



# Food for Thought

## Middle Level Lesson Plan

### Overview

QUEST *Food for Thought* exposes students to some of the current thinking about nutrition and an optimal diet based on the latest scientific evidence and popular opinion.

### Introduction

Middle-level students who participate in the activities in this teaching unit will learn about the scientific meaning behind the term *food*. They will apply this knowledge to their own lives by designing individual menu selections for peers. By hearing about the menu plans of other students, they will come to realize that food, in the scientific sense, refers to nutrients that provide materials for energy and growth. They will also learn that the food requirements of different people depend on their activity levels as well as on other specific personal factors.

### Time Allotment

This QUEST unit requires approximately seven 45-minute-class sessions. If the final take-home activity is assigned, additional time will be required. Teachers with lengthier block scheduling may adapt the sessions best to suit their circumstances.

### Accessing Prior Knowledge

In order to understand fully the concepts of human diet and nutrition, students should have some knowledge of the scientific definition and purposes of food. This involves an understanding of the connection between food and the general flow of matter and energy in ecosystems. More information on this topic can be found in the *Benchmarks for Science Literacy* and *Atlas for Science Literacy* (see References at the end of these teaching notes).

### Concepts to Clarify

Middle-school students often have incorrect ideas about health which are derived mainly from their somewhat limited cultural knowledge. For example, students in grades 5 through 8 tend to associate health with



QUEST lessons are developed in partnership with Maine Mathematics and Science Alliance



Major funding for Quest is provided by the National Science Foundation. Additional funding is provided by the Maine Department of Inland Fisheries and Wildlife, Maine Forest Products Council, and Irving Woodlands LLC.





## INVESTIGATING OUR WORLD

food and fitness in general. However, a critical student misperception that teachers must help students overcome is the belief that most factors related to health are beyond their own control.

Research indicates that after instruction, students often appear to have accurate knowledge about nutrition but are often unable to explain their knowledge in scientific terms. Students often have mastered the vocabulary for various aspects of health but do not understand the science related to that terminology. Developing a scientific understanding of health as it applies to diet and nutrition is the focus of the standards that form the foundation for this lesson.

### CONNECTIONS TO THE STANDARDS

National Science Education Standards	Benchmarks for Science Literacy	Maine Learning Results	New Hampshire Curriculum Framework	Vermont Learning Standards
<p><b>Science in Personal and Social Perspective</b></p> <p>A. Personal Health , 5: Food provides energy and nutrients for growth and development. Nutrition requirements vary with body weight, age, sex, activity and body functioning.</p>	<p><b>Chapter 6E: Physical Health</b></p> <p>1. Food provides energy and materials for growth and repair of body parts. Vitamins and minerals, present in small amounts in foods, are essential to keep everything working well. As people grow up, the amounts and kinds of food and exercise needed by the body may change.</p> <p>1. The amount of food energy (calories) a person requires varies with body weight, age, sex, activity level and natural body efficiency.</p> <p>2. Some dietary habits may be bad for one's health. ... Changing dietary habits to reduce the intake of such things as animal fat increases the chances of living longer.</p>	<p><b>C. Cells</b></p> <p>4. Identify causes and effects of diseases and identify prevention strategies.</p>	<p><b>Life Science</b></p> <p>3d. Explain how the human body remains healthy and fights off disease, i.e. the influence of diet and food ...</p>	<p><b>The Living World: The Human Body</b></p> <p>7.14.cc. Provide examples of how the health of human beings is affected by their environmental factors.</p>



### Materials Needed

- TV with VCR
- *QUEST Food for Thought* video
- Chart paper and markers
- Computers for student use with Internet access
- The following 5 food items to use as discussion prompts:
  - lettuce (or other leafy vegetable)
  - mini-marshmallow
  - walnut
  - can of tuna fish
  - slice of bread
- Materials for demonstration (1 set for each group of 4 students):
  - 4 pairs safety goggles
  - 1 pie tin
  - 1 tea light candle
  - 1 dissecting needle
  - 1 test tube rack with 1 test tube in it
  - 1 test tube clamp
  - 1 graduated cylinder (to measure out 20 mL of water)
  - 1 beaker of water at room temperature
  - 1 thermometer
  - 2 mini-marshmallows
  - 2 unshelled walnuts
  - 1 extra cup of water (to cool heated food materials)
  - 1 butane lighter (for teacher use only)

One copy per student of each of the following reproducible handouts:

- Student Handout 1: Survey: Food for Thought
- Student Handout 2: Why Food?
- Student Handout 3: Food – What Is It? What Does It Do for Your Body?
- Student Handouts 3A-3D: Nutrient Readings (1 set per student group)
- Student Handout 4: How Many Calories and How Many Nutrients Do You Need a Day?
- Student Handout 5: Creating a Food Pie Diagram of Your Daily Needs
- Student Handout 6: USDA Food Guide Pyramid
- Student Handout 7: Request for Help
- Student Handout 8: Quest At Home: Think Food!



# I. Introducing the Concepts

## Activity I

This initial activity will help to elicit students' ideas about the scientific concept of food – specifically, what food is and why the human body needs it.

**Note:** This lesson and those that follow are designed for students to work in cooperative groups of four students each.

### Step 1

Begin the activity by brainstorming with students about the word *diet*. Ask: What do you think of when you hear the word *diet*? What kinds of diets do people follow? (In order to accommodate all learning styles, you may wish to have students first record their own individual ideas in their notebooks, then have them take turns sharing one idea each with the group.) Record their thoughts on the board or on chart paper.

### Step 2

After recording students' ideas on the board, pose the following question: Why do you think people try these different diets? (Typical responses would include: to lose weight, to perform better in a particular sport, to look better, etc.)

Then tell students, "With such a large emphasis in our culture on diets, you might be surprised to know that in the last 20 years, the rate of obesity in children up to age 11 has doubled, and the rate of obesity for teenagers has tripled."

Explain that these next few activities will help us understand the *science* of food – what it is, why the human body needs it, and how individual food needs differ from person to person. Students will also learn how to make better-informed choices about our own food selections, based on science rather than on the latest trends and advertising programs.

### Step 3

Distribute copies of Student Handout 1 (Food for Thought). Review the handout with the class. Each group of four students should select a recorder and a reporter at this time. The recorder should write down the group's responses; the reporter should prepare to report the group's results to the class. (**Note:** Students within each group should rotate these roles during the course of this teaching unit.)

Allow students about 10 minutes to respond to the survey. Then have them discuss their survey results within their groups; check to make sure that all group members are actively participating in this process.

### Step 4

Ask reporters to share the two most common responses to each question from their own groups.

Regarding question 5 on Student Handout 1 ("What kinds of food might be bad for someone's



health?"), one or more students will probably mention that food choices can be unhealthy when they involve high fat/low nutrient choices (e.g., as in many fast-food establishments), or when food choices do not provide enough nutrients for survival (e.g., in cases of anorexia and other eating disorders). If no one mentions such situations, you may wish to prompt students so that the class can begin to consider them.

### Step 5

Introduce the QUEST video *Food for Thought* by saying, "The purpose of this program is to stimulate and inform our thinking about food – what it is and how we can find information that will support wise food choices." Tell students that they should record any information that would add to their responses on the survey just completed.

Show approximately the first half of the video, stopping when the tape reaches the end of the segment about the "Off Program," in which people are discussing the importance of strength training. You should stop just before the discussion about diabetes.

### Step 6

Wrap up this session by discussing any new information that students have picked up and recorded in their notes.

## 2. Exploring the Concepts

### Activity 2

This activity will help students to continue developing their initial ideas about the purposes that food serves in the human body.

**(Note** that the scientific definition of *food* is slightly different from the common one: scientifically speaking, food provides energy and materials for growth and repair of body parts.)

By observing and comparing the changes in water temperature caused by a burning mini-marshmallow and a burning walnut as heat sources, students can gain an initial understanding about food as a source of energy. They can also see that different kinds of food provide different amounts of energy to the human body.

**(Note:** The formal definition of *calorie* will be introduced in a later activity, but this demonstration should provide a strong foundation for their understanding of that concept.)

### Step 1

Begin by holding up five items:

- lettuce (or other leafy vegetable)
- mini-marshmallow
- walnut
- can of tuna fish
- slice of bread



## INVESTIGATING OUR WORLD

---

Have students think about and record their ideas in response to the following prompts:

1. "Thinking about these five items, write a definition in your notebook for *food*."
2. "How are various foods different?"

### Step 2

Ask students to make a list of the different ways in which the body uses food. Explain that they will be carrying out a demonstration that will help them think about one of the purposes of food – as an energy source for the human body. (Students will also have an opportunity to think about how various foods may differ in terms of the amount of energy that they provide; however, for the moment it is best to offer the simple statement above as an introduction.)

### Step 3

Provide each student with a copy of Student Handout 2: (Why Food?) Review the entire handout with the class, paying particular attention to the safety suggestions. Answer any questions students might have about the roles, safety suggestions, or procedures.

### Step 4

Have the students in each group decide who will take on the following roles: materials manager, recorder, reporter, and demonstration manager. (**Note:** For groups with fewer than four members, one or more students will need to take on an additional role.)

### Step 5

Provide about 5-10 minutes for each group to decide on a design for their data table. (The group's recorder should actually draw up the final design and use it to collect data for the group as they work through the demonstration.)

### Step 6

Have the materials manager gather a bucket (or other collection container) with all of the materials that are listed on Student Handout 2. Be ready with the butane lighter to light candles as student groups become ready to perform the demonstration. Allow each group sufficient time to perform all procedures and to carefully record their findings.

### Step 7

Once the groups have completed their demonstration, provide students with additional time to record their individual responses on the student handout.

### Step 8

Lead a wrap-up discussion after the demonstration, using the following prompts:

- "What happened to the water when you burned each food item?" (*It became warmer.*)
- "Was there a difference between your results with the marshmallows and your results with the walnut?" (*The water was heated to a higher temperature with the walnut than with the marshmallows.*)



Explain to students that each food item had a certain amount of stored energy that was released when it was burned. In this case, the energy heated the water in the test tube; in the case of their bodies, food gives them energy that they can burn in order to move and for their bodies to carry out their ongoing functions.

### Step 9

Hold up the five food items that you showed in Step 1. Ask: Looking again at these foods, what else do you think they give your body besides energy? (Discuss and accept all responses, which might include *vitamins, nutrients, fiber*, and so on.)

Close the activity by explaining that the next couple of classes will help students to gather specific, scientific information about food. Tell them that they will be using this information to design a research-based menu that would be healthful as well as enjoyable for them to follow.

## 3. Developing the Concepts

### Activity 3

This activity will allow students to develop a deeper understanding of what food is. Specifically, they will gain the knowledge to answer the following questions:

- What is the scientific definition of food?
- What are the nutrients found in foods, and how does the body use them?

### Step 1

**Before the class begins**, write this definition of food on chart paper, post it, and leave it posted for the remainder of the unit of study:

- Food provides molecules that serve as fuel and building materials for all organisms.

This food can be used immediately for fuel or for materials; or it may be stored for later use.

### Step 2

Begin the lesson with a discussion of this definition. You may even wish to have the following prompt available on an overhead transparency for those students who are not auditory learners:

In groups of four, read and think about the scientific definition of food that is posted in this classroom. See if you can come up with a list of the major nutrients, or components of food, that all humans need. If it is helpful, you can use the posted definition as a guide: Think about nutrients that are **fuels** and nutrients that are **building materials**. Also, consider what you already know about how the body uses and stores these nutrients.

Allow adequate time for student to read, reflect, and discuss their responses within their groups of four.



## INVESTIGATING OUR WORLD

---

### Step 3

Have each group select someone to be the reporter. (This should be someone who has not yet performed that role.) Ask reporters to share their groups' responses with the class. Record all responses on the board.

### Step 4

Tell students that, according to this scientific definition, food can be found mainly in the following nutrients: ■ Carbohydrates ■ Proteins ■ Fats

These three nutrients are the real energy sources and building materials for the human body.

Continue to inform students that there are three other nutrients that the body needs, some in very small amounts: ■ Vitamins ■ Minerals ■ Water

### Step 5

Distribute copies of Student Handout 3 (Food – What Is It? What Does It Do for Your Body?). Read the Introduction together as a class. Then explain the jigsaw process, in which each group member will read a different selection and then share his or her “expertise” with the rest of the group. Review Step 1 under Jigsaw Reading with students.

### Step 6

Provide the individual members of each group with one of the four readings (Student Handout 3A – Protein, Student Handout 3B – Carbohydrates, Student Handout 3C – Fat, or Student Handout 3D – Vitamins and Minerals). (**Note:** If there are any student groups with fewer than four members, one or more students may have to read two handouts instead of just one, or you may choose to assist them yourself.)

Give students about 15 minutes to complete their readings.

### Step 7

To conclude the activity, point out the directions on Student Handout 3 (Steps 2 and 3 under Jigsaw Reading). At this time, make sure that all timekeepers have a clear view of the classroom clock. Allow groups adequate time to share their findings and pose their questions. Circulate to make sure that all students are actively participating and taking notes in the spaces provided on Student Handout 3.

### Step 8

To close the activity, ask each student to consider the following question: “What surprised or interested you about the information in your reading?” Encourage as many students as possible to share their reflections.

(**Note:** At the end of this activity, you may wish to provide each student with all four of the nutrient readings so that they can use them as reference materials for their final project.)



### Activity 4

This activity will lead students to a better understanding of the recommended daily allotment (RDA) of each nutrient that is found in food. With the information provided here, students will be nearly ready to complete their final challenge of developing a scientifically based menu.

#### Step 1

Have students discuss what they have learned about the components (or nutrients) that are in food and the purposes that each one serves in the body. Explain that students will be investigating what the daily recommendations are for each of these nutrients to maintain a healthy body. Introduce a term that all students will be familiar with: the calorie. Ask, "What do you think a *calorie* is?" (Have students first jot down definitions individually in their notebooks, then discuss as a whole class.)

Remind students of the demonstration that they did with the mini-marshmallows and the walnut. Ask: What happened to the water when you burned each of the foods? Explain that the scientific definition of a calorie is: a unit of measure for *heat energy*. One calorie is the amount of heat that is needed to raise the temperature of one gram of water one degree Celsius. (To give students a concrete example, explain, "If we had measured the water carefully the other day so that it was exactly a gram, and if we had stopped the burning when the temperature recorded a one-degree rise, we would have experienced exactly what a calorie was.")

Go on to explain that when scientists want to know how many calories are in a particular food, they burn the food to see how much heat is produced. Then they can calculate the number of calories it contains.

Also explain that when we read the calorie amount on a food label, we are actually reading a unit that is 1,000 times more than the "small calorie" that we have just defined. This unit is actually capitalized and called a *Calorie*. (The scientific measurement of a Calorie is actually 1,000 calories, or a *kilocalorie*.)

#### Step 2

Distribute copies of Student Handout 4 (How Many Calories and Nutrients Do You Need in a Day?). Provide students with enough time to read the handout carefully. Answer any questions they might have based on their reading.

#### Step 3

Now distribute copies of Student Handout 5 (Creating a Food Pie Diagram of Your Daily Needs). Review the handout with the class, clarifying as needed. Then allow students time to complete their individual pie charts.

#### Step 4

Have students share their pie charts with classmates. Discuss the similarities and differences among students' charts.



### Step 5

Finally, distribute copies of Student Handout 6 (USDA Food Guide Pyramid). Some students may already be familiar with this guide, but others may not. Review the graphic with the class, and have students compare the government model with their own food pie charts. Discuss whether students find it easier to picture the recommendations in the Food Pyramid after having created their own food pie diagrams .

### Step 6 (optional)

As an extension, have students visit the Energy Calculator Website (<http://www.nat.uiuc.edu/energy/daily.html>). At this Web site, students can calculate their own personal energy use in a day. Visitors to the site enter their height, weight, age, and gender as well as the number of hours they spend each day at varying levels of activity. With all of the information entered, a calculator then computes their total daily calorie needs.

As a further optional activity, students can calculate their own daily energy expenditure based on lists of Calories used up by various activities (this is similar to the chart on Student Handout 4).

## Activity 5 (optional)

**Note:** Since students can gain a scientific understanding of food and its nutritional importance to the human body without devoting the time now to learn about nutrition food labels, you may choose not to dedicate any class time to reading and interpreting nutrition food labels. However, if your school's curriculum includes learning standards from the behavioral health field, you may wish to spend a class period teaching students the ins and outs of food labels. Or, you may wish to discuss these concepts with your school's health educator to learn ways of integrating such activities with the health curriculum.

Here are two excellent resources that can help you to develop a lesson about food labels should you be required to do so. (You might also use a search engine to seek articles with similar titles):

Guidance on how to understand and use the nutrition facts panel on food labels:

<http://vm.cfsan.fda.gov/~dms/foodlab.html>

**Kids World** – nutrition information and understanding food labels:

<http://www.ncagr.com/cyber/kidswrld/nutrition/Labels.htm>

## 4. Synthesizing and Applying the Concepts

### Activity 6

**Note:** This activity will require two class periods: one period for students to develop their individual responses to the challenge, and one for reporting and discussing their responses with peers.



## INVESTIGATING OUR WORLD

This culminating activity allows students to connect the scientific concepts they have learned with their own lives. Each student will be creating a menu that meets healthy food-intake recommendations for a hypothetical fellow student who needs to eat well in order to try out for his or her school's soccer team.

### Proficiency Guidelines

You will know that a student is proficient in understanding the key concepts of this teaching unit if the student's menu and accompanying explanation conform to the following guidelines:

- The menu follows the general guidelines for calorie expenditure per day for the body type and activity level of the student for whom the menu is designed.
- The menu contains a correct percentage and amount of each of the three major nutrients (protein, carbohydrates, and fat).
- The menu seems to offer a realistic and reasonable set of choices for a teenager.

#### Step 1

Begin by telling students that they are now being challenged to create a menu for a teenager who needs help with his or her diet. Distribute copies of Student Handout 7 (Request for Help) and Student Handout 8 (Request for Help: Project Guidelines). Read the letter on Student Handout 7 with the class; then review the guidelines on Student Handout 8. (If you do not have Internet access for your students, you may wish to print out some of the materials located at the Web sites that are listed on the guidelines handout).

#### Step 2

Allow students the rest of this class period (as well as homework time, if necessary) to complete their menus. Assign a date on which they will need to present their menus to their classmates.

#### Step 3

On the assigned day, students should take turns presenting their menus. Before they begin their presentations, you might have students first brainstorm a definition and guidelines for a "quality audience." It may also help to reinforce key concepts if student groups consider the following questions after each presentation:

- In what ways did this presentation conform to the guidelines?
- Were the food selections varied and interesting? Was there anything unusual about the menu?
- Would we actually enjoy eating the foods on this menu?

#### Step 4 (optional)

An additional, brief assessment of students' understanding would be to pose the following question after the presentations and to have each student respond individually:

- Imagine that instead of being a 13-year-old teenager, Jody is a 5-year-old "couch potato." How would your menu change? Explain each change.



Finally, an enjoyable extension of this activity can be found at the NASA Web site under Classifying Space Food: <http://spacelink.nasa.gov/products/Space.Food.and.Nutrition/activity4.html>

At this site, students can classify the space food manifested on one of the space shuttles or on the International Space Station into the major food groups found in the Food Pyramid Guide.

## 5. Extending the Concepts

### Activity 7

This take-home activity provides students with an opportunity to synthesize further their conceptual understanding about food and the purposes that it serves in the human body. It also encourages them to think about their daily eating habits within the context of their own homes.

#### Step 1

Distribute copies of Student Handout 9 (Quest At Home: Think Food!). If necessary, provide students with suggestions about where they might locate and borrow good cookbooks if they do not have them at home. Set a deadline for the completion of the activity.

#### Step 2

Upon completion of the assignment, student volunteers should share their menus with the class. (You may wish to use a feedback process similar to the one described in Activity 6.)

### Career Opportunities

Check with the adult education program in your community to find out about such course listings as healthy heart, vegetarian, or ethnic cooking classes. If possible, invite a cooking teacher to come to class to provide sample foods or to give a cooking demonstration. This adult might also offer information about what is involved in teaching a cooking class or in instructing others about balanced diets and maintaining daily nutrients.

### Community Connections

#### Health Fairs

Many school systems use funding sources such as the Safe and Drug Free Schools program to develop wellness activities. These can include health fairs which are offered to the community. Check with your school system to determine if such a program exists. Similarly, many local hospitals and medical centers provide health fairs and nutritional events. If possible, arrange for you and your students to attend one of these events.

#### Fast-Food Information

Many fast-food establishments now offer pamphlets with suggested healthful menus from their offerings. Gather an assortment of these pamphlets to share with students



### Resources

#### **National Science Standards Documents**

There are two major standards documents at the national level for K-12 science:

**Benchmarks for Science Literacy**, created by the American Association for the Advancement of Science (Oxford University Press, 1-800-222-7809)

<http://www.project2061.org/tools/benchol/ch5/ch5.htm>

**The National Science Education Standards**, developed by the National Research Council. (National Academy Press, 1-800-624-6242)

<http://www.nap.edu/catalog/4962.html>



---

## **Survey: Food for Thought**

The purpose of this survey is to find out your current thoughts about food and diet. It will be interesting to see whether any of your ideas change over the course of this unit of study.

1. What is "food"?

---

---

---

---

2. For what purpose(s) does the human body use food?

---

---

---

---

3. What kinds of food are "good" foods?

---

---

---

---

4. How does a person know what to eat every day to stay healthy?

---

---

---

---

5. What kinds of food might be bad for someone's health?

---

---

---

---

---

---

---

---



## INVESTIGATING OUR WORLD

### Why Food?

The following demonstration will help you to observe and think about one of the things that food does for your body.

**A.** You will perform the demonstration in small groups. **Each group member should choose and carry out one of the roles described below in order to help your group complete the demonstration.** (If your group has fewer than four people, one or more members will need to perform two roles.)

#### Roles

**Materials Manager:** Gathers all materials needed by the group; also oversees the cleanup and return of these items.

**Recorder:** Helps the group decide on the design of its data table; also uses that table to keep a record of the group's results.

**Demonstration Manager:** Makes sure that all steps are followed properly and that all safety rules are followed.

**Reporter:** Reports the group's results to the whole class at the end of the demonstration.

**B.** With the other members of your group, read through the steps listed below under **Procedures**. Then discuss how to design a data table that can hold all of the information that you will need to save. Help your group's recorder create the data table on the back of the last page of this handout. The recorder will be responsible for noting all relevant information in the data table.

**C. A word about safety:** In this demonstration, you will be using materials that could cause harm if the following instructions are not followed.

- **Wear safety goggles.** The materials manager in each group should check to be sure that each team member is wearing these.
- Hold all equipment (such as dissecting needles and test tubes) **away from yourself and other students.**
- **Let all materials cool** before moving them. This includes candles, heated food, and so on (the directions below include hints about cooling various materials).
- As with all scientific inquiries, all materials should be used as scientific equipment and **not eaten!**



## Student Handout 2 (continued)

### INVESTIGATING OUR WORLD

D. The materials manager in each group should gather all of the equipment listed below.

#### Equipment

- 4 pairs safety goggles (1 for each group member)
- 1 pie tin
- 1 tea light candle
- 1 dissecting needle
- 1 test tube rack with 1 test tube in it
- 1 test tube clamp
- 1 graduated cylinder (to measure out 20 mL of water)
- 1 beaker of water at room temperature
- 1 thermometer
- 2 mini-marshmallows
- 2 unshelled walnuts
- 1 extra cup of water (to cool heated materials)

**Note:** Your teacher will have a butane lighter and will use this to help your group when you reach that part of the demonstration.

E. As you perform this demonstration, be thinking about **how this activity might demonstrate one of the purposes that food serves in your body.**

#### Procedures

**Step 1** Using the graduated cylinder, measure out 20 mL of room-temperature water. Pour it into the test tube.

**Step 2** Place the test tube clamp around the test tube so that you can hold it up.

**Step 3** Place the thermometer into the water in the test tube, being careful not to touch the sides of the test tube with the thermometer. Let the thermometer stand in the water for about 30 seconds. Have the group recorder read the temperature of the water and record it in the data table.

**Step 4** Have a member of your group ask your teacher to light the candle that is in the pie tin.

**Step 5** Another group member should use the dissecting needle to hold the mini-marshmallow over the flame of the candle until the marshmallow ignites. Move the burning marshmallow over so that the flame touches the base of your test tube. Hold it there for as long as the marshmallow is burning. **Be sure to hold the test tube and other materials over the pie tin so that any particles will fall into the tin.**



## Student Handout 2 (continued)

### INVESTIGATING OUR WORLD

---

**Step 6** The recorder should again read the temperature of the water in the test tube and record it in the data table. (Has the temperature changed at all?)

**Step 7** Cool the mini-marshmallow in the extra cup of water; then set it aside.

**Step 8** Pour out the warm water from the test tube. Let the test tube cool.

**Step 9** Using the second mini-marshmallow, repeat steps 1-8. Record your results. Then find the average water temperature for the two trials.

**Step 10** Using a walnut instead of a mini-marshmallow, repeat steps 1-9. (**Hint:** The safest way to get the walnut to stay on the dissecting needle is first to place it in the pie tin, then gently press the needle into the walnut, moving the needle back and forth if necessary.)

**Step 11** Check to make sure that you have completed all of the necessary steps described above. The materials manager should then gather up your group's materials and return them to the distribution area as directed by your teacher.

**F. Thinking about what you have observed:** Please use your science journal to record your responses to each of the following questions.

1. What happened to the water in the test tube when you burned the mini-marshmallows? (Please be sure to include all observations and data in your response.)

---

---

---

---

---

---

2. What happened to the water in the test tube when you burned the walnut? (Please be sure to include all observations and data in your response.)

---

---

---

---

---

---



**Student Handout 2 (continued)**  
**INVESTIGATING OUR WORLD**

---

3. What did the burning food provide to the water? (Similarly, when your body burns food, what does that food provide to your body?)

---

---

---

---

---

---

---

---

---

---

4. Based on your observations during this demonstration, what can you say about the differences between foods like marshmallows and walnuts?

---

---

---

---

---

---

---

---

---

---



# Food – What Is It? What Does It Do for Your Body?

## Introduction

From a scientific standpoint, food provides your body with the **energy** and the **building materials** that it needs to grow and to repair itself.

**Nutrients** are the components in foods that promote good health. There are six major nutrients in the foodstuffs that you eat. Three of them actually meet the strictly scientific definition of food.

They are:

1. **Carbohydrates**
2. **Proteins**
3. **Fats**

You need these three nutrients in relatively large amounts in order for your body to perform its daily functions and to grow and repair itself.

Other nutrients include:

4. **Vitamins**
5. **Minerals**

Vitamins and minerals are present in very small amounts in the things we eat. They are essential to keep everything in your body working well.

Finally, there is:

6. **Water**

Water is found in all of the cells in the human body. It keeps other important materials moving throughout our bodies day and night.

Your body cannot make nutrients; they must be supplied by the foods you eat. During **digestion**, food is broken down into nutrients, which are absorbed into the bloodstream and carried to every cell in your body. Each nutrient has a specific function.

## Jigsaw Reading

In order to learn more about each nutrient, you will work with your group on a jigsaw reading. This means that each group member will read about one or more different nutrients, and will then share your new “expertise” with the rest of the group. You will listen carefully to your teammates and will discuss each of the other nutrients that they have researched. Then you will use all of the information you have gathered to complete the final challenge for this food unit.



**INVESTIGATING OUR WORLD**

**Step 1** Individually, read through the nutrient information provided by your teacher. Make notes about how you will share your new knowledge with the group. You should also think of a couple of questions that you could ask teammates as you lead a discussion about your nutrient(s).

**Step 2** Rejoin your group. Together, you should choose a timekeeper. The timekeeper will make sure that each group member has five minutes for sharing information and discussion.

**Step 3** Taking turns, have each group member share the nutrient information that he or she has just researched. Each member should also pose at least two questions to the group. When someone else is leading the discussion, you should jot down some information in the spaces that follow. (**Note:** You will need this information later in the unit, so be sure to make your notes carefully.)

**Notes About Nutrients**

**NOTES ON FIRST GROUP MEMBER'S FINDINGS**

■ Nutrient name(s): \_\_\_\_\_

Nutrient's function in your body (what it does): \_\_\_\_\_

\_\_\_\_\_

Description of the nutrient: \_\_\_\_\_

\_\_\_\_\_

**NOTES ON SECOND GROUP MEMBER'S FINDINGS**

■ Nutrient name(s): \_\_\_\_\_

Nutrient's function in your body (what it does): \_\_\_\_\_

\_\_\_\_\_

Description of the nutrient: \_\_\_\_\_

\_\_\_\_\_



**NOTES ON THIRD GROUP MEMBER'S FINDINGS**

■ Nutrient name(s): \_\_\_\_\_

Nutrient's function in your body (what it does): \_\_\_\_\_

\_\_\_\_\_

Description of the nutrient: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**NOTES ON FOURTH GROUP MEMBER'S FINDINGS**

■ Nutrient name(s): \_\_\_\_\_

Nutrient's function in your body (what it does): \_\_\_\_\_

\_\_\_\_\_

Description of the nutrient: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



## Nutrient Reading I

# Protein

### ■ SOME SOURCE FOODS FOR THIS NUTRIENT

Protein is found mainly in animal products (eggs, meat, dairy foods, and fish). In smaller quantities, it is found in all vegetables. Although a vegetable source (such as beans) may contain less protein in terms of quantity, it may still be preferable to an animal source in terms of overall health benefits.

### ■ WHAT THIS NUTRIENT DOES FOR YOUR BODY

Protein's main job is to supply chemicals called amino acids. Amino acids are "building blocks" that build, repair, and maintain every cell in your body. (Each cell in your body contains protein; it is the second most abundant substance in the body, following water.)

Protein is also used by the body for energy, but usually not as a significant energy source. In fact, protein is only used for energy when fuel from carbohydrates and fats is not available to meet the body's needs. This can happen during periods of great physical exertion – such as in a running marathon or during a fast.

Occurring in various shapes and sizes (depending on how the amino acids are put together), proteins play many other roles in the body. These include:

- Muscle contraction
- Protective coating for hair, skin, and nails
- Helping bones and teeth to stay rigid
- Formation of scar tissue
- Contraction and relaxation of vessels for blood pressure control

### ■ DESCRIPTION OF THE NUTRIENT

Animal products like eggs, meat, dairy, and fish contain all of the essential building blocks of proteins (the amino acids) in the proper ratio and quantity to meet the needs of the body. Thus, they are called **complete proteins**. A chicken's egg has been called the **perfect protein**, because it has the highest value of all protein sources.

It is important to note, however, that many animal sources of protein also contain high amounts of fat and cholesterol.

All vegetables contain at least small amounts of protein. Plants are often called **incomplete proteins**, because they lack one or more amino acids. However, by combining different vegetable sources at a meal, it is possible to achieve a complete protein -- and with less fat and fewer carbohydrates than from animal sources. (A common diet in many countries is based on rice and beans, which together provide an excellent source of protein.)



## Nutrient Reading 2

# Carbohydrates

### ■ SOME SOURCE FOODS FOR THIS NUTRIENT

Carbohydrates are found in fruits, many vegetables, and flour or cereal products (grains).

### ■ WHAT THIS NUTRIENT DOES FOR YOUR BODY

Carbohydrates are the body's main (and preferred) source of energy, or calories. The body uses this energy to carry out all of its activities, including basic functions like breathing and heartbeat, as well as everyday movement, sports, lifting, and other activities. (An interesting fact: The brain uses **glucose**, a sugar that results from the breakdown of carbohydrates, as its energy source.)

Carbohydrates also perform a special role with relation to another nutrient – protein – by “sparing” the protein as an energy source. What does this mean? Usually, your body can fuel its cells even hours after a meal because there are adequate stores of carbohydrates. However, if a person has been fasting or has had a very high-energy expenditure (like a very long hike or a marathon), his or her body will start to use its protein for energy. This is not a preferred – or an efficient – energy source, so it's a good thing there are usually enough carbohydrates for the human body to burn!

Finally, carbohydrates must be present if fat is to be burned for energy. Carbohydrates supply the body with a special acid that is needed by working muscles to break down fat for energy.

### ■ DESCRIPTION OF THE NUTRIENT

Carbohydrates are often classified as **complex carbohydrates** (starches) and **simple carbohydrates** (sugars). **Fiber**, which is another carbohydrate, aids digestion and helps fight off some diseases, but it is not considered a “food” because it is not digested and absorbed by the body.



## Nutrient Reading 3

# Fat

### ■ SOME SOURCE FOODS FOR THIS NUTRIENT

Fat can be found in all nuts (such as walnuts, pecans, almonds, cashews, and peanuts). Fat can also be found in certain fruits and vegetables (like corn, cottonseed, sunflower, coconut, cacao, [Author: since cocoa is not a fruit or vegetable – it is simply a powder derived from the cacao bean or seed – I altered the text to “cacao,” which is the real fruit here. OK?] avocado, and olives). [Author: Since many of these items are NOT vegetables (like avocado, coconut, and olive, all of which are classified as fruits), I have changed the text to say “fruits and vegetables.” OK?] In addition, fat occurs in animal products (butter, cheese, egg yolk, milk, lard, meat, poultry, and fish).

### ■ WHAT THIS NUTRIENT DOES FOR YOUR BODY

Fats make up part of many body cells. Fats provide fuel for energy for all bodily functions.

Fat has many other important functions, too. These include:

Transporting nutrients and helping digestion

- Storing energy (from carbohydrates and protein, which are stored in the form of fat when they aren't needed by the body)
- Insulating against heat and cold
- Protecting organs
- Helping the nerves transmit signals
- Making the body feel full after eating

### ■ DESCRIPTION OF THE NUTRIENT

Fats take the longest of any nutrients to be digested. They are first broken down into fatty acids and are coated with another nutrient, protein. Then they are sent around the body to be used or stored.

Fat can be **saturated** (hard at room temperature, like butter or lard), or **unsaturated** (like most vegetable fats or the Omega-3 fatty acids found in fish and other special foods). Saturated fat increases the amount of cholesterol in our blood and is not healthy in large amounts. Unsaturated fat decreases the amount of cholesterol in our blood and is generally healthier.

How Many Calories and Nutrients

Do You Need in a Day?

The human body needs food for energy. This is measured in Calories (1,000 times the amount of heat needed to raise 1 gram of water 1 degree Celsius). The body also needs nutrients for many other purposes; you learned about many of these in the previous activity.

It is interesting to know that the amount of calories that any one person needs depends on many factors, including the person's age, size, gender, and activity level.



---

## Nutrient Reading 4

# Vitamins and Minerals

### ■ SOME SOURCE FOODS FOR THESE NUTRIENTS

**Vitamins** come from a variety of sources. Here are some examples:

- Vitamin A is found in cantaloupe, carrot, sweet potato, spinach, and broccoli.
- Vitamin C is found in grapefruit, orange, green pepper, and cauliflower.

There are many vitamins, all of which are important to your body in varying amounts. Each of these vitamins can be found in different foods. This is one reason why eating a wide variety of foods can be important for maintaining good health.

**Minerals**, too, come from a variety of sources. Here are some examples:

- Calcium is found in dairy products as well as in broccoli and other foods. Think Food!
- Iron is found in red meats and spinach.

### ■ WHAT THESE NUTRIENTS DO FOR YOUR BODY

**Vitamins** are the triggers for many bodily processes. They are needed in very small amounts in your diet in order to regulate chemical reactions. Each type of vitamin (A, B, C, D, etc.) has a specific job, so *one vitamin cannot replace another*. Vitamins do *not* provide energy, but they help our bodies use energy from food by triggering metabolism.

**Minerals** are similar to vitamins; they are used to promote chemical reactions and to form body structures. One well-known example is the mineral calcium, which supports a strong bone structure; calcium also helps to prevent osteoporosis, a disease in which bones become brittle and break easily.



## INVESTIGATING OUR WORLD

### How Many Calories and Nutrients Do You Need in a Day?

The human body needs food for energy. This is measured in **Calories** (1,000 times the amount of heat needed to raise 1 gram of water 1 degree Celsius). The body also needs nutrients for many other purposes; you learned about many of these in the previous activity.

It is interesting to know that the amount of calories that any one person needs depends on many factors, including the person's age, size, gender, and activity level.

In general, active teenagers need more calories than children or adults do:

- **Boys need about 2,500 Calories per day.**
- **Girls need about 2,200 Calories per day.**

These numbers, of course, are *averages*. They may vary depending on the various factors mentioned above.

Here are some examples of activities and the number of Calories (energy) needed to do them:

Activity	Calories Needed per Hour
Swimming	300
Soccer	400
Sleeping	60
Reading	100

When making daily diet choices, we must consider the total number of calories needed. We also need to consider the kinds of nutrients our bodies are receiving along with those calories.

#### Specific nutrients needed by teenagers in one day include:

Nutrient	Percentage of Daily Diet
Fats	Less than 30% of daily calories
Carbohydrates	Approximately 50-60% of daily calories
Proteins	Approximately 15% of daily calories

You may have heard of the famous **Food Pyramid**. This is a diagram that government nutritionists have created to help us choose our daily food allotments.

Before taking a look at this pyramid, you will be creating your own graphic of your daily food needs – the Food Pie!



## Creating a Food Pie Diagram of Your Daily Needs

Use the following table to help you organize all of the information that you will need to create your own diagram of daily food needs. Follow the numbered steps below to complete the table correctly.

Type of Nutrient	Foods That Supply It	Food Group That Is a Primary Source for This Nutrient	Recommended % of Daily Calories Provided by This Nutrient
Carbohydrate			
Fat			
Protein			

1. Use your notes from the previous activity or from other research to create a list of foods that supply each type of nutrient listed above. (List these foods in the first blank column of the data table.) Also use your notes to indicate the recommended percentage of daily calories that each nutrient should provide. (List these in the third blank column of the data table.)

2. The major “food groups” identified by the U.S. Department of Agriculture are listed below. In the second blank column of the data table, list each food group that is a primary source of calories for each type of nutrient. (You will have to do some thinking in order to connect each food group to each type of nutrient that it provides. Your notes from the last activity will help you to do this as well.)

### USDA Food Groups

- Vegetables
- Meat, poultry, fish, dry beans, eggs, and nuts
- Milk, yogurt, cheese
- Bread, rice, cereals, and pasta
- Fruits
- Fats, oils



**INVESTIGATING OUR WORLD**

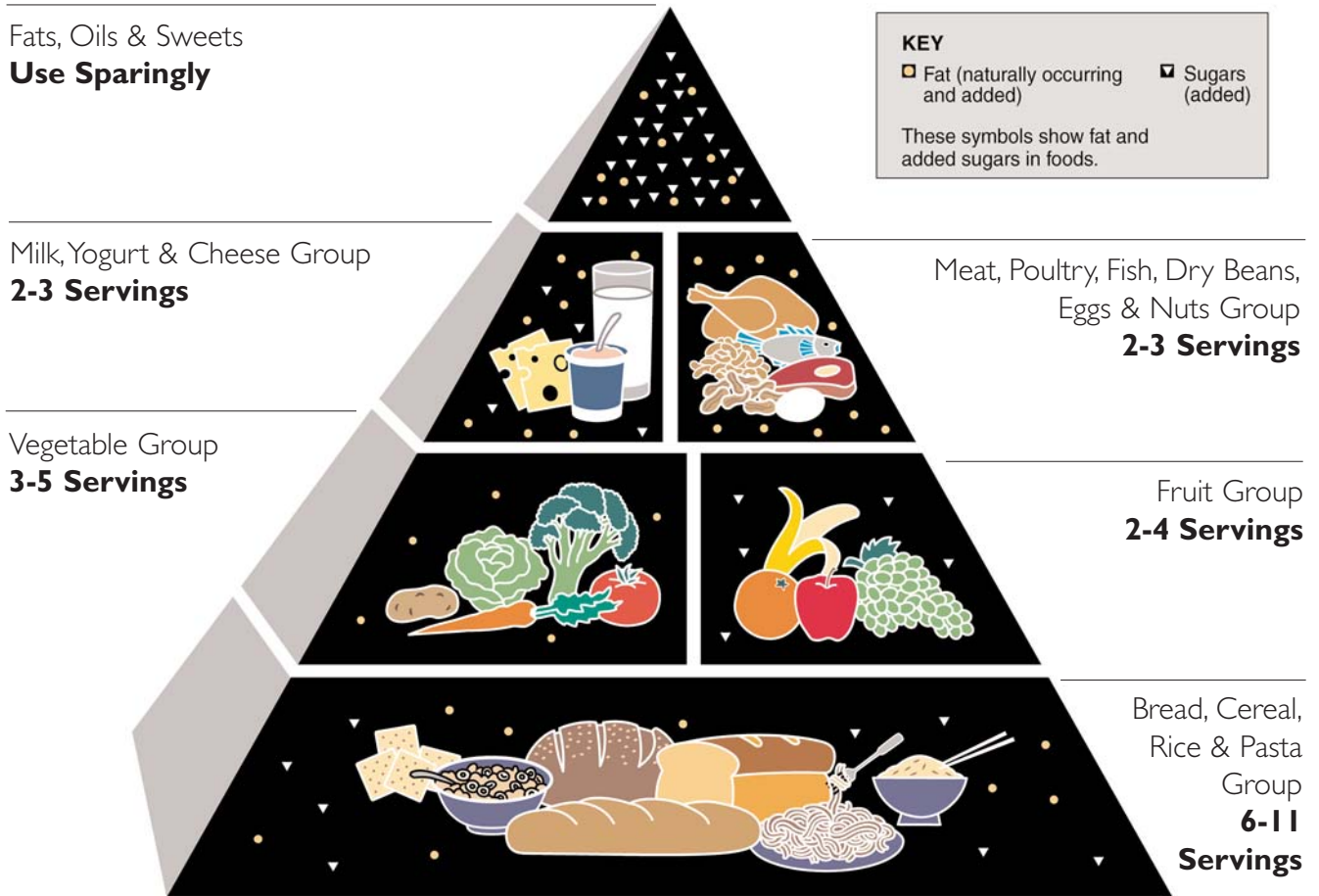
---

3. Now create a “food pie chart” using the information from your data table. Remember that a whole pie (a full circle) represents 100% of your total daily calories. Each section of the pie should represent the recommended percentage for one particular food group.

**Hint:** It might help you to refer back to the definition of *food* that is posted in your classroom as you think about calories and food groups. Some food groups provide other nutrients, such as vitamins and minerals, which do not have calories in any measurable amount.

4. Share your results with your classmates. Then compare your “food pie” with the latest version of the Food Pyramid that your teacher will show you.

## USDA food Guide Pyramid





## Request for Help

Imagine that you receive the following letter from Jody, a 13-year-old. How would you respond?

Use the guidelines that follow the letter to create a response to Jody's request. Incorporate all that you have learned about food, nutrients, and daily energy requirements to develop your response.

Dear Fellow Student,

Help!

I have been a junk food lover for most of my life. Some of the food that I've chosen to eat hasn't even tasted all that good, but I've become so used to a high level of salt and fat that I now seem to crave them both whenever I am hungry.

Here's the situation that I could use your help with:

All of my best friends are on the soccer team. I seem to do pretty well on the field, too, for short periods of time. I'd really like to join the team, but the coach says that unless I start eating a better diet, I won't have enough energy to stay in the game.

I've heard from the coach that you have been studying about food – what it is, what it does for your body, and how much should be eaten each day by all different kinds of people.

I wondered if you would please be willing to help me out. Could you create a sample menu for me for one day that would...

- Give me enough of the nutrients I need for energy – to make it through school and through soccer practice, besides what I need just for my regular body functions like breathing and thinking
- Meet the recommended guidelines for different nutrients according to my body type
- Taste good (this is the most important one for me!)

Here is some more information about me: I am 13 years old and 5'3" tall.

Please send the menu soon! The season is about to begin, and I'd really like to join the team.

With many thanks,

Jody



## Request for Help – Project Guidelines

As you know, the daily recommendations for nutrients that make up a healthful diet are just averages. The correct amount of calories needed by anyone on a daily basis will vary according to a person's age, weight, height, gender, and level of activity.

- The first information that you will need to provide to Jody is the foundation upon which you based Jody's diet. You should explain what assumptions you made about Jody in order to design the day-long menu.
- Next, you need to describe each of the meals (including snacks) that you recommend, *along with reasons for each recommendation*. In this menu, you should name each meal and the foods that it includes, providing both descriptions of the nutrients in these foods and the quantities of each food that will help Jody meet the total recommended calories for a day. (You may find it easier to create a data table, database, or spreadsheet as a way to share this information.)
- Finally, you will need to think about how best to present the sample menu that you have created for Jody. You will be reporting on the menu to your classmates.



### Resources

Here are some Web sites that you might find helpful as you research the best sample menu for Jody:

#### **Energy Calculator**

<http://www.nat.uiuc.edu/energy/daily.html>

At this site, students can calculate their own personal energy use in a day. Visitors enter their height, weight, age, and gender, as well as the number of hours they spend each day at varying levels of activity. With all of the information entered, a calculator then computes their required total daily calories.

#### **The Real Truth About Fast Foods and Nutrition**

<http://tqjunior.thinkquest.org/4885/frconten.htm>

This Web site provides accurate background information on nutrition. It also contains descriptions and comparisons of school lunches and meals from typical American fast-food restaurants.

#### **Food Facts – Interactive Food Finder**

<http://www.olen.com/food/food>

This interactive Web site helps you to search within the menus of famous fast-food restaurants for foods that meet guidelines that you establish.

#### **Nutrition and Food – Finding the Right Stuff**

<http://www.sfu.ca/~jfremont/ethnic.html>

Information and recipes for interesting ethnic cuisine – foods from other cultures and other countries – can be found at this site.



### Think Food! You're on a Quest!

We hear about food nutrients like carbohydrates, proteins, and fats. Many of us study the outside packaged food labels to investigate how many nutrients are included. By further exploring the foods we eat, we will be better prepared to know why we need these nutrients and what they do to help us survive, stay healthy, and live longer.

#### Investigate with your family!

- Why do we eat?
- Why types of foods are good for you? Bad for you?
- What should a person eat each day to stay healthy?

**Materials needed:**

- Computer with Internet access
- Pen and paper for notes
- Cookbooks or family recipes

Here is a list of helpful Web sites on healthy eating – what is good and bad for you, and what is recommended by nutritionists as part of our daily diets:

**Food Pyramid Information – How much is “one serving”?**

<http://www.ring.com/health/food/food.htm>

**Healthy eating based on the Food Guide Pyramid**

<http://primusweb.com/fitnesspartner/library/nutrition/pyramid.htm>

#### Cooking healthy

Look through cookbooks or family recipes that you have at home. You may also choose to borrow cookbooks from the library or download recipes from the Web. Create a family menu of meals and in-between-meal snacks, following the recommended food guidelines.



Meal	List of Foods	Amount of Each	What Your Body Will Use It For	Reference (Where to find the recipe)
Breakfast				
Morning Snack				
Lunch				
Afternoon Snack				
Dinner				

■ Does your menu cover all of the requirements of the food pyramid? Make a note of all of the requirements you've included:

---



---



---

### Electronic Quest!

Looking for healthy choices for kids? Here are some Web sites loaded with recipes, health tips, and more – just for kids!

#### Kids Health

<http://kidshealth.org/>

#### Healthy Choices for Kids

<http://www.healthychoices.org/>

#### All Recipes for Kids

<http://www.allrecipes.com/cb/w2m/forkids/>

#### 10 Tips for Healthy Eating for Kids

[http://www.oznet.ksu.edu/ext\\_f&n/\\_timely/KIDEAT.htm](http://www.oznet.ksu.edu/ext_f&n/_timely/KIDEAT.htm)

#### Food and Drug Administration -- Just for Kids!

<http://www.fda.gov/oc/opacom/kids/>



QUEST lessons are developed in partnership with Maine Mathematics and Science Alliance



Major funding for Quest is provided by the National Science Foundation. Additional funding is provided by the Maine Department of Inland Fisheries and Wildlife, Maine Forest Products Council, and Irving Woodlands LLC.

