulations to increase food safety.

1.3 Advances in knowledge have helped researchers understand the science behind many food products. Food scientists have developed thousands of new food products and many food processing methods which have helped grow the food supply. Food safety regulations developed in the US have

1.4

Check Your Understanding

1. Why is food science called an integrated course? (1.1)
2. How did the food supply affect the development of early civilizations? (1.2)
3. What tool was invented near the beginning of the Industrial Revolution that helped food scientists begin to understand food spoilage? (1.2)
4. List the three major periods in the development of food. (1.2)
5. What two laws are the basis for all the rules and regulations written by the FDA? (1.2)
6. What is the reference used by restaurants, grocery stores, and institutions as a guide to safe food handling? (1.2)
7. What can be presumed about a food product that has the USDA organic seal? (1.2)
8. Give some examples of hydroponic crops and explain how they are grown. (1.3)
9. Why might consumers choose to use food analogs instead of traditional food products? (1.3)
10. Name 10 techniques or processes that may be used to create a processed food. (1.3)
11. What is the advantage of using cryogenic liquids in food production? (1.3)
12. How does food defense differ from food security? (1.3)
13. Name three benefits of studying food science. (1.4)

Critical Thinking

14. Describe the major accomplishments regarding food during each of the three periods of history discussed in this chapter. (1.2)
15. Although adulterating food is illegal, what can food producers gain by doing this? What potential hazards do such products create for consumers? (1.2)
16. What food analogs are regular parts of your diet? (1.3)
17. How can this course help you evaluate new developments in food products in the future? (1.4)

Core Skills

18. **Writing, Research**. Conduct a short research project to answer the question, "What happens when foods exported by one country are not permitted to enter another on the claim of lack of safety?" Find three cases whereby scientific evidence was presented to dispute the claim. Prepare a report answering the question and citing whether the disputing countries opened their markets to the products or kept markets closed. If the latter occurred, report the reason for the decision. (1.2)
19. **Communication**. Create a brochure on why students should take food science. Use color and graphics to make the brochure both informative and appealing to teens. (1.4)
20. **Writing, Research**. Research the Nutrition Labeling and Education Act. Write a one-page paper on the information required on a food label. (1.2)
21. **Research**. Identify food deserts that exist in your county and where they are located. Research what community-based services are in place to help improve the food availability in those areas and what barriers exist in finding adequate healthy food choices. Develop a series of recommendations for improving food accessibility in a food desert near you. (1.2)

STEM Connections

22. **Technology**. Research the consumption of a food, product, or ingredient over the last 100 years. Use a spreadsheet program to chart the results. Discuss any trends observed in a written or oral presentation. (1.3)
23. **Engineering**. Research how new methods of engineering a unique farming system is producing food in a nontraditional way in your state. (1.3)
24. **Math**. Choose one of the following to research. Create a pie graph based on your findings. (1.4)
    - The average percentage of income dollars a family spends on food
    - The percentage of food dollars spent on eating out
    - The percentage of jobs in the US directly related to food (farm to table)

End-of-Chapter Content

CHAPTER 17 EXPERIMENT

Comparing Traditional Pancakes to Sourdough Pancakes

Safety

- Do not taste the sourdough starter.
- Follow sanitation procedures for food preparation and cleanup.

Purpose

Any change in ingredients can alter the flavor, texture, and appearance of a food product. In this experiment, you will conduct a sensory evaluation of sourdough pancakes and pancakes made with chemical leavening agents. Each lab group will prepare only one type of pancake. Then you will share pancakes with a group preparing the other variation. Note that both types of pancakes are made with equal amounts of flour and liquid. The proportions given result in thinner, almost crepe-like pancakes that cook quickly. To make thicker, cake-like pancakes, increase the flour by 50 mL (1/4 cup) in each recipe. Decide as a class on the thickness of the batter to use to avoid an extra variable.

Equipment

metric dry measuring cups
metric measuring spoons
large mixing bowl
whisk
medium mixing bowl
500 mL (2-cup) liquid measuring cup
6- to 10-inch nonstick skillet or griddle
pancake turner

Supplies

Traditional Pancakes

250 mL (1 cup) flour
10 mL (2 teaspoons) baking powder
2 mL (1/2 teaspoon) salt
15 mL (1 tablespoon) sugar
1 egg
30 mL (2 tablespoons) vegetable oil
250 mL (1 cup) milk

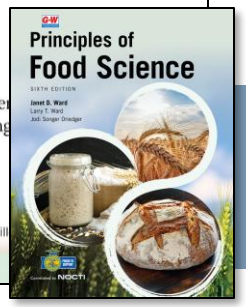
Sourdough Pancakes

1 batch sourdough starter
15 mL (1 tablespoon) sugar
2 mL (1/2 teaspoon) salt
1 mL (1/4 teaspoon) baking powder
1 egg
30 mL (2 tablespoons) vegetable oil
1 mL (1/4 teaspoon) baking soda
dissolved in 5 mL (1 teaspoon) water

Procedure

Traditional Pancakes

1. Combine 250 mL (1 cup) flour, 10 mL (2 teaspoons) baking powder
   (1/2 teaspoon) salt, and 15 mL (1 tablespoon) sugar in a large mixing
2. Beat egg in a medium mixing bowl.



3. Add 30 mL (2 tablespoons) vegetable oil and 250 mL (1 cup) milk to the beaten egg.
4. Add the liquid ingredients to the dry ingredients all at once.
5. Stir until blended.
6. Pour approximately 50 mL (1/4 cup) portions of batter onto a preheated skillet or griddle. (The skillet or griddle has reached an appropriate temperature when water drops dance and sizzle as they hit the hot surface.)
7. Cook pancakes until the top surfaces are bubbly and set around the edges.
8. Flip and cook until browned. (The pancakes will rise in the center and then flatten down slightly when finished cooking.) Do not push down on the pancakes with the pancake turner after flipping!

Sourdough Pancakes

1. Reserve 125 mL (1/2 cup) starter. Place the remaining starter in a large mixing bowl and add 15 mL (1 tablespoon) sugar, 2 mL (1/2 teaspoon) salt, 1 mL (1/4 teaspoon) baking powder, and 30 mL (2 tablespoons) vegetable oil. Stir until combined.
2. Beat in an egg.
3. Gently fold in 1 mL (¼ teaspoon) baking soda dissolved in 5 mL (1 teaspoon) water.
4. Cook pancakes following steps 6 to 8 under the procedure for traditional pancakes.
5. Add 250 mL (1 cup) of flour and 250 mL (1 cup) of water to the 125 mL (1/2 cup) reserved starter. Place the starter in a covered plastic container and refrigerate for up to one week before using or "refeeding." (The container should have at least twice the volume of the starter.)

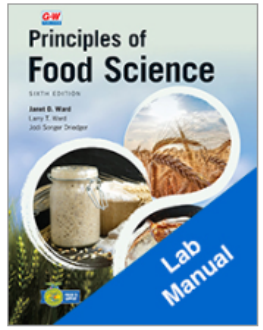
Tasting

1. Each member of two lab groups should receive one of each type of pancake.
2. Conduct a sensory evaluation of each type of pancake. Evaluate color, appearance, and flavor. Record your observations in a data table.

Questions

1. How did the flavors of the two types of pancakes differ? Which type did you prefer?
2. How did the textures of the two types of pancakes differ? Which type did you prefer?
3. Which method of mixing pancakes is faster (disregard the time required to make the starter)?
4. For what types of products could a sourdough starter be used?
5. What types of changes would be needed in a standard recipe if it was to be made with sourdough?

Chapter Experiments



Principles of Food Science 6e, Lab Manual Assignments

These activities provide students with an
are provided in DOCX format. This type o

Locate the desired activity below.

1 Food Science: An Old but New Subj

- Activity 1A: Vocabulary Anagrams
- Activity 1B: News Update
- Activity 1C: Developing Data Table
- Activity 1D: Using Data for Calcula
- Activity 1E: Using Data to Create G

2 Scientific Evaluation: Being Objecti

- Activity 2A: Scientific Evaluation M
- Activity 2B: Metric Units
- Activity 2C: Converting Recipes
- Lab Experiment 2D: Balancing Che
- Lab Experiment 2E: Measuring Acc

Principles of Food Science Lab Workbook: Chapter 1 Activity 1C

Name:
Date:
Class:

Chapter 1: Food Science: An Old but New Subject

Activity 1C: Developing Data Tables

Purpose

Scientists conduct experiments to collect information. Scientists use data tables to organize information in a way that is easy to read. A well-designed data table will also help scientists see patterns and relationships in data they might miss otherwise. In this activity, you will set up a data table. This will prepare you to set up and use data tables in experiments throughout this course.

Equipment

ruler

pencil

computer with spreadsheet program (optional)

Procedure

1. Data tables are made up of small boxes called *cells*, which are used for recording information. Cells are organized vertically into *columns*. Cells are organized horizontally into *rows*. Set up a data table that provides rows and columns to list the year and the total number of new products developed for each of six years.
2. *Headings* define the types of information that are listed in rows and columns. Headings for columns are written in the spaces of the first row or above the first row. Headings for rows are listed in a data table from top to bottom in the first column. Enter headings to define the types of information that will be recorded in your table.
3. Enter the years 1970, 1990, 1995, 2000, 2011, and 2016 into the appropriate cells of your data table.
4. The number of new food products developed each year in order are 1,041; 10,301;

Lab Manual

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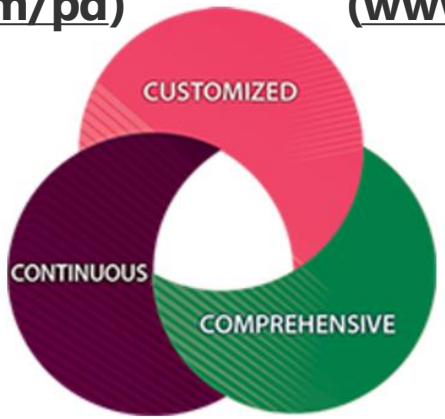

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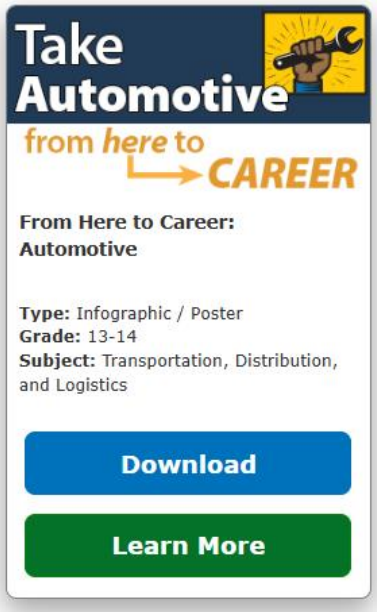

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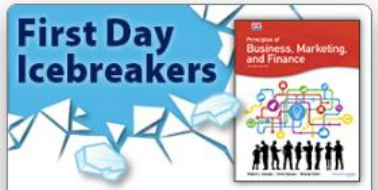
View Product



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Grade: 9-12
Subject: Health and Physical Education

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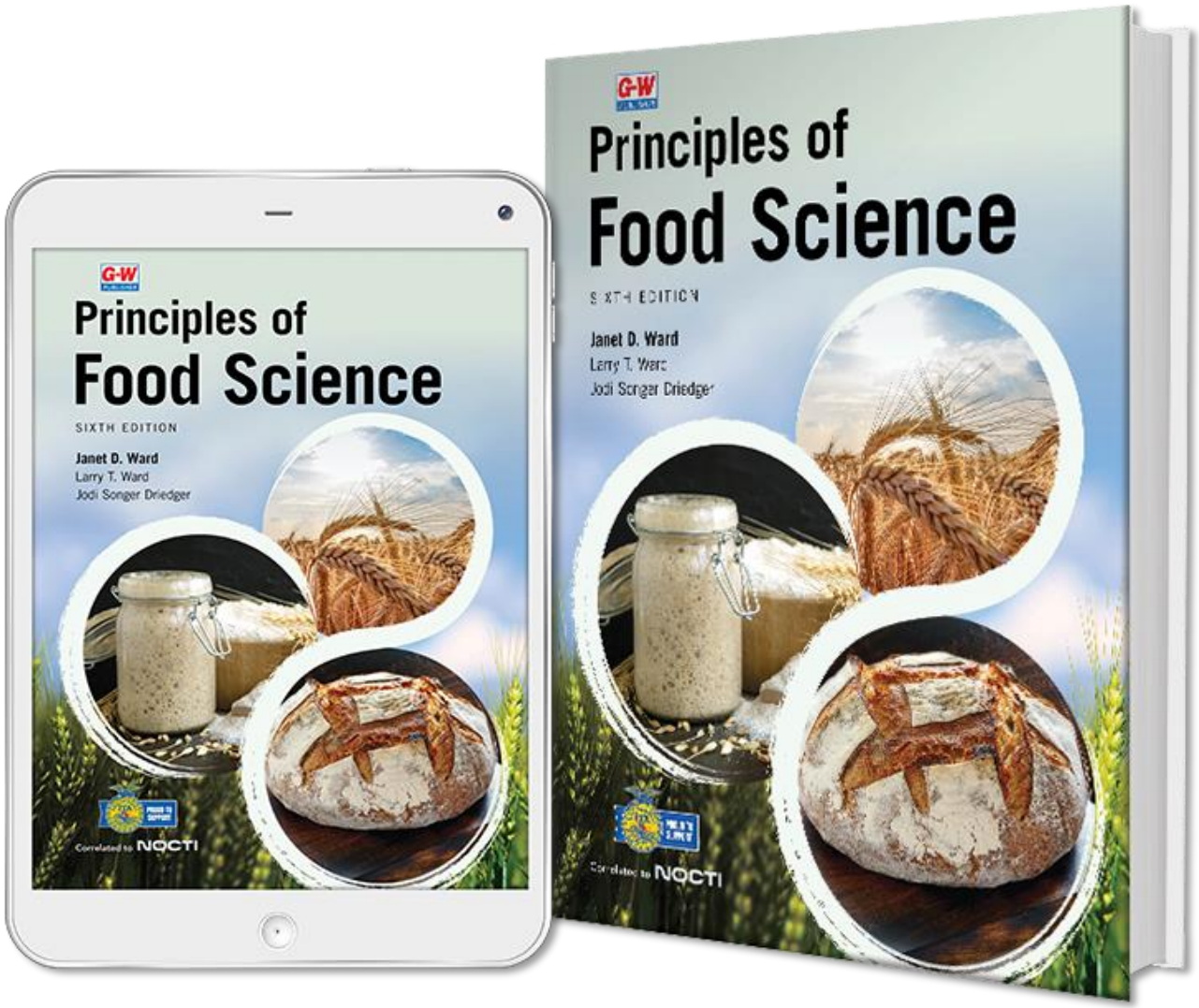

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