

INTRODUCTION

Use this document to facilitate student work as they complete this Project-Based Learning (PBL) Pack. Students will complete the *PBL Project Organizer* sheets as they progress through the project. See the *PBL Overview* for more in-depth instructional tips for teaching with Project-Based Learning Packs.

PBL Topic: A Healthy Lunch

This PBL Pack is part of the Food and Nutrition unit (grades 5–6) and focuses on how food is grown, food preparation, and what constitutes a nutritious meal.

Driving Question: How can you develop a healthy, nutritious new lunch for the school cafeteria?

PROJECT OBJECTIVES

- Students will research how foods are grown and prepared.
- Students will understand which nutrients people need in their diet.
- Students will learn about how schools select food and create schedules of meals for students to eat in the cafeteria.
- Each team will develop a nutritious new lunch within budget constraints and kitchen facility limitations.
- At the culmination of the project, teams will prepare and deliver a presentation, including a demonstration of how their lunch could be prepared, to share the outcome of their project with the class. The presentation will ideally incorporate technology and the arts.

CONNECTIONS TO NEXT GENERATION SCIENCE STANDARDS*

Below is a list of key national science standards supported by this pack.

Performance Expectations

5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

Science and Engineering Practices

Constructing Explanations and Designing Solutions
Engaging in Argument from Evidence
Obtaining, Evaluating, and Communicating Information

Disciplinary Core Ideas

PS3.D: Energy in Chemical Processes and Everyday Life
The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).

Crosscutting Concepts

Energy and Matter (energy from the Sun is incorporated into food as matter and ultimately provides people with nutrition)

Systems and System Models (the human body is a system that requires certain nutrients to stay healthy)

CONNECTIONS TO COMMON CORE STATE STANDARDS

Below is a list of selected key ELA/Literacy standards supported by this pack.

- SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.
- RI.6.7 Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.
- WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research.

CONNECTIONS TO 21ST CENTURY SKILLS†

- **Health Literacy:** Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance and stress reduction
- **Use Systems Thinking:** Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems
- **Work Independently:** Monitor, define, prioritize and complete tasks without direct oversight
- **Manage Projects:** Prioritize, plan and manage work to achieve the intended result

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PROJECT TIMELINE

The following timeline is a guide to help prepare for and schedule this Project-Based Learning Pack. It is meant to be used as an approximate guide and can be adapted to meet the needs of the class. The project timeline will vary, depending on the number of Science A–Z resources used to build background and the time allocated for students to develop their project.

Activity	Estimated Time	Date(s)
GETTING STARTED		
Introduce the Topic (p. 3)	1 day	
Conduct an Entry Event (p. 3)	1–2 days	
Preteach Vocabulary (p. 4)	1 day	
Build Background Knowledge (p. 4)	5–15 days	
PLAN AND CREATE		
Plan the Project (p. 7)	1–2 days	
Pitch the Project (p. 7)	1 day	
Develop and Conduct the Project (p. 8)	5–15 days	
PRESENT, ASSESS, AND EXTEND		
Practice the Presentation and Complete Peer Review (p. 8)	1–2 days	
Present and Assess the Final Project (p. 9)	2–3 days	
Extensions and Variations (p. 10)	0–5 days	
ESTIMATED TOTAL SCHEDULE		
4–8 weeks		

BACKGROUND AND MISCONCEPTIONS

Use this section as a resource for more background knowledge about nutrition and what constitutes a healthy, balanced meal and to clarify the content for students if misconceptions arise. The *Unit Guide* from the Food and Nutrition unit provides additional background information for this PBL Pack.

Q: *Are carbohydrates bad for you? I've heard that some people try hard to reduce their carbs.*

A: Actually, carbohydrates are important nutrients. Foods such as whole grains, beans, and vegetables contain complex carbohydrates as well as essential vitamins, minerals, and fiber. The body digests complex carbohydrates more slowly than simple carbohydrates, and the complex carbs provide energy throughout the day. Simple carbohydrates, often found in foods with processed sugars and/or refined grains, are the kind that digest very quickly. They provide only temporary spikes in energy and can be stored as body fat.

Q: *Aren't all fats bad for you?*

A: No. Fat is an essential nutrient that stores vitamins, protects organs, and regulates temperature, among other things. Nutritionists often recommend eating a healthy balance of omega-3 and omega-6 fatty acids. Omega-3s help reduce inflammation, which is a major factor in many diseases. Unsaturated fats found in vegetables, nuts, and seeds are often judged to be healthier than saturated fats, which contain cholesterol and mainly come from animal fats. Trans fats have been chemically altered and are not considered to be healthy choices. While fats are important nutrients, nutritionists recommend choosing foods that contain a healthy balance of fats and avoiding foods that contain trans fats.

Q: *Foods that are good for you taste bad, and foods that taste good are bad for you—right?*

A: Certainly not! It's a popular misconception that "good-for-you" foods are bland and tasteless. While it's true that many unhealthy foods often do taste good (why else would you choose to eat them?), healthy foods often taste good, too. Taste is very subjective. Different people may eat the same food and feel differently about its taste. And tastes change over time, too.

Preteach Vocabulary

Refer students to *PBL Sheet 3: PBL Vocabulary*. Have them read the Background, Problem, and Driving Question again. Ask students to identify any important or unfamiliar words related to the topic. Have them write the words in the *Words About the Topic We Need to Learn* section. Ask students to identify any other important or unfamiliar words, including academic vocabulary, and write them in the *Other Important Words We Need to Learn* section. Ask teams to look up each word’s definition and write the meaning next to it.



The terms listed below appear in one or more of the Recommended and Supplemental Resources. Have students add these terms to their vocabulary sheet or *SAZ Journal*. You may also choose to display key vocabulary on a Word Wall for ongoing access during the Entry Event and throughout the entire project.



Use the Food and Nutrition *Vocabulary Cards* and *Image Cards* to teach related content vocabulary in multiple ways.

Enriching Vocabulary

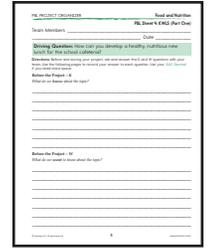
- calorie** a unit used to measure the amount of energy in food
- carbohydrates** organic nutrients, including sugars and starches, that provide an organism with energy
- enriched** describes foods with added vitamins and minerals that make them more nutritious
- fat** a type of lipid found in plants and animals that is a necessary nutrient
- protein** organic nutrients used by the body to grow and to repair cells

Academic Vocabulary

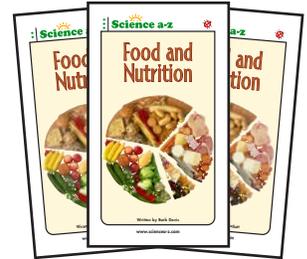
- approximate** almost exact or correct
- consume** to eat, buy, or use
- estimate** to roughly calculate
- regulate** to control or maintain the amount, rate, speed, or behavior of something so it works as intended
- substitute** to replace one thing with another

Build Background Knowledge

Before students begin research, introduce *PBL Sheet 4: KWLS (Part One)* and explain the purpose of its sections. Have students write what they already know about the topic (K section) and what they still want to know (W section).

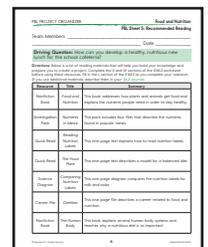


Begin by having students read the *Nonfiction Book* titled *Food and Nutrition* to provide a foundation of understanding about the science content. Select the most appropriate reading level—high, mid, or low—for each student. The *Nonfiction Book Teacher’s Guide* provides a guided reading lesson plan to accompany the books, including vocabulary support and a set of discussion questions differentiated by reading level.



The other recommended resources listed below will provide additional information and practice for students before they begin their project. In addition, consider using the supplemental resources listed in the chart to further develop students’ understanding of and experience with the content.

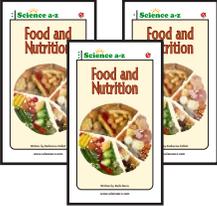
The *PBL Project Organizer* used by student teams contains a similar list of resources on *PBL Sheet 5: Recommended Reading*. As students plan their project, they may need to conduct more research or may come up with new questions that can be answered by selecting from these additional resources. Some resources listed below do not appear on the student list, since they require teacher management.

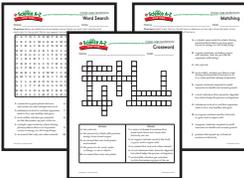
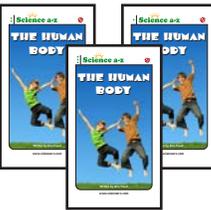


To view a list of all the resources from the Food and Nutrition unit, use the *Unit Resource List* or visit the unit page on the Science A–Z website.



Recommended and Supplemental Resources – Teacher’s List

Recommended			
Resource Type	Title	Summary	Preview
Nonfiction Book	<i>Food and Nutrition</i>	This book addresses the ways in which plants and animals get food and the various organic and inorganic nutrients people need in order to maintain health. It is offered at three reading levels.	
Vocabulary Cards	<i>Food and Nutrition Vocabulary Cards</i>	Unit vocabulary terms are defined on clipable cards, along with parts of speech and the levels of reading materials in which each term appears.	
Process Activity	<i>Comparing the Fat Content of Foods</i>	In this exploration, students compare the fat content of various foods by observing grease stains left on paper.	
Investigation Pack	<i>Nutrients in Meals</i>	This pack includes four two-page files that describe the nutrients found in popular meals and a mystery file that compares multivitamins to the nutrients found in food.	
Quick Read	<i>Reading Nutrition Labels</i>	This one-page text explains how to read nutrition labels. It is offered at three reading levels.	
Debate	<i>Vending Machines</i>	In this activity, students take a position on whether a vending machine containing some junk food should be installed in a school cafeteria.	

Supplemental			
Resource Type	Title	Summary	Preview
Quick Read	<i>The Food Plate</i>	This one-page text describes the USDA's Food Plate model for a balanced diet. It is offered at three reading levels.	
Science Diagram	<i>Comparing Nutrition Labels</i>	This science diagram allows students to directly compare the nutrition labels for milk and soda.	
Word Work	<i>Crossword, Word Search, Matching</i>	These puzzles allow students to practice using content-specific vocabulary related to food and nutrition.	
Nonfiction Book	<i>The Human Body</i> (Grades 3–4 Human Body Unit)	This book explains human body systems and touches on the importance of a nutritious diet. It is offered at three reading levels.	
Career File	<i>Dietitian</i>	This one-page file describes a career related to food and nutrition.	

Additional Research

Students may need to conduct additional research before planning their project and while working on the project as a team. Some of this research can be done in a library, and some can be done online during a supervised search. The following are examples of websites that may be useful resources for students as they complete this PBL Pack:

- <http://kidshealth.org/en/kids>
Learn more about the digestive system and staying healthy on this interactive website.
- <http://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/basics/nutrition-basics/hlv-20049477>
Explore activities and information about healthy meal planning from the Mayo Clinic.

What Have We Learned?

After teams conduct research, have them fill in *PBL Sheet 6: KWLS (Part Two)* by writing what they have learned about the topic (L section) and what they still want to learn (S section). Encourage students to refer back to this list of questions as they complete the project, and have them conduct additional research if needed.

This is a form titled 'PBL Sheet 6: KWLS (Part Two)'. It has sections for 'Team Members', 'Date', and 'Driving Question'. Below these are several lines of text for 'What I Know (K)', 'What I Want to Learn (S)', and 'What I Learned (L)'. There are also checkboxes for 'I understand it well' and 'I need more help'.

PLAN AND CREATE

Plan the Project

Facilitate a class discussion to summarize what students have learned so far and discuss how this information will help them answer the Driving Question. Refer to *PBL Sheet 1: Project Outline*.

Using the information students learned during the Getting Started activities, encourage each team to brainstorm at least three project ideas that would solve the Problem while meeting all the project constraints. Teams should discuss how they would complete each project, including the materials they would need. Have students record all ideas in the table on *PBL Sheet 7: Project Ideas* without rejecting any student’s ideas.

This is a form titled 'PBL Sheet 7: Project Ideas'. It contains a table with 3 columns: 'Project Name', 'I understand it well', and 'I need more help'. There are 5 rows for recording project ideas. Below the table are sections for 'Date', 'Driving Question', and 'Team Members'.

Next, challenge each team to evaluate its list of ideas to determine which will make the best project. Teams may find certain project ideas fun or appealing, but remind them that the best project will satisfy all requirements in the Project Outline. Review the project guidelines, including requirements regarding

materials, time, cost, and any other constraints. Have teams circle their project selection and explain their decision at the bottom of the sheet.

Introduce *PBL Sheet 8: Project Description*. Instruct teams to describe the project they have chosen. They should give their PBL project a name that describes what they will do or learn. Then have students briefly explain what they plan to do and how they expect to do it. Finally, have them list the materials they think they will need. Explain that the list may change as they work on the project.

This is a form titled 'PBL Sheet 8: Project Description'. It includes sections for 'Team Members', 'Date', 'Driving Question', 'Project Name', 'Project Description', and 'Materials Needed'. The 'Materials Needed' section has a list of lines for writing materials.

Pitch the Project

Have each team present its Project Plan to the class for review (refer to *PBL Sheet 8: Project Description*). One team at a time should explain to the class how it plans to complete the project and what materials it will use. Students should describe how their project will help answer the Driving Question while working within the project constraints.

Invite other students in the class to provide constructive feedback to the team presenting its project idea. The other students should make suggestions on how to improve portions of the project. The presenting team should record comments from classmates on *PBL Sheet 9: Pitch Your Project*. Allow each team to present its plan and record peer feedback.

This is a form titled 'PBL Sheet 9: Pitch Your Project'. It includes sections for 'Team Members', 'Date', 'Driving Question', 'Project Name', 'Project Description', and 'Materials Needed'. It also has a section for 'Pitch Your Project' with lines for recording feedback.

Next, have each team review the comments it received and discuss how these ideas might affect the project plan. Once students agree on any changes, have them record their revised plan at the bottom of *PBL Sheet 9*. Before each team begins project development, review each team’s plan. Ensure that the activities are safe, can be completed within the allotted time frame, are of suitable complexity, adhere to any project constraints, and are designed so that all team members will contribute.

Additional Research

If new questions arise, students may need to conduct additional research on their project topic. Consider using Science A–Z resources listed in the supplemental section of the Recommended and Supplemental Resources chart. Also help students locate resources in a library, online, or in the community.

Develop and Conduct the Project

Refer to the *PBL Overview* for management tips to help teams get their project started and how best to facilitate their work as they develop their project.

Review *PBL Sheet 2: Team Project Planner* to help students stay on track with project milestones.

Encourage students to use their *SAZ Journal* to record notes, draw sketches, and revise project plans.

Project

Through research, students should develop a basic understanding of the nutritional needs of children 10–12 years old and what constitutes a healthy, nutritious meal. Then students will research different aspects of a school cafeteria, including how the food is selected, purchased, and prepared. This might be accomplished by reviewing the school district’s website, interviewing cafeteria staff, or visiting the district food services facility. Students should conduct additional research to learn how each food is grown or produced. Ideally, students should also learn about the cafeteria’s kitchen facilities and budget in order to inform planning of their own meal design. If the actual budgetary information is unavailable, create a mock cafeteria budget that provides students with realistic constraints for their project.

Each team will design a new meal to add to the school’s lunch menu. The meal must include a healthy balance of nutrients (from foods and drinks) in order to provide students with sustainable energy throughout the day. The meal will need to be designed within the constraints of the cafeteria’s facilities and budget. For example, grilled salmon cannot be served if the cafeteria is not equipped with a grill or if the cost of the salmon is too great.

Teams will develop a lunch menu that includes their new meal, along with a diagram or other visual presentation to represent the food preparation process for their meal. If feasible, teams might prepare their meal and share it with the class.

Materials

Listed below are materials that students may need during the course of this project. Teams may propose different or additional materials they need to complete their projects based on their unique plans.

- paper plates
- plastic utensils
- cardboard or construction paper
- paper cups
- glue
- scissors
- markers

Project Checkup

Facilitate a touch-base meeting with each team partway through the project to ensure that the team is on track to successfully complete the project on time. Introduce *PBL Sheet 10: Project Checkup* and have each team complete the form.

A form titled 'PBL Sheet 10: Project Checkup' with a 'Date' field and a 'Team Members' list. It contains several 'Check' questions with 'Yes' and 'No' columns. The questions are: '1. A timeline or plan was being created?', '2. A timeline has been created and shared?', '3. A team has been formed and assigned?', '4. A team has been assigned to complete the project?' Below the questions is a section for 'How often do you check in with your team?' and a 'Date' field.

What Have We Learned?

During and after the project, have students update *PBL Sheet 6: KWLS (Part Two)* by writing additional facts they have *learned* about the topic (L section) and what they *still* want to learn about the topic (S section).

A form titled 'PBL Sheet 6: KWLS (Part Two)' with a 'Date' field and a 'Team Members' list. It has sections for 'What I Know', 'What I Want to Learn', and 'What I Learned'. Below these are several lines for notes and a 'Date' field at the bottom.

PRESENT, ASSESS, AND EXTEND

Practice the Presentation and Complete Peer Review

Once teams have completed work on their project, they will get ready to present it to the class. First, have them plan their presentation as a team. Have them refer to *PBL Sheet 11: Presentation Rubric* and *PBL Sheet 12: Practice Presentation and Peer Review* as guides so they are aware of the expectations and elements of a good presentation. Provide time for preparation and practice.

Two overlapping form thumbnails. The top one is 'PBL Sheet 11: Presentation Rubric' with a table for 'Presentation Rubric' and a 'Date' field. The bottom one is 'PBL Sheet 12: Practice Presentation and Peer Review' with a 'Date' field and a table for 'Peer Review'.

Discuss various options that teams might choose from to prepare a presentation, such as:

- Leading a talk with visual aids (display board, posters, dioramas, digital artwork, data, and so on)
- Producing a digital slideshow using presentation software
- Presenting a physical model and explaining its structure and function
- Producing a video and playing it for the class
- Performing a role-play or skit
- Writing a report and discussing it with the class

Teams should include the following in their presentation:

- Description of the project
- How they addressed the Driving Question
- How well they worked within the project constraints
- Materials used
- Steps followed
- Challenges faced
- How they dealt with challenges
- How well they worked as a team
- What they learned during the project
- What new investigable questions they have

Peer Review

The purpose of the peer review is to allow teams to practice and improve their presentations before speaking to the whole class. Pair each team with another team and ask the two teams to practice presenting to each other. Each team should complete *PBL Sheet 12: Practice Presentation and Peer Review* after receiving feedback from the other team.

Present and Assess the Final Project

Final Presentations

After practicing, each team will deliver its final presentation to the class. Allow teams time to review the peer-review suggestions from their practice presentation and incorporate this feedback into their planning for the final presentation.

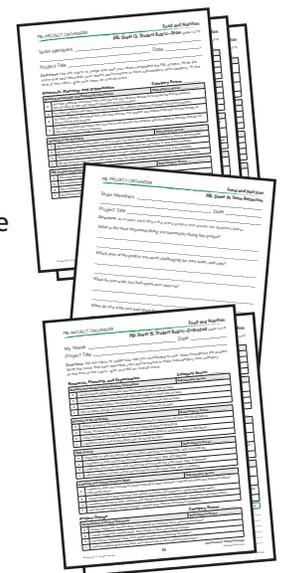
Give each team between 5 and 10 minutes to deliver its final presentation. Encourage the audience to ask questions of the team after the presentation.

TIP Consider inviting guests to observe the presentations and provide feedback. These may include content-area experts, scientists, engineers, community members, parents, or students from other classes.

Team and Individual Self-Assessment

After the final presentations, have teams complete *PBL Sheet 13: Student Rubric-Team* and *PBL Sheet 14: Team Reflection*. Also distribute a copy of *PBL Sheet 15: Student Rubric-Individual* to each student. Have students evaluate their team’s performance and their own contributions to the project.

Collect each team’s completed *PBL Project Organizer* sheets to assess how well students met the objectives of this Project-Based Learning Pack. Also collect each student’s *SAZ Journal* to evaluate his or her note-taking skills and individual contributions to the team.



Teacher Rubrics

In addition to the assessments completed by students, use the *Teacher Rubric-Team* and *Teacher Rubric-Individual* to complete your own evaluation of each team and student.

Extensions and Variations

Extension activities are an important way for students to continue learning about a topic and to understand how it relates to the real world beyond the classroom. As each PBL experience concludes, new questions may lead to new project ideas. Unused ideas from the Sample Entry Events section may be used to extend the learning. In addition to the following extensions and variations, also see the Extensions and Variations section in the [PBL Overview](#) for ideas that can be used with any PBL Pack.

- **Math:** Once teams design their meal, have them write out a specific recipe for a single serving of that meal, complete with accurate measurements for each ingredient. Then task students with scaling their recipe for the actual number of students who eat the school lunch each day so they can estimate the quantity of each ingredient they would need in order to serve it to the whole group.
 - **Variation:** Instead of the scenario being a new lunch for the school cafeteria, students might design a bagged lunch for a field trip, a pack of snacks for a weekend hike, a new breakfast, a special dinner with guests, or any other meal.
 - **Social Studies/Home Connection:** Ask teams to research nutritious meals from various cultures around the world and incorporate these foods into their plans for the new school lunch. Invite students to also share information about healthy meals their own families serve at home and consider these foods in their planning as well.
- **Writing/Arts:** Have students write humorous poems or songs about eating various foods. Invite them to add illustrations to accompany their writing or create videos to present their work to an audience.
- **ELL/ESL:** Let students play various vocabulary games from the Food and Nutrition unit Game Pack, which includes Image Cards that pair vocabulary terms with images. The Game Pack Guide lists several dozen activities and games to engage students in vocabulary practice. For more vocabulary resources, visit [Vocabulary A-Z](#).
- **Field Trip:** With permission, bring students to the school district's food services headquarters or some other large-scale meal-preparation facility. Be sensitive to students' needs as you select a location (e.g., avoid a location that uses peanuts if any students are allergic). Allow them to learn about dietary planning, requirements for food handling and storage, equipment safety techniques, food sources, handling a large volume of perishables, and other aspects of this complex system.
- **Research:** Students can use the Internet and library to conduct research on how new foods are designed. They might learn about food chemistry, professional taste testers, regional food preferences, and a wide variety of dietary restrictions among consumers.