The Mathematics of Good Nutrition:
Graphing, Percents, & Formulas/Equations

A Unit for Tech Prep Mathematics Courses

Produced by the Mathematics Education Development Center
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Based on a Unit Developed at
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Unit Overview/Teacher's Notes

Students will gain knowledge needed to follow more healthful eating habits. They will focus mainly on the place of fats, carbohydrates, and protein in their diets, which includes learning to read and interpret food labels and consult appropriate resources. Students will use graphing, percents, and formulas/
equations to reach the nutrition objectives. You might wish to spend more time on prerequisite skills than is included in this unit.

Including the teacher's parts of this unit and having students work in small groups for most or all of the activities are important components in teaching the unit effectively. In some cases answer keys provide *sample* answers—other reasonable answers should be considered. Individual activities are not intended to be accomplished in one class period. Each might take up to several class periods to complete. Key objectives addressed the previous day or two should be reviewed in some manner at the beginning of each class period. The teacher will need to begin collecting nutrition fact labels from various food items (and perhaps nutrition guides from various restaurants) prior to beginning the unit.

Many reference sheets are included in this unit. Some of these may be used as transparencies, although they might instead or also be distributed to students as handouts (reduced in size, if desired). A suggestion for saving both paper over the years and photocopying time is to prepare permanent copies of all reference sheets that you will not use as transparencies. For example, you might make multiple bound copies or copies placed in three-hole-clasped folders, which could be numbered for signing out to students during the unit, or several laminated sets might be prepared.

Table of Contents

Materials

transparency of Reference Sheet R1
calculators [optional]
nutrition fact labels from various food products

Activity Summary: Students will learn to read and interpret nutrition fact labels ("food labels") from food products, a task that involves the use of various mathematics skills (e.g., number concepts and number sense). Use with R1.

Objectives

- To stimulate thinking about good nutrition and to spark interest in understanding and monitoring one's own eating habits.
- To read and interpret nutrition fact labels ("food labels") on food packages.

Introduction

Ask students how healthful they think their diet is, and why. In what ways do they monitor their eating habits, if any? What might they do to improve these? Why is a good diet important? (*Address this not only in terms of its effects upon longevity and prevention of poor health in later life, but also in terms of its impact upon the quality of daily life at all ages by way of energy level, self concept, etc.*) Tell students that they will be using mathematics—working with graphing, percents, and formulas/equations—to help them learn how to maintain a better diet. They will focus mainly on the macronutrients of fat, carbohydrates, and protein. These nutrients have the prefix "macro-" ("large") because they are the only three nutrients that we need in relatively large amounts and which, almost exclusively, provide the energy we need.

Make a transparency of **Reference Sheet R1**, and project it for students to see. Ask students:

- What can you tell me about this food label?

If not included, ask:

- About how many cookies are in one box of Thin Mints? (*about 36*) How do you know? (*serving size of 4 cookies times about 9 servings per container*)
- How many grams of fat are in 2 cookies? (*4.5g, because two cookies are half of the serving size for which the values are listed*) 6 cookies? (*13.5, or 1.5 times the serving size*)

You might want to limit and keep simple any discussion of percent in the following questions, because the topic will be explored in some detail in Activity 3.

- What percent of one cookie's calories comes from fat? (*50%—20 of 40 calories*) What fractional part is that? ($1/2$) Do you know what percent of your daily calories is recommended as the maximum amount of fat intake? (*30%*)

Allow students to use paper/pencil or calculators, as needed, in answering some of the following questions. Give them sufficient time to think through and explore various concepts before arriving at answers, and ask students to

support their responses by explaining their reasoning before classmates indicate whether or not they agree with answers given.

- What do you think the 13% at the end of the total fat row means? (*For people who consume a fairly average amount of calories—2000 daily—it represents the percent of the recommended daily maximum intake of calories from fat that one serving size (four cookies) comprises. In other words, after four cookies are eaten—13% of the recommended daily maximum of calories from fat—a person on a 2000-calorie diet has 87% of her/his daily "fat calories" left to "spend." Do not dwell too long on this concept—it will be returned to in more detail in Activity 3.*) Since 100% represents the "whole," or total amount of fat a person takes in each day, the serving size of four cookies makes up about what fraction of the total amount of fat allowed in one day for a more healthful diet? (*a little more than $^1/_{8*}$*) Explain how you know this. (*100% divided by 13%—recommended daily maximum divided by one serving—is about 8; or, 13 out of 100, represented by the fraction $^{13}/_{100}$, is a little more than $^1/_8$*) How many cookies would you have to eat to reach the maximum recommended fat allowance (assuming you're on a 2000-calorie diet)? (*about 31**) Explain. (*8 times the serving size of four cookies is 32, but since one serving size is a little more than $^1/_8$ of the day's fat allowance, 31 cookies is more accurate**)

  *Note that, because of rounding error stemming from values listed on the food labels, different answers can be obtained. If a student answered the questions based on the facts that the total fat for one serving is 9 grams and the total fat intake for a day (2000-calorie diet) should be 65 grams or less (see lower part of label), the answers change to one serving size being a little less than $^1/_7$ of the total daily fat and the number of cookies consumed in reaching the daily fat maximum would be about 29.
- The percent daily values are based on a diet of how many calories? (*2000*) Where do you find this information? (*table near the bottom*) If the number of recommended calories for your diet is 2200, do you think you could eat more grams of fat than the 65g recommended for the 2000 calorie diet and still have a healthful diet? (*Yes, 30% of 2200 calories is about 73 grams of fat. Students will learn later how to determine such values.*)

Student Activity

Give each pair of students a nutrition facts label (or a photocopied label) from a food product—preferably different labels to different pairs. Have each pair work together to create a set of questions similar to those discussed as a class for the Thin Mints. (You might want to designate a range, e.g., 5-10 questions, the specific number depending on the complexity of the questions and the number of subquestions within each.) When finished, each pair should exchange their label and questions with another (designated) pair. Each pair should work together—preferably using a calculator—to answer the other pair's questions on paper. The pairs should then exchange the label/questions/answers for the original pair to assess the other's work, afterwards

returning the work to the pair who completed it and discussing errors/disagreements as needed.

Tell students that they should be prepared to discuss afterwards difficulties encountered while doing the activity, confusion experienced, interesting findings, and so forth. Students might be asked to write some of these on paper while they are waiting for their designated exchange pair to complete work and/or after they finish the activity.

Closing Discussion

Conduct an open-ended class discussion about the previous activity. Have students share some questions they asked or were asked that differed from the type asked in the class discussion that preceded the activity. You might want to examine the methods used (and others that could have been used) to answer particular questions. Also address such items as:

- difficulties encountered
- areas of confusion
- interesting findings

Nutrition Facts

Serving Size 4 cookies (31g)
Servings Per Container about 9

Amount Per Serving

Calories 160	Calories from Fat 80
	% Daily Value*
Total Fat 9g	**13%**
Saturated Fat 6g	**28%**
Cholesterol 0mg	**0%**
Sodium 140mg	**6%**
Total Carbohydrate 20g	**7%**
Dietary Fiber 1g	**5%**
Sugars 11g	
Protein 1g	

Vitamin A 0% • Vitamin C 0%

Calcium 0% • Iron 2%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

INGREDIENTS: ENRICHED FLOUR (WHEAT FLOUR, NIACIN, REDUCED IRON, THIAMINE MONONITRATE, RIBOFLAVIN), SUGAR, VEGETABLE SHORTENING (CONTAINS ONE OR MORE OF THE FOLLOWING PARTIALLY HYDROGENATED OILS: PALM KERNEL, SOYBEAN, COTTONSEED), COCOA (PROCESSED WITH ALKALI), CARAMEL COLOR, LEAVENING (SODIUM BICARBONATE, MONOCALCIUM PHOSPHATE, AMMONIUM BICARBONATE), HIGH FRUCTOSE CORN SYRUP, SALT, WHEY, SOY LECITHIN (EMULSIFIER), PEPPERMINT OIL, NATURAL AND ARTIFICIAL FLAVOR

Activity 2: Graphing
Teacher Copy

Materials

transparencies of Reference Sheets R2 pages 1-5

Activity Summary: Students will learn to read and construct bar, line, and circle (pie) graphs, including double and triple bar and line graphs, in learning about the Food Guide Pyramid, recommended daily food servings for various categories of people, and proportions of protein, carbohydrates, and fat that comprise a healthful diet. Use with S2 and R2.

Objectives

- To read and construct single, double, and triple bar graphs.
- To read and construct single, double, and triple line graphs.
- To read and construct circle (pie) graphs.
- To become familiar with the Food Guide Pyramid and the recommended daily food servings for various categories of people.
- To become familiar with the recommended daily proportions of protein, carbohydrates, and fat that comprise a healthful diet.

Introduction

Tell students that being able to read, interpret, and make various types of graphs is useful for both acquiring and presenting many different types of information. In this unit they will work with graphs while learning more about nutrition.

Tell students that they will first look at data displayed in picture form—the Food Guide Pyramid. Ask:

- Who has heard of the Food Guide Pyramid? What is it? (*It is a chart prepared by the U.S. Department of Agriculture and the U.S. Department of Health and Human Services that names food categories and tells what proportion of the daily diet each should comprise.*) What did it replace in recent years? (*the "four food groups"*)

Show a transparency of **Reference Sheet R2 p. 1**.

- Which food group makes up the largest proportion of a good daily diet? (*breads/grains*) the smallest? (*fats/sweets*)

You might want to ask students to name a few foods from each food group and/or list some foods for students to name the food group to which each belongs.

- How do you think the "typical" American diet compares to the pyramid? (*probably includes more food from the fats/sweets and meat groups and less from the lower levels than is recommended*)
- What do you think a food pyramid of your daily diet would look like?
- Why do you think there is a range listed in the number of servings recommended within each food group? (*Upper and lower limits show that there is a bit of flexibility in some cases in number of servings included from a group but mainly serve to include the different types of diets needed by different people, as dictated by age, height, body frame size, body composition [fat vs. muscle], activity level, gender, etc.*)

• What do you think counts as one serving of: bread (*1 slice*), ready-to-eat cereal (*1 ounce*), rice (*1/2 cup*), vegetable or fruit juice (*3/4 cup, or 6 ounces*), milk (*1 cup, or 8 ounces*), meat (*2-3 ounces of lean meat, poultry, or fish*)

Note that students should strive to become familiar with what constitutes one serving and to know what various measures of a food amount look like (e.g., 8 ounces of milk or 1/2 cup of rice). A dinner portion of spaghetti, for example, might account for 2-3 servings from the grain group.

Tell students they will be seeing the recommended daily food servings for women and some older adults in three graphical forms—bar, line, and circle. They will not only be asked to read some information from the graphs, but they should pay attention to appropriate uses for the different types of graphs and to which ones they think best suit particular data. Fats and sweets will not be included, because they should be used sparingly and they are not assigned a designated number of daily servings. Show students a transparency of **Reference Sheet R2 p. 2**. Note that this is typically called a *bar graph*, although it might also be called a *column graph* (usually on computer graphing software) because the bars are vertical. Ask:

• From which food group should the fewest number of servings come? (*fruit; meat*)
• How many servings of vegetables are recommended? (*3*)
• Besides the labels along the x (horizontal) and y (vertical) axes, what purpose do the other three labels (sets of words) serve? (*The top one is the title that tells what the graph is displaying, the one on the left tells what the numbers by the tick marks on the y axis stand for, and the bottom label similarly categorizes the terms along the x axis.*)
• What types of information do you think a bar graph is especially effective for showing? (*the relative amounts/sizes of a set of items that may or may not constitute a whole*)
• Could the labels along the x and y axes be reversed (all labeling on left exchanged with all labeling along the bottom)? (*Yes; display R2 p. 3 to illustrate.*)

Show a transparency of **Reference Sheet R2 p. 3**. Tell students that this is also called a bar graph, but that the bars are horizontal. Ask them which type of bar graph they liked better and why.

Show a transparency of **Reference Sheet R2 p. 4**. Tell students that this is called a *line graph*, because it connects plotted points with a line (line segments). Ask:

• How is this graph like the bar graph? (*Both have a rectangular format created by use of an x and a y axis. Both employ similar labeling, and the key data is found where the pertinent x and y descriptors/values meet. Both employ length in reaching a graphed value.*) How is it different? (*The values for each column are represented only by a point rather than by a thick bar that extends along its entire length, and plotted data are connected with adjacent data.*)

• What types of information do you think a line graph is especially effective for showing? (*values over a period of time*)

Show a transparency of **Reference Sheet R2 p. 5**. Tell students this is called a *circle graph*, although it is also called a *pie graph* or *pie chart* (for the obvious reason that it resembles a pie cut into pieces). Ask:

• How is this graph like either or both of the other two graphs? (*Displays the same information graphically; shows values in a relative manner, which especially compares to the bar graph.*) How is it different? (*It is circular rather than rectangular; it does not have two different sets of labels that are set up along axes; data is displayed as fractional parts of a single whole.*)

• What types of information do you think a circle graph is especially effective for showing? (*fractional parts or relative proportions of a single whole*)

Ask students which of the three types of graphs—bar, line, or circle—they think is most suited to representing the daily food servings information they saw. (*Although all display the data accurately, the bar graph is probably the most appropriate, because it shows numerical information in relative proportions particularly well, the values are not necessarily part of a single whole, and the information displayed is not showing data across time. The circle graph might be okay, too, since it nicely displays relative proportions. However, individual numbers—number of servings, which is important for this particular information—cannot be determined from the circle graph from the graphical representation; they must be stated through labeling. Further, the circle graph, which represents a whole, implies that no other foods comprise the diet—precluding the possibility of fats and sweets, which are absent but not necessarily precluded in the other two graphs.*)

Have students work in pairs or small groups to complete Parts A and B.

Note that students will need to use a compass (to draw circles and mark their centers) and a protractor (to measure in degrees and mark off sections on circles) in Part B #3. Be prepared to give much guidance during this time, or teach or review these prerequisite skills before attempting the activity.

Answer Key

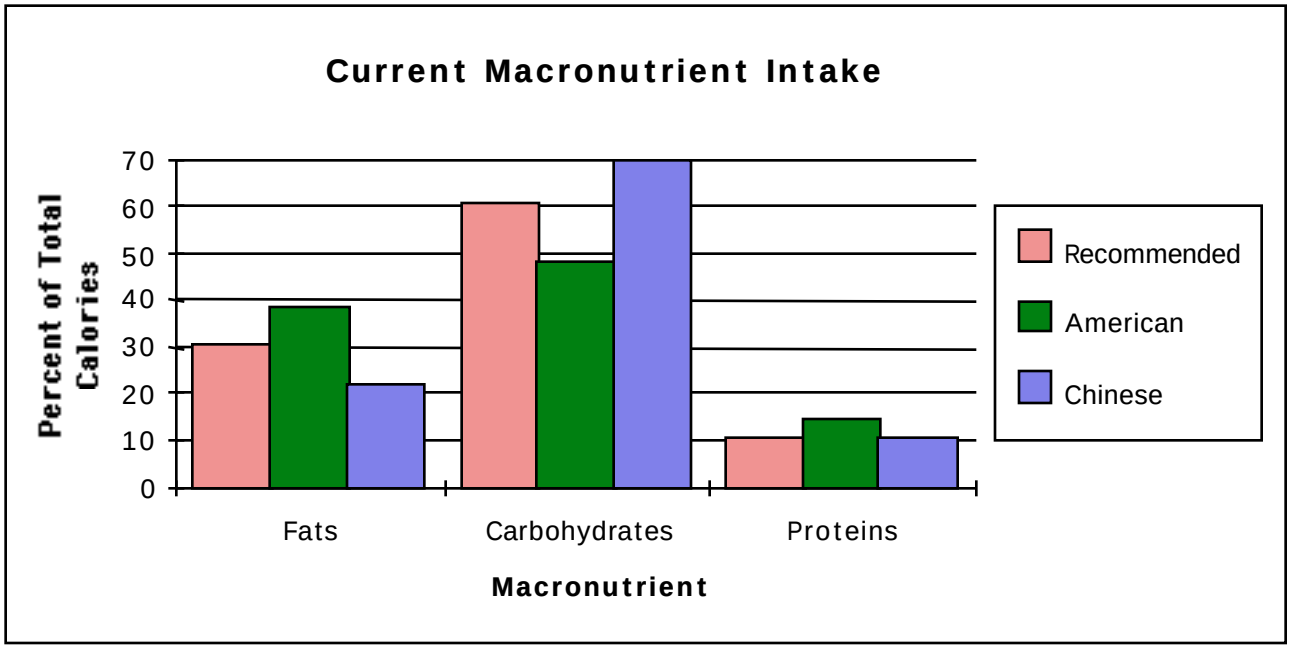
Part A

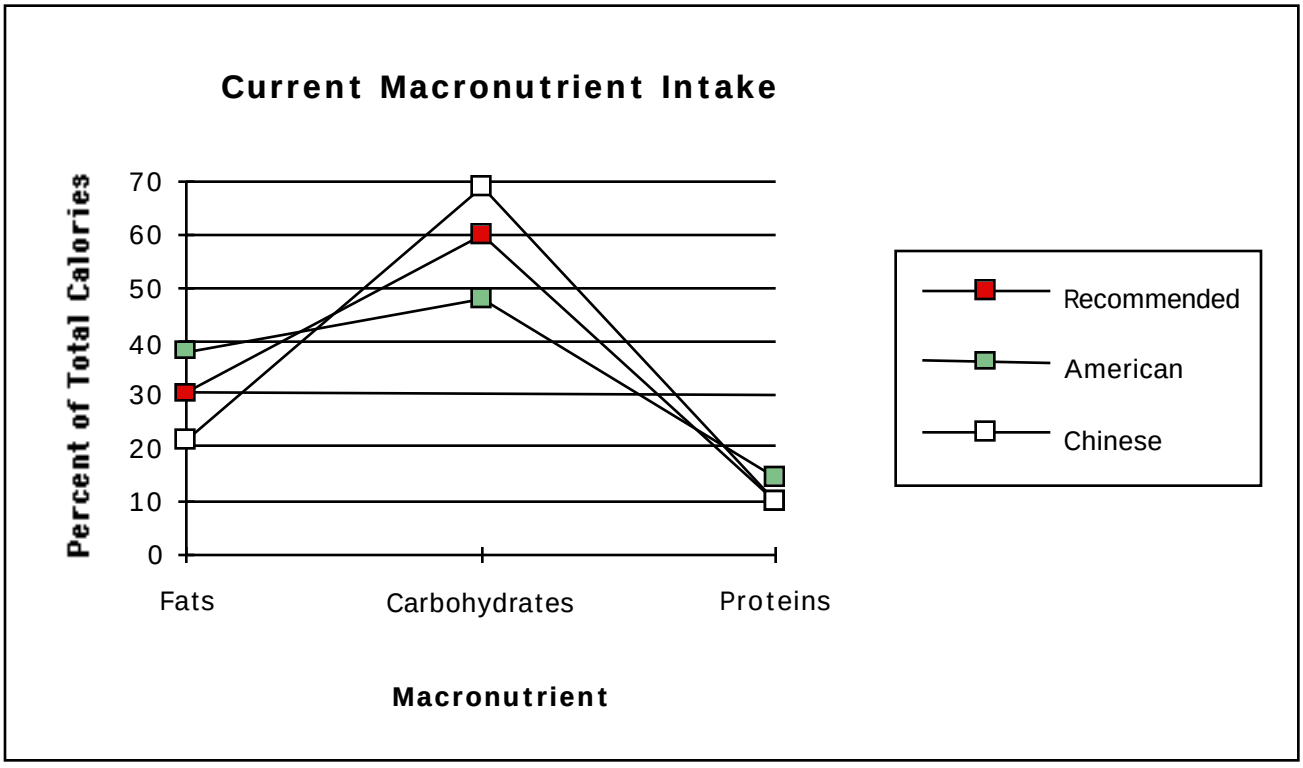
1. A. *The bars are grouped in pairs with each of the two bars representing (in a consistent manner) the same type of information for a different category.*
   B. *Two (for a total of 6 oz.)*
   C. *Fruit—girls, milk—girls and boys, meat—boys*
2. A. *A double line graph*
   B. *Two servings*
   C. *Milk*
3. A. *A legend (or key)—an explanatory list of the symbols on a map or chart*
   B. *Maps...*
4. *Because each of the two sets of information—girls, boys—is a separate complete entity, and a circle graph can only show one "whole" at a time.*
5. *Probably Figure 1, the bar graph, because the adjacent bars nicely show direct girl-boy comparisons, and the full length shown for each bar gives a better sense of the relative size of the values than is gained by looking at single points. Also see the discussion following the last bullet on T2 p. 3.*

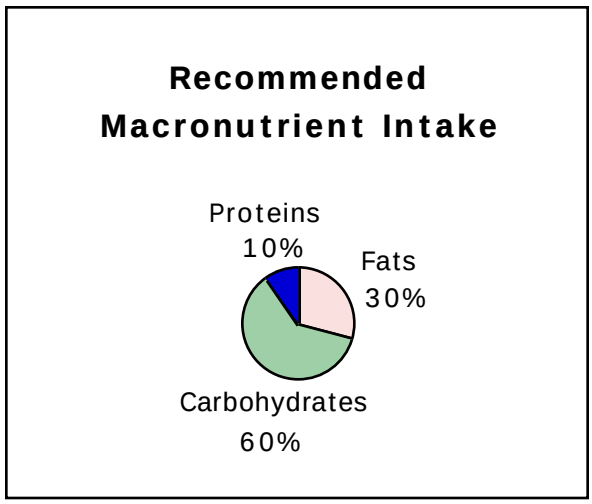
Part C

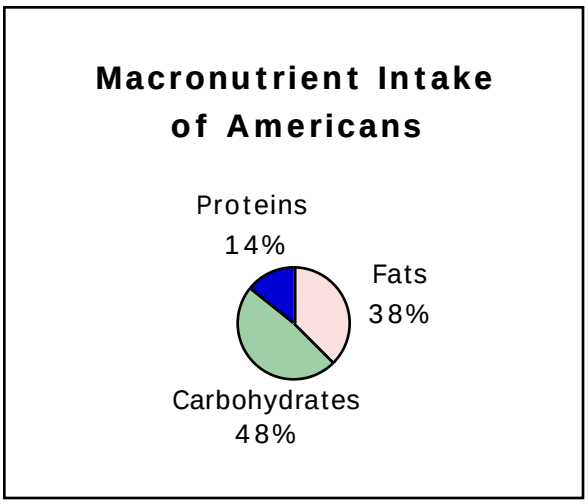
1. A. *360°*
   B. *fraction—$^{1}/_{2}$, percent—50%, # of degrees—180°*
   C. *fraction—$^{1}/_{4}$, percent—25%, # of degrees—90°*
   D. *fraction—$^{1}/_{3}$, percent—33 $^{1}/_{3}$% ($33.\overline{3}$ %), # of degrees—120°*
2. A. *Equivalent fractions: $^{30}/_{120} = {}^{1}/_{4}$ (divide both terms of fraction by greatest common factor); four 30s in 120 means four equal parts, of which 30 is one (and so forth)*
   B. *Equivalent fractions: $^{30}/_{120} = {}^{1}/_{4} = {}^{25}/_{100}$ = 25%; division to the nearest hundredth (30 ÷ 120, or dividing the numerator of any fraction equivalent to $^{30}/_{120}$ by its denominator)*
   C. *Proportion: $^{30}/_{120} = {}^{x}/_{360}$; division: 360 ÷ 120 to find how many degrees each number in the 120 represents, then multiplying that times the number of units of interest (each unit of the 120 is "worth" 3 degrees, so 30 times 3 degrees each is 90 degrees)—in other words, "inflating" both numbers to put them on a scale in 360ths (essentially, finding a proportion).*

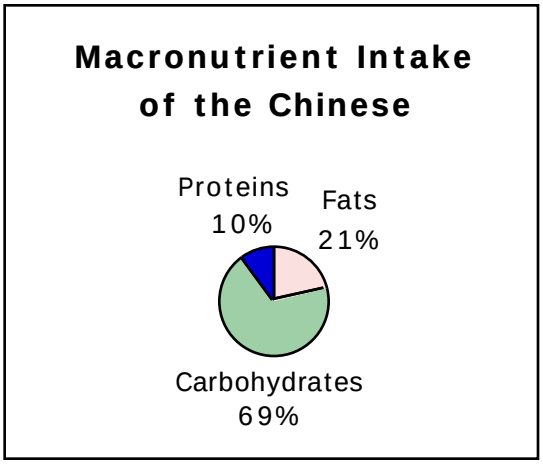
3. Elicit names of first two types of graph: triple bar graph; triple line graph.











4. *Use decimal form of percent and multiply it times 360, as in 64% of the circle would be 230.4° (0.64 x 360); use equivalent fractions or proportions after converting a percent to its fraction form (see earlier explanations, as in #2B).*
5. *Probably the bar graph for the same reasons given in Part A #5, although other answers may be reasonable.*
6. *Proteins*
7. *Chinese, because if any proportions are to deviate from those that are recommended, it is better to be lower in fats and higher in carbohydrates than the reverse.*

8.

	a value of 0	**a negative number**
Bar Graph	no bar shows beyond axis	bar goes below x axis for vertical bars, left of y axis for horizontal bars
Line Graph	point is on x axis	point goes below x axis
Circle Graph	can't be shown	can't be shown

Materials

rulers
Reference Sheets R2 pages 6-7
protractors
mechanical compasses
graph paper

Part A

Use **Reference Sheet R2 p. 6** to answer items 1 and 2.

1. A. Figure 1 is called a *double bar graph*. How does it differ from a single bar graph? What does it show? _____
   _____
   _____
   _____
   _____

   B. How many servings of meat are recommended for girls? _____

   C. In what food groups and for whom is 3 servings of a food recommended?
   _____

2. A. What do you think the graph in Figure 2 is called? _____
   _____

   B. What is the difference between the number of servings of grain recommended for girls and for boys? _____

   C. From what food group is it recommended that boys and girls get the same number of servings? _____

3. A. What is the box on the right side called, and what purpose does it serve?
   _____
   _____
   _____

   B. Have you seen one of these (see A) before? If so, where? _____
   _____

Note that in both graphs on Reference Sheet R2 p. 6 different patterns are used for the bars or boxes used to distinguish between the two types of information (girls and boys). These may also be distinguished by using different colors for each. Also, in the case of the line graph, different types of lines (e.g., solid, dotted, dashed/broken) may be used to represent different things.

4. Look at Figures 3 and 4 on **Reference Sheet R2 p. 7**. Why does it take two graphs to show what each graph on R2 p. 6 shows within a single graph?

   _____

   _____

   _____

   _____

5. Which of the three types of graphs on R2 pages 6-7 do you think is best for representing the recommended daily food servings for teenage boys and girls, and why? _____

   _____

   _____

   _____

   _____

Note that the recommended daily servings information provides rough estimates that can vary widely among individuals in a category, depending on various factors such as height and activity level. The guidelines for teenage girls also serves as a basic guideline for children, active women, and most men. The guidelines for active men is the same as for teenage boys.

Part B

Read and become familiar with the following information, which will help you to better understand and appreciate the information and activities that follow.

macronutrients: fat, carbohydrates, and protein. These nutrients have the prefix "macro-" ("large") because they are the only three nutrients that we need in relatively large amounts and which, almost exclusively, provide the energy we need.

fats: most concentrated source of energy; excess fat intake has been associated with heart disease and other adverse health effects.

carbohydrates: most readily available source of food energy; includes sugars and starches; cannot be stored in large amounts in the body; cheapest source of energy and hence a high percentage of food source for poorer nations.

protein: needed for growth and repair of body tissue; many protein-rich foods naturally include fat stores; extra protein doesn't turn into muscle—it is used for energy or turned into fat.

Part C

1. A. How many degrees are in a circle? _____

   If you made a circle graph to show the composition of a food using percents, how much of the circle would you shade to represent fat if fat accounted for:

   B. 60 out of 120 calories in one serving of the food?

   fraction: _____ percent: _____ # of degrees: _____

   C. 30 out of 120 calories in one serving of the food?

   fraction: _____ percent: _____ # of degrees: _____

   D. 40 out of 120 calories in one serving of the food?

   fraction: _____ percent: _____ # of degrees: _____

2. Explain as many different methods as you can think of for finding each value above (use back of sheet if needed):

   A. fraction _____

   _____

   _____

   _____

   B. percent _____

   _____

   _____

   _____

   C. # of degrees _____

   _____

   _____

   _____

   Be sure that you understand the information in letter B before moving on. Also, be sure that you know how to use a protractor. You will need these concepts/skills to complete the next item.

3. Make a bar, a line, and a circle graph that shows the information in the table that follows. Include all information for each of the three types of graphs on a single graph where possible. Compare your graphs to those on Reference Sheets R6-7 to be sure that you are including all important parts. Note that some of the data in the table represent "middle numbers" that fall within a range of different values that come from consulting various sources for the given information. Current fat intake in the American diet is the most variable value, which depends on how the information was

gathered, by whom, and in what year. Also, American fat intake is listed in many different resources, whereas the other two pieces of data cannot be found nearly as often. In different sources the percent calories from fat for the American diet ranges from 34% to 42^{+}%. Some sources also list the recommended carbohydrate proportion at slightly lower values and the protein proportion at slightly higher values than those shown.

Current Macronutrient Intake as a Percent of Total Calories

	Recommended*	American	Chinese
Fats	30%	38%	21%
Carbohydrates	60%	48%	69%
Proteins	10%	14%	10%

*Recommended percentages are to be reached by considering nutrient intake across different foods within a day (in a complementary sense), rather than within single foods, and the percentages can even out to some degree over consecutive days. For example, you might eat a food that is 40% fat then one that is 20% fat, and so forth. Try to get the various foods you eat in a day and over a few days to balance out to the recommended percents listed for the macronutrients in the chart (it is unlikely that the percents will be distributed in that proportion for individual foods you eat). Also, other considerations are important in planning a healthful diet, such as a food's total calories, micronutrient values (vitamins, minerals, trace elements), and ingredients such as food additives (although the perceived detrimental effects of these is debated).

4. Explain two or more ways to determine what size (how many degrees) to make each section on a circle graph when you are working with proportions in the form of percents. _____
_____
_____
_____
_____
_____
_____
_____
_____
_____

5. Which of your three types of graphs do you think best represents the data? Why? _____
   _____
   _____
   _____

6. Which macronutrient is the most consistent in terms of intake across the three categories? _____

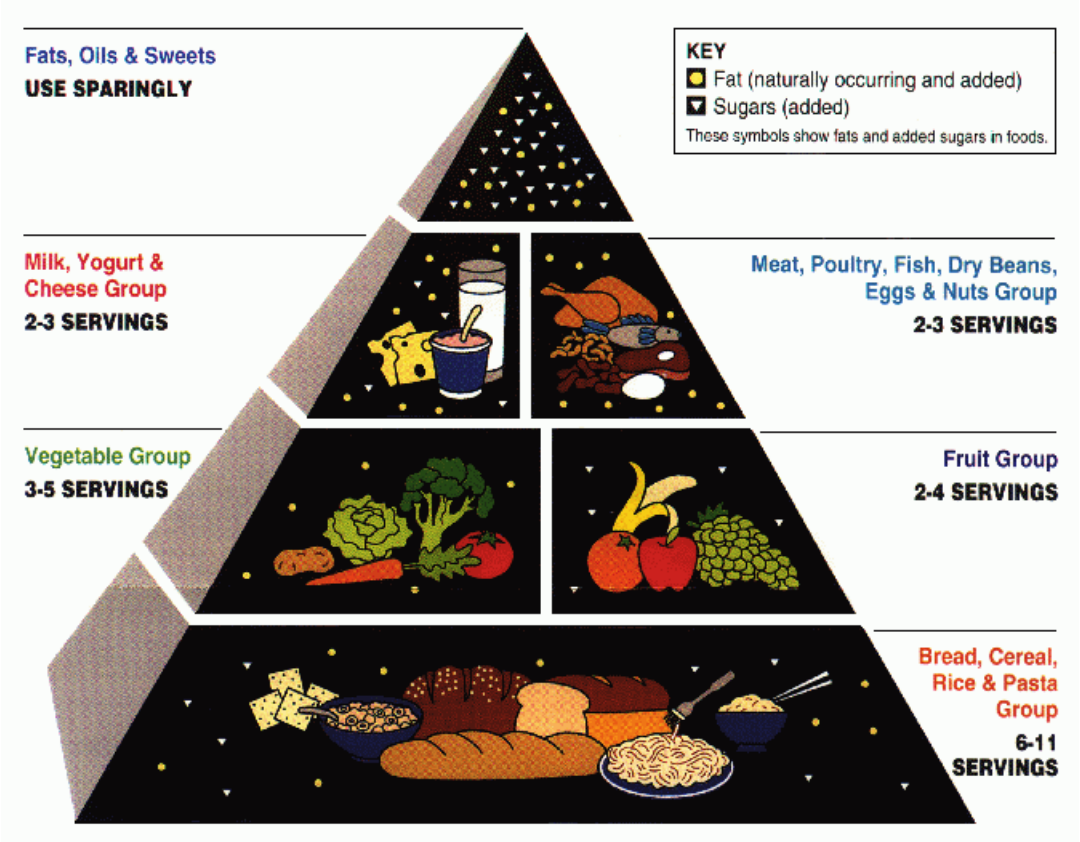
7. Do you think the American or Chinese diet is more healthful? Explain why. _____
   _____
   _____
   _____

Extension/Follow-Up

Complete the chart that follows to tell how you would show each of the listed values for an item on each type of graph named (you may include drawings).

	a value of 0	**a negative number**
Bar Graph		
Line Graph		
Circle Graph		

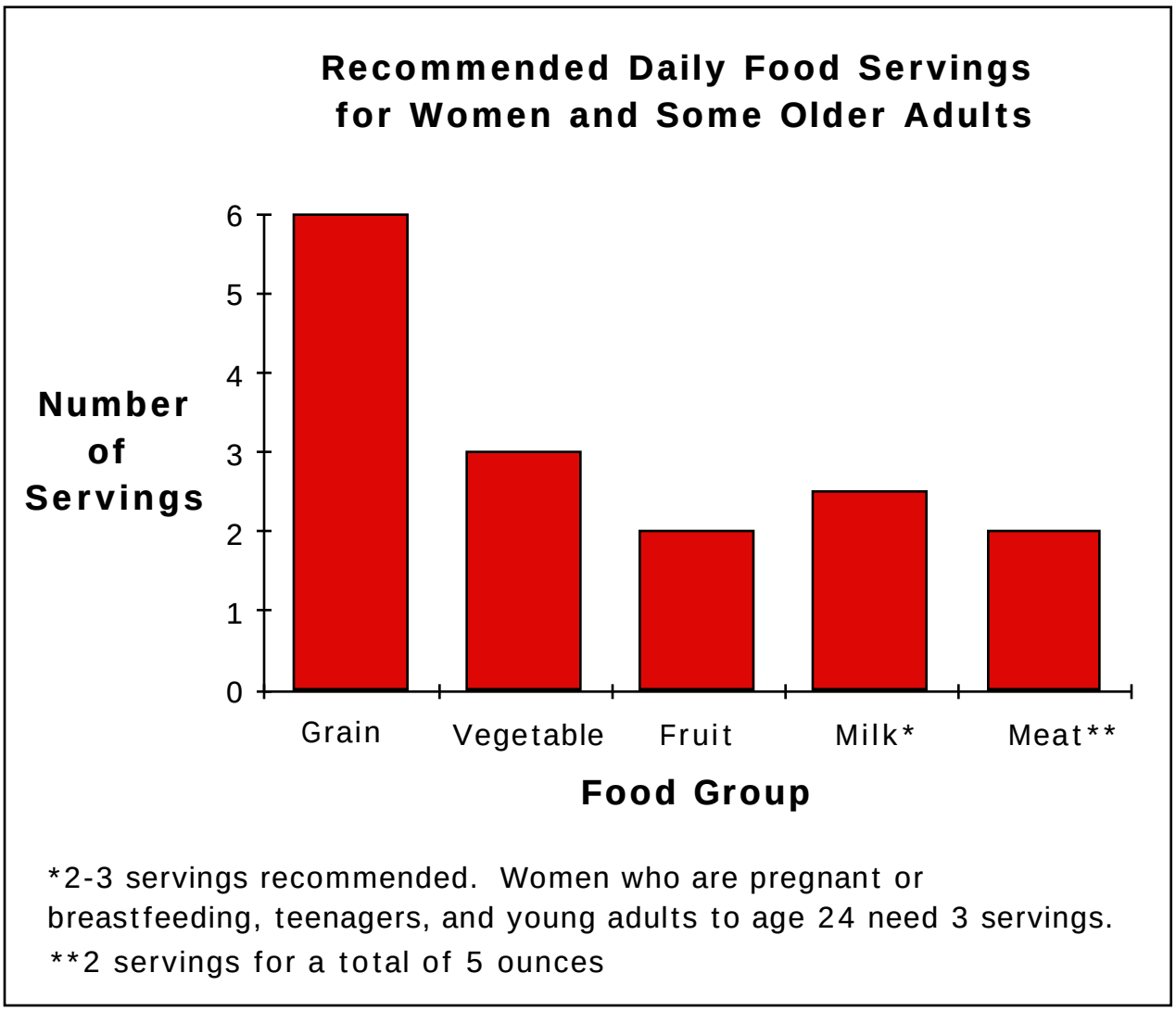
FOOD GUIDE PYRAMID
A guide to Daily Food Choices



Daily Food Servings as Recommended in the Food Guide Pyramid

(U.S. Dept. of Agriculture / U.S. Dept. of Health and Human Services)

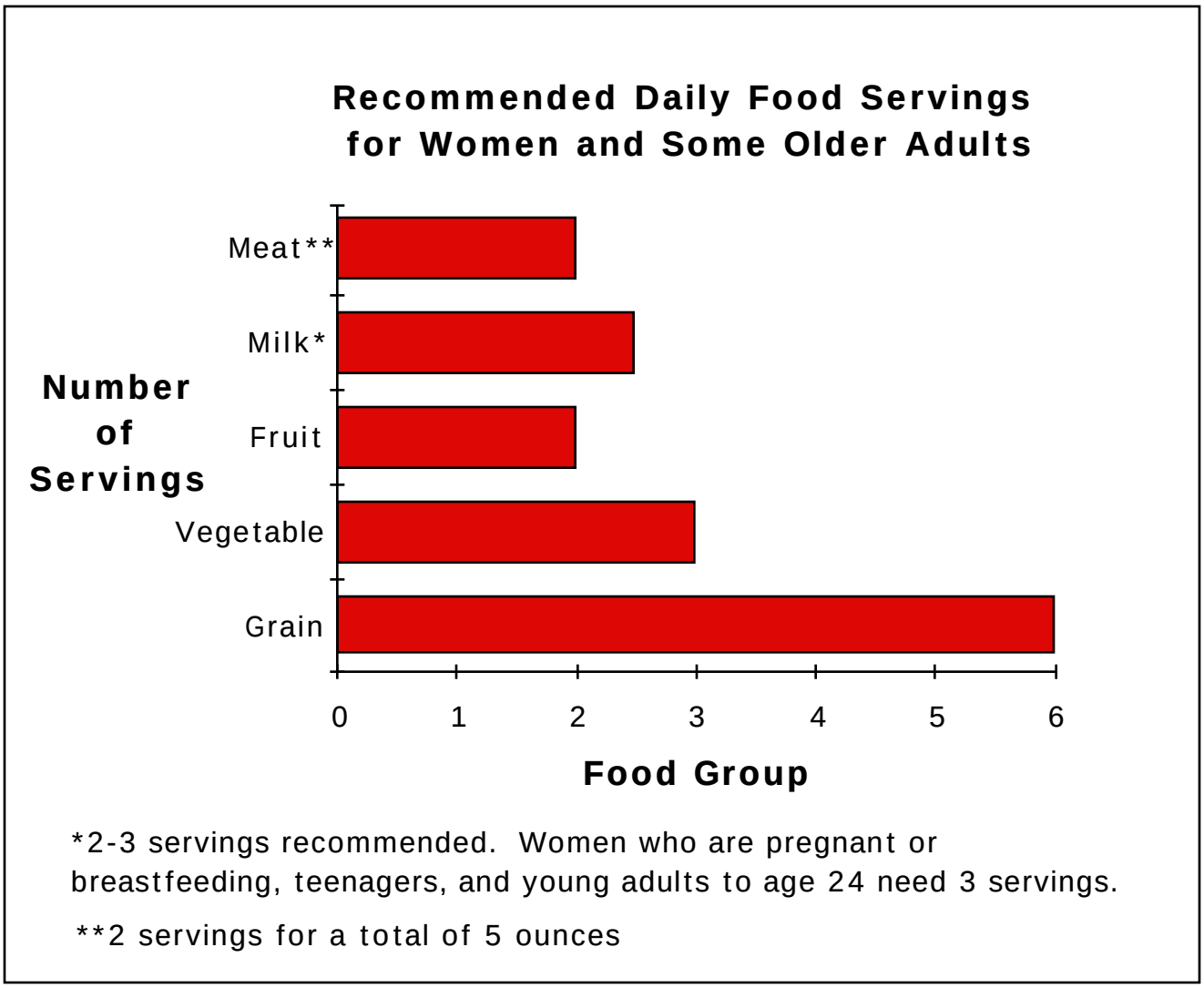
Bar Graph (Column Graph)



Daily Food Servings as Recommended in the Food Guide Pyramid

(U.S. Dept. of Agriculture / U.S. Dept. of Health and Human Services)

Bar Graph



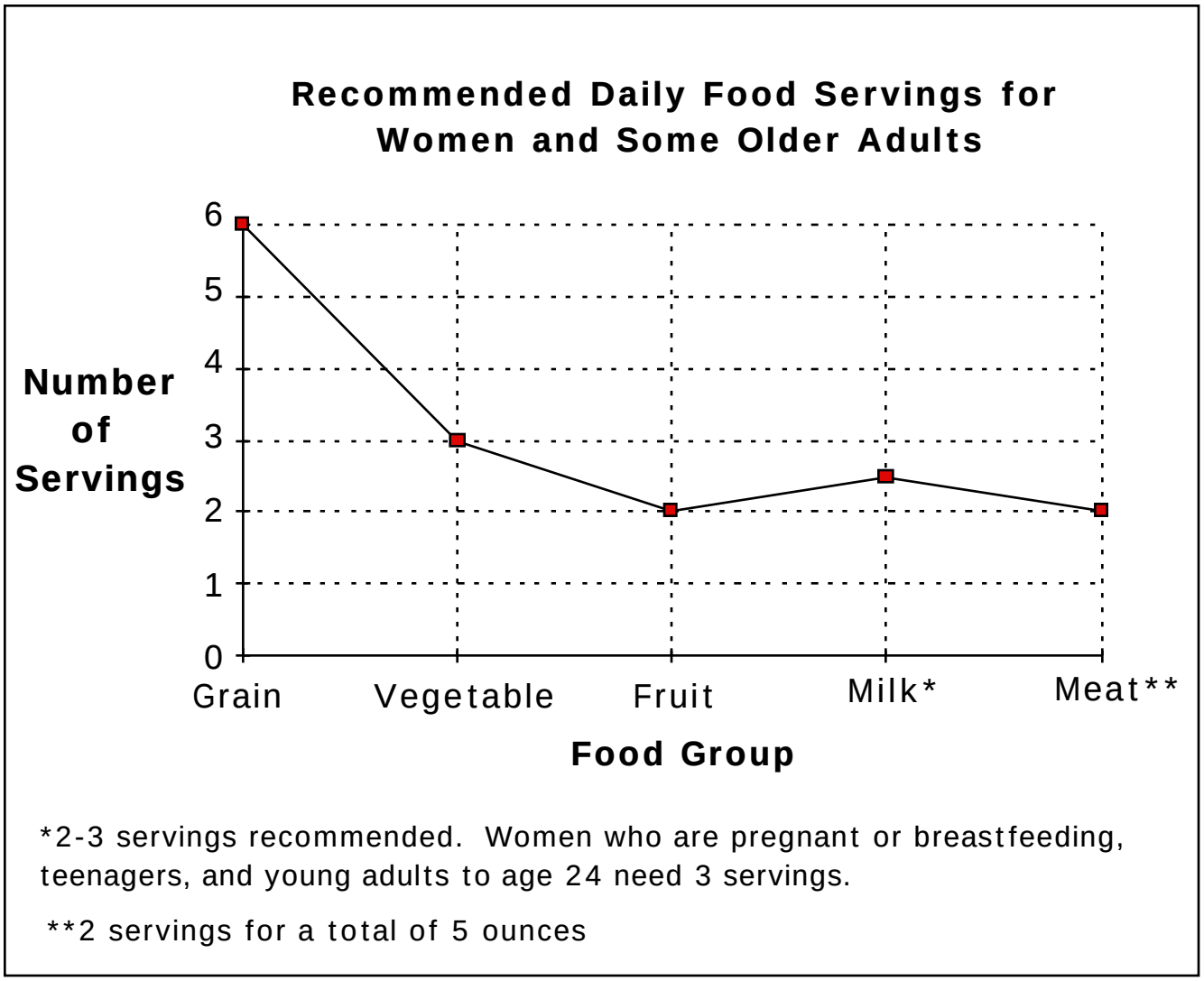
*2-3 servings recommended. Women who are pregnant or breastfeeding, teenagers, and young adults to age 24 need 3 servings.

**2 servings for a total of 5 ounces

Daily Food Servings as Recommended in the Food Guide Pyramid

(U.S. Dept. of Agriculture / U.S. Dept. of Health and Human Services)

Line Graph



*2-3 servings recommended. Women who are pregnant or breastfeeding, teenagers, and young adults to age 24 need 3 servings.

**2 servings for a total of 5 ounces

Daily Food Servings as Recommended in the Food Guide Pyramid

(U.S. Dept. of Agriculture / U.S. Dept. of Health and Human Services)

Circle Graph (also called Pie Graph or Pie Chart)

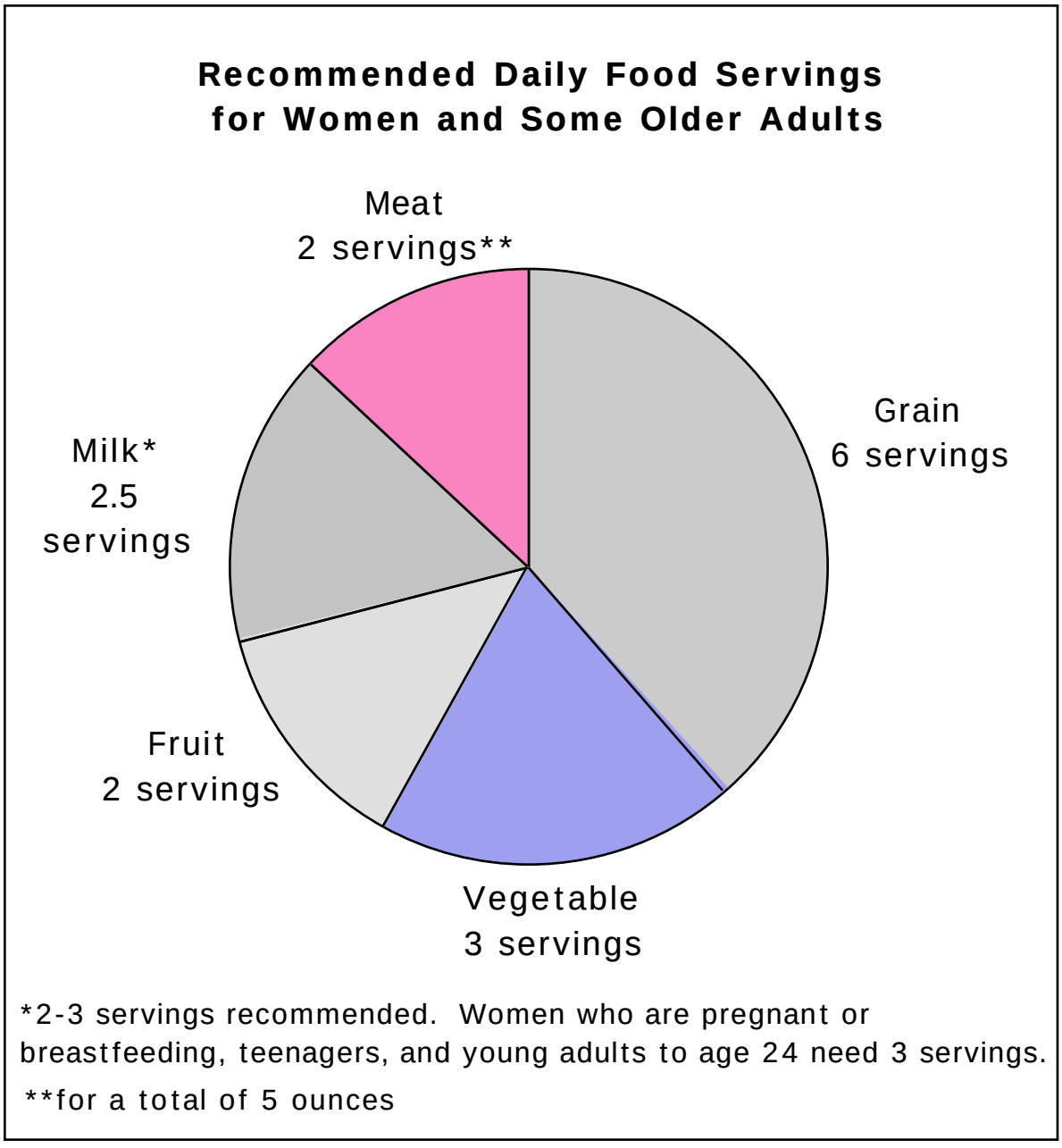


Figure 1

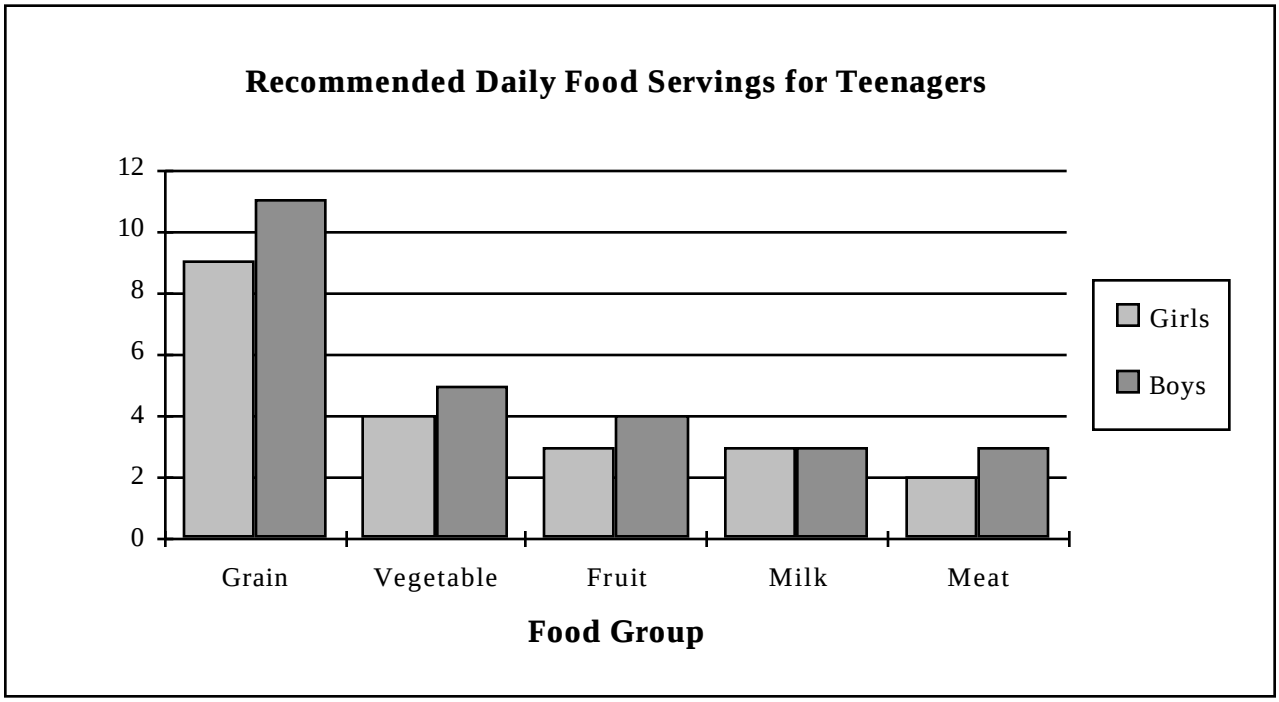


Figure 2

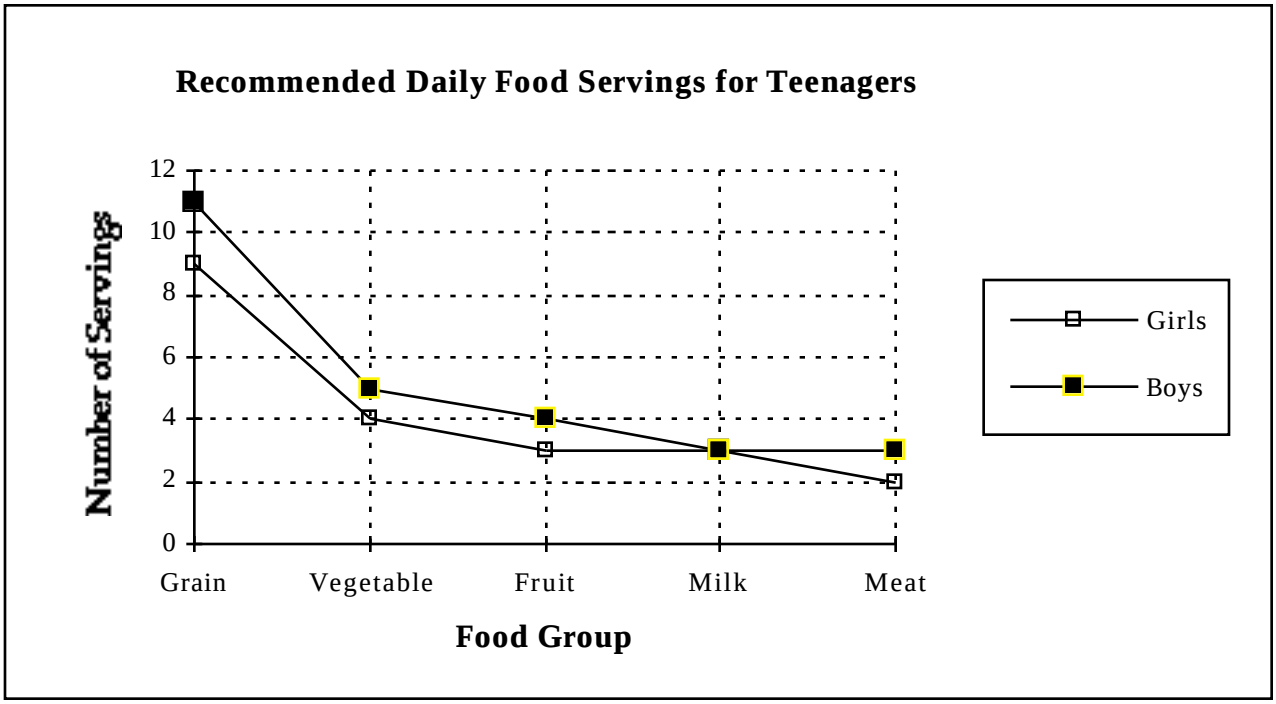


Figure 3

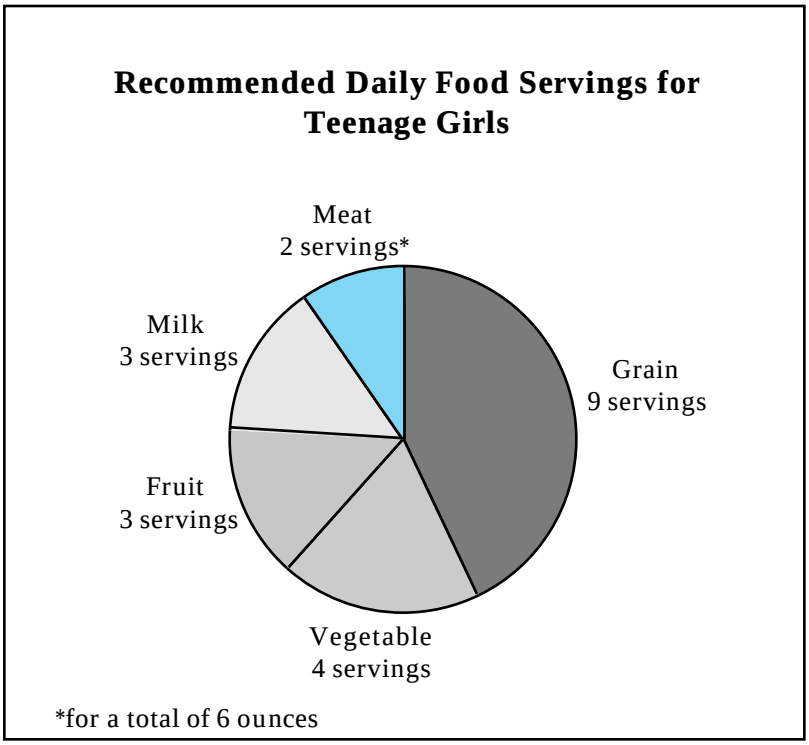
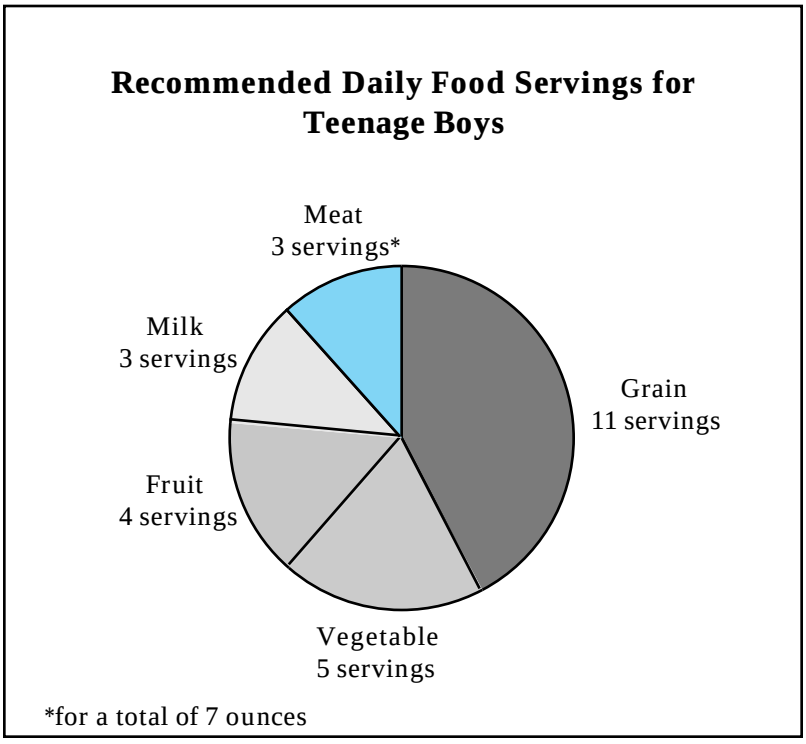


Figure 4



Materials

Reference Sheet R3 page 1 [optional]

Activity Summary: Students will examine various concepts of percent while extending their understanding of percent daily intake of protein, carbohydrates, and fat and examining nutrition information for various food products. Use with S3 and R3.

Objectives

- To know the meaning of percent and be able to represent a percent in percent, fraction, and decimal forms.
- To informally find any of three missing values in a percent problem, such as a% of b =c.
- To become familiar with percents greater than 100%.
- To find the percent calories from fat, carbohydrates, and protein in a food product.
- To determine percent daily values for fat and carbohydrates.

Introduction

[Notes: It might be best to have students use paper and pencil as needed for this portion of the activity and to provide calculators when they work on their own on the student sheets. If students ask about the meaning of %DV, you might just tell them that it will be addressed later.]

Ask students to tell you everything they know about percent. Note that percent literally means "by the hundred," and you might want to ask students where else they have seen "cent" used in association with "hundred." (*cents as parts of a dollar, century, centennial, centimeter, centigrade*)

Ask students to state the maximum percent of a person's daily calories that should come from fat (*30%—learned in last activity*). Mention that some people, for health or weight-loss purposes, attempt to limit fat intake to even less (e.g., 20%). Ask students to explain what 30% of something means. Ask questions such as those below, if they are not raised otherwise. Have students explain their thinking in words and/or drawings, and elicit multiple approaches where possible. You and/or volunteer students might want to illustrate answers to selected questions on a transparency of **Reference Sheet R3 p. 1**.

- 30% means how many parts out of every 100 equal parts? (*30; literally "30 by the hundred" or "30 per hundred"*) What fraction is this equal to (ask for both original and simplified forms if students don't offer them)? ($^{30}/_{100}$; $^{3}/_{10}$) Is 30% of something greater or less than $^{1}/_{4}$ of it? (*greater*) How do you know? ($^{1}/_{4}$ *of something is 25% of it because the equivalent fraction on a scale of 100 is* $^{25}/_{100}$*, or 25 out of every 100 equal parts, which is less than 30 out of 100*) Is it greater or less than $^{1}/_{3}$? (Explain.) (*less, because* $^{1}/_{3}$ *of something is* $33.\overline{3}$ *% of it because the equivalent fraction on a scale of 100 is* $33.\overline{3}/100$ *, or*

$33.\overline{3}$ *out of every 100 equal parts, which is more than 30 out of 100* [*you might want to use 33 $^{1}/_{3}$ or 33.3 (rounded) in place of* $33.\overline{3}$])

- 30% means how many parts out of every 10 equal parts? (*3, because 30 units out of 100 units on a 10 x 10 hundred chart is the same as 3 rows out of 10, and the fraction $^{30}/_{100}$ is equivalent to $^{3}/_{10}$*) Thinking proportionally or in terms of equivalent fractions, you can determine that 30% means how many parts out of 200? (*60—Since 30% is 30 parts out of each 100 parts, then there are 30 parts for each of the two hundreds; $^{30}/_{100} = {}^{60}/_{200}$.*) What is 30% of 50? (*15—Since 30% of 100 is 30, then 30% of half that number is half of 30; three out of every ten units means 15 because 50 has five groups of ten; $^{30}/_{100} = {}^{15}/_{50}$.*) What is 30% of 150? (*45—Add 30 [30% of 100] and 15 [30% of 50] or use any other types of reasoning explained previously*.)
- What does 30% look like in decimal form? (*0.30, i.e., $^{30}/_{100}$*)
- Campbell's Chicken Gumbo condensed soup has 15 calories from fat in one serving, which is 60 calories. What percent fat is that? (*25%; explore/work through many methods, but particularly emphasize the first two of the following three sample solutions (use of equivalent fractions, and division to the nearest hundredth): $^{15}/_{60}$ (i.e., 15 out of 60 calories) is equivalent to $^{1}/_{4}$, which we know from the previous discussion is 25%; $^{15}/_{60}$ reads from top down "15 divided by 60"—carry out the division to the hundredths place [or round to the hundredths place as needed either after dividing to the thousandths or by considering the fractional part remaining after dividing to hundredths]; set up a proportion to find the percent, which must always relate to one hundred—$^{15}/_{60} = {}^{x}/_{100}$*) Note that the fat calories fall below the 30% maximum, but Campbell's soups are too high in sodium according to recommended measures of a good diet.
- Frito Lay's potato chips have 60% calories from fat (twice the recommended maximum!). There are 150 calories in one serving (1 oz.). How many calories from fat do the chips have? (*90; the question becomes "What is 60% of 150?," which is found by either using the decimal form of 60% [0.60 or 0.6] or the fraction form [$^{60}/_{100}$, $^{6}/_{10}$, or $^{3}/_{5}$] times 150 [again, setting up proportions for such problems will also work]*)
- Mr. Turkey turkey bacon has 60% of its calories from fat (imagine the fat in beef and pork bacon!), which accounts for 15 calories in every serving (1 slice). How many calories are in one serving? (*25; the problem can be stated as "60% of what is 15 calories?" [0.6(0) x ___ = 15] or "15 is 60% of what?" [15 = 0.6 x ___], which is solved by the problem 15 ÷ 0.6(0). You might want to refer students to a simpler example to illustrate why the method works: 4 x ___ = 36 can be solved by the problem 36 ÷ 4. Students might also use a knowledge of proportions or formal or informal reasoning that uses fractions in their solutions.*)
- Tell students that Land O' Lakes Sweet Cream Butter has 100 calories per serving (1 tablespoon) and that 100 calories per serving are from fat. Ask what percent of calories is from fat. (*100%*) Have them explain what 100%

means. (*all of a designated whole*) Ask if it's possible to have more than 100% calories from fat, and why/why not. (*No, there can't be more calories from fat than the total number of calories that are in the product*.) What does it mean to say that a person gave 110% for some effort that she or he made, and is that possible? (*No, a person cannot give more than 100% effort, which is—theoretically—the maximum amount she or he has to give. It is a saying meant to indicate that someone has exerted a tremendous effort*.) Is it possible to ever have more than 100% of something? (*Yes*) When? (*When a whole or total is capable of being exceeded, for example, if someone weighs 100 pounds and gains 15 pounds in one year. The person's weight is now 115% of the weight of one year before because it is now 100% [all] of the former whole—100 pounds—plus 15 percent more of the original 100%/whole. The percent increase is 15%*.) Have students find the percent increase for a change in diet from 2000 calories daily to 2200 calories daily and then give the percent that the new caloric intake is of the former one. (*The percent increase is 10%—2000 of the calories can be ignored because they represent no increase, but the 200 extra calories is $^{200}/_{2000}$, which is $^{1}/_{10}$ or 10%, of the original whole. The new calorie intake is 110% of the former one*.)

- One serving (2 slices) of Wonder Bread is 100 calories. The calories from fat in one serving is 15. How many calories are not from fat? (*85*) How do you know? (*Because 100 calories per serving is the total or whole, so 100 calories minus 15 calories leaves 85 calories that are accounted for by other nutrients*.) Explain the saying, "Success is 10% inspiration and 90% perspiration." (*It means that the total or whole of success—100%—results from a proportion of 10 of 100 equal parts ($^{10}/_{100}$, or $^{1}/_{10}$) inspiration and 90 of 100 equal parts ($^{90}/_{100}$, or $^{9}/_{10}$) perspiration (i.e., mostly from hard work!*).

Answer Key

Part A

1. A.
   - *Answers may vary; the actual answers are Harry and David Jumbo Cashews (74%), Hershey's Kisses with Almonds (57%), Frito-Lay Chee•tos (Crunchy) (53%), and Chunky Chips Ahoy! (50%), Country Club Neapolitan Ice Cream (46%), Little Debbie Granola Bars (Chocolate Chip) (38%), Low Sodium Triscuits (32%) [Ralston Chex Mix is at but not greater than 30%]*.
   - *Methods will vary but may include different types of mental computations or estimating by looking for calorie proportions that are about $^{1}/_{3}$ or greater of the calories per serving*.
   - *Answers may vary; the actual answers are Harry and David Jumbo Cashews (74%), Hershey's Kisses with Almonds (57%), Frito-Lay Chee•tos (Crunchy) (53%), and Chunky Chips Ahoy! (50%)*.
   - *Methods will vary but may include different types of mental computations or estimating by looking for calorie proportions that are about $^{1}/_{2}$ or greater of the calories per serving*.

- *Answers may vary; the actual answers are Harry and David Jumbo Cashews (74%) and Hershey's Kisses with Almonds (57%).*
- 1st part: *Answers may vary; the actual answers are Nabisco SnackWell's Devil's Food Cookie Cakes (0%) and Hostess Lights Low Fat Cup Cakes (10%).* 2nd part: *Answers may vary; the actual answers are Ralston Chex Mix (30%) and Low Sodium Triscuits (32%).*

B. A—*Ralston Chex Mix (Traditional): 30%*
B—Frito-Lay Chee•tos (Crunchy): 53%
C—Nabisco SnackWell's Devil's Food Cookie Cakes: 0%
D—Little Debbie Granola Bars (Chocolate Chip): 38%
E—Hershey's Kisses with Almonds: 57%
F—Hostess Lights Low Fat Cup Cakes: 10%
G—Chunky Chips Ahoy!: 50%
H—Country Club Neapolitan Ice Cream: 46%
I—Low Sodium Triscuits: 32%
J—Harry and David Jumbo Cashews: 74%

- *Answers will vary; see fourth bullet (regarding Campbell's Chicken Gumbo soup) in the Introduction for possible solution strategies.*

C. • *at least 70%*
• *47%*

D. *Rounding error accounts for such differences. Note that in this case the rounding rules for nutrition labels result in 0, .5, and .5 grams of fat for the three types of fat for a single cake, but the total fat for one is 1.5 grams. This means that the three numbers collectively must be rounded to 1.5 grams even though, individually, they (two or more) probably round down. For example, the first might actually be .2 grams, the second .6, and the third .5, which, when added, equal 1.3 and round to 1.5.*

It is probably best to work through and discuss Part A with students before moving on to Part B so that errors and misunderstandings in figuring percents as well as the notion of rounding error can be addressed before students reinforce or compound errors in the next section.

Part B

Note: Because of the fact that there are <u>about</u> and not <u>exactly</u> 9 calories in one gram of fat, further incongruencies (beyond rounding error as discussed in #'s 1D above and 1B below) can occur between figures on labels and those that students compute based on general nutrition guidelines. The same holds true for the calories per gram for other nutrients. As an example, note that for Post Raisin Bran (letter K on p. 4 of R3) 4 x 46 carbohydrate grams is 184 calories, 4 x 4 protein grams is 16 calories, and 10 calories from fat totals 210 calories, but the product lists only 190 calories per serving. Therefore, all percents figured computationally are approximate.

1. A. • *Yes, 5x 9 = 45 calories.*
   • *No, because 13 x 9 = 117, and the total calories is 120. Also accept "yes" answers by those who recognize that rounding error has occurred.*
   • *Same idea as the last bullet (7 x 9 = 63, but the total calories is 60...)*

   B. *Answer might be yes or no. See second bullet in #1A (rounding error). Grams listed are rounded to the nearest whole number. Even if the number was only rounded off by one or two tenths, this "error" is magnified 9 times when the rounded number is multiplied by 9.*
2. A. • *Possible answers include: Post Raisin Bran (K)—8%,Philadelphia Brand Cream Cheese (N)—8%, Kroger Yogurt (U)—13%, Prairie Farms French Onion Dip (P)—7%, Olde Tyme Whipping Cream (S)—less than 8% [Little Charlie's Pizza(P)—15%, Stove Top Stuffing (Q)—15%, Lender's Bagels (R)—15%*]
   • *Possible answers include: Post Raisin Bran (K)—97%, Thomas' English Muffins (L)—87%, Tropicana Orange Juice (M)—98%, Lender's Bagels (R)—78%, Healthy Choice Bean and Ham Soup (T)—76%, Kroger Yogurt (U)—74% [Stove Top Stuffing (Q) is 47% carbohydrate <u>as</u> <u>prepared</u>, which more important for health purposes than is the dry mix composition]*

   B.

Food	Carb (g)	Carb (cal)	Carb (% cal)	Pro (g)	Pro (cal)	Pro (% cal)
Raisin Bran	*46 g*	*184 cal*	*97 %*	*4 g*	*16 cal*	*8%*
Lender's Bagels (Plain)	*43 g*	*172 cal*	*78 %*	*8 g*	*32 cal*	*15 %*
Healthy Choice Bean & Ham Soup	*34 g*	*136 cal*	*76%*	*10 g*	*40 cal*	*22%*

3. Note: Because of errors such as those described in the note preceding #1 above, values supplied in missing blanks may differ somewhat from the actual values on the restaurants' nutrition fact sheets. Also, student answers may differ depending on their solutions. For example, for the Subway sub, the percent protein calories rounds down to 23% if figured by (37.73 x 4) ÷ 643.33 but is 25% if figured as the missing component to the other two percents in arriving at 100%. In cases that are dependent on method used, both answers are shown, or an acceptable range of answers.

Macronutrients: Percent Composition of Total Calories

Source: Nutrition charts provided by the listed restaurants

Food Item	Macronutrient/ Grams Per Serving	Total Calories (1 serving)	Percent of Total Calories
Subway: 12" Ham & Cheese Sub on White	• fat/***18*** g • carbos/80.59 g • protein/37.73 g	643.33 cal	• f: 25% • c: 50% • p: ***23 or 25***%
Taco Bell: Taco	• fat/11 g • carbos/not listed • protein/***10*** g	180 cal	• f: ***55***% • c: ***23***% • p: 22%
McDonald's: Big Mac	• fat/27 g • carbos/49 g • protein/24 g	***480 - 535*** cal (actual is 486 cal)	• f: 50% • c: 40% • p: 20%
Kentucky Fried Chicken: Drumstick (1), Extra Tasty Crispy	• fat/12 g • carbos/***6*** g • protein/14 g	190 cal	• f: ***57***% • c: 13% • p: 29%
Pizza Hut: Pan Pizza (2 slices med. cheese)	• fat/18 g • carbos/57 g • protein/30 g	***480 - 510*** cal (actual is 491 cal)	• f: 33% • c: 46% • p: 24%
Wendy's: Jr. Bacon Cheeseburger	• fat/***25*** g • carbos/33 g • protein/22 g	440 cal	• f: 51% • c: ***30 or 29***% • p: 20%

4. *Answers will vary*.
5. *Probably fat and protein*.
6. *Probably the Subway sub or the Pizza Hut pizza in terms of percent calories from fat. Note that the pizza (two slices) has a higher proportion of fat but that it is about 150 calories less than the sub. (The comparison should also be based on how much each of these items an individual would probably eat. For example, if a person would eat three, instead of two, medium slices of pizza versus one sub, nutrition decisions might differ.)*
7. *Percent fat, carbohydrate, and protein calories; total calories; amount likely to be eaten in comparison with the listed serving size [factors not shown on the chart might also be considered in such decision-making, such as proportions of vitamins and other nutrients important for good health]*
8. *Determine the percent fat of total calories, add that to the percent protein, and subtract from 100%*.
9. *See the note preceding #1 in Part B above.*

10. A. *For fat, multiply the percent (third column) in decimal form times the total calories (middle column), then divide by 9. [The first step finds the number of calories that fat comprises of one serving of the product. Each gram of fat is about nine calories, which the second step addresses.] The same method is used for finding grams of carbohydrates and protein, except that the second step involves dividing by 4 rather than 9. Explore other methods. For example, for the Subway sub, which is 25% fat, a student might divide total calories by 4 for the first step.*

    B. *Multiply fat grams times 9 calories and carbohydrate and protein grams times 4 calories each, then add the three numbers. Explore other methods. For example, a student might multiply 27 fat grams for the Big Mac times 9 calories to get 243 calories, then multiply that times 2 (because fat is 50% of the calories) to get 486 calories. Note that different methods will yield different answers, which is acceptable based on room for error as discussed previously.*

    C. *One solution is to add the other two percents in the box and subtract the sum from 100%. Another solution is to multiply a nutrient in the first column times its equivalent number of calories (4 or 9) and then to divide it by the total calories (and round to the nearest hundredth). Again, different methods will yield different acceptable answers.*

Part C

1. A. *300. 60% (recommended daily intake of carbohydrates) times 2000 calories (assumed diet) equals 1200 calories from carbohydrates, which is 300 grams because there are 4 calories in each gram.*

    B. • *8%. 96 calories (24 grams of carbohydrates) divided by 1200 calories that come from carbohydrates in a healthful 2000-calorie diet.*
    - *92%*

    C. • *11%. 7 grams of fat times 9 calories each is 63 calories, which—divided by the maximum daily caloric intake of 600 calories (30% of 2000 calories)—is 10.5 percent. Another method is to simply divide 7 grams of fat by 65 grams (the maximum recommended daily grams of fat for a 2000-calorie diet, as noted at the beginning of Part C), which is about 10.8%.*
    - *About $^1/_9$.*
    - *58 grams. 65 grams (maximum recommended fat intake in grams for a 2000-calorie diet) minus 7 grams (one serving of Doritos).*
    - *89%. 100% (total percent of fat calories for a particular diet) minus 11% (determined in first item in letter C for 7 grams of fat).*

Extension/Follow-Up

A. *Correct answer is water (bottled spring water).*

B. *Answers will vary.*

C. *Yes. Percent Daily Value's are based on a 2000-calorie diet. If you are on a 2500-calorie diet, you can consume 25% more calories ($^1/_4$ of the 2000-calorie base), and, therefore, the %DV's found on food labels may add up to 125% for your daily intake. For example, the Daily Value for saturated fat is 20 grams, or 100%, for a 2000-calorie diet, but a person on a 2500-calorie diet may consume another 5 grams, or 25% of the base amount, for a total of 125% of the Daily Value, which is always based on a 2000-calorie diet.*

D. *$^1/_2$% of something is one-half of 1%. Since that is one-half of one part out of 100 parts, it means one out of every 200 parts.* (You might want to work through some examples of this.)

E. *7 calories per gram of alcohol.*

Materials

calculators
Reference Sheet R3 pages 2-5

Part A

1. Use **Reference Sheet R3 pages 2-3** to answer the following questions.

A. • Without doing actual computations on paper or with a calculator, write the letters of the snacks that you think have a percent calories from fat that is greater than the recommended 30% maximum.

_____

• Describe your general method for arriving at answers to the previous item.

_____

_____

_____

_____

• List any of the snacks that you think have 50% or greater calories from fat.

_____

• Describe your general method for arriving at answers to the previous item.

_____

_____

_____

_____

• Which two snacks do you think have the largest percentage of calories from fat?

_____

• Which two snacks do you think have the smallest percentage of calories from fat?

_____ Which two do you think have the next smallest percentage? _____

B. • Choose four snacks and find the percent calories from fat for each using one serving as your reference. You may use a calculator. Find answers to the nearest percent (i.e., round to the hundredths place).

_____

_____

_____

• Describe how you solved the problems in the previous item. If you used the same method for two or all three of them, you may describe that procedure just once (refer to the problems you solved, if needed; continue on next page).

_____

_____

_____

_____

_____

C. • What minimum percent of a food should not come from fat? _____
   • What percent of Chee•tos does not come from fat? _____

D. Look at the Hostess Lights Low Fat Cup Cakes nutrition label. How do you think it's possible for the percent calories from fat to differ for one and two cakes?

_____

_____

_____

Part B

1. The type of food label you looked at in Activity 1 was made mandatory for most packaged foods beginning in 1994. You have already taken advantage of one major change—figuring percent calories from fat. Finding that value was more involved on the old labels, which did not list the calories from fat. To figure the percent calories from fat, consumers had to know that there are about *9 calories in one gram of fat*, so they had to multiply the number of grams of fat times 9 and then figure the percent.

   A. Looking at **Reference Sheet R3 pages 2-3**, tell whether or not this rule "works" for each of the following. Explain why it did or did not work.

   • Triscuits _____

   _____

   • Hershey's Kisses _____

   _____

   • Country Club Ice Cream _____

   _____

   B. Did the rule work for all of the items? _____ If not, why do you think this is so?

   _____

   _____

   _____

   _____

2. Consumers interested in knowing the percent calories of protein or carbohydrates of a packaged food must use a procedure like the one described in number 1 above, because

food labels list the grams for each of these nutrients but not the calories. Each gram of protein or carbohydrate

has about 4 calories. Therefore, you can see why fatty foods contribute to weight gain much more readily than those consisting of large proportions of the other two macronutrients (proteins, carbohydrates). You learned in Activity 2 that current recommendations are that about 60% of a person's calories come from carbohydrates and 10% from protein.

A. Look at **Reference Sheet R3 pages 4-5**. Using mental computation or estimation only—and remembering that *protein and carbohydrates have 4 calories per gram*—tell which items, if any:
   - get about 10% of their calories from protein? _____
     _____
     _____
   - get more than half (50%) of their calories from carbohydrates _____
     _____
     _____

B. Complete the chart below using one serving as the standard. List the number of grams (g) for carbohydrates ("Carb") and protein ("Pro"), the number of calories ("cal") for each, and the percent of the total calories ("% cal") that each comprises. As an example, the Stove Top Stuffing Mix for Turkey ($^1/_2$ cup prepared with margarine) has 20 grams (g) of carbohydrates. Multiply that by 4 to find how many calories the carbohydrates comprise, and you get 80. Out of 170 calories, 80 calories is 47 percent (170 ÷ 80, rounded to the nearest hundredth). Protein is found using the same procedure.

Food	Carb (g)	Carb (cal)	Carb (% cal)	Pro (g)	Pro (cal)	Pro (% cal)
Raisin Bran						
Lender's Bagels (Plain)						
Healthy Choice Bean & Ham Soup						

3. Use a calculator to fill in all missing values in the chart that follows. For the carbohydrates for the taco, estimate the percent only (leave grams blank). Round numbers to the nearest whole number. Remember that 1 gram of fat is about 9 calories, and carbohydrates and protein are each about 4 calories per gram.

Macronutrients: Percent Composition of Total Calories

Source: Nutrition charts provided by the listed restaurants

Food Item	Macronutrient/ Grams Per Serving	Total Calories (1 serving)	Percent of Total Calories
Subway: **12" Ham & Cheese Sub on White**	• fat/_____ g • carbos/80.59 g • protein/37.73 g	643.33 cal	• f: 25% • c: 50% • p: _____ %
Taco Bell: **Taco**	• fat/11 g • carbos/not listed • protein/_____ g	180 cal	• f: _____ % • c: _____ % (estimate) • p: 22%
McDonald's: **Big Mac**	• fat/27 g • carbos/49 g • protein/24 g	_____ cal	• f: 50% • c: 40% • p: 20%
Kentucky Fried Chicken: **Drumstick (1), Extra Tasty Crispy**	• fat/12 g • carbos/_____ g • protein/14 g	190 cal	• f: _____ % • c: 13% • p: 29%
Pizza Hut: **Pan Pizza (2 slices med. cheese)**	• fat/18 g • carbos/57 g • protein/30 g	_____ cal	• f: 33% • c: 46% • p: 24%
Wendy's: **Jr. Bacon Cheeseburger**	• fat/_____ g • carbos/33 g • protein/22 g	440 cal	• f: 51% • c: _____ % • p: 20%

Note: Some restaurants, such as those above (mainly fast food types), provide nutrition fact charts upon request. If restaurants do not have nutrition guides to hand out, they might have them posted on the wall or available for you to see.

4. Did any of the nutrition facts in the chart surprise you? If so, which ones and why? _____
_____
_____

5. If you added pepperoni to the pizza, which nutrient(s) do you think would increase most in terms of percent calories out of total calories? _____
_____

6. Which one or two of the six foods do you think is most nutritious (it is probably more accurate to say "least unhealthy"!)? Explain. _____
_____
_____
_____

7. What types of things should be considered in comparing the foods in the chart (in terms of nutrition) in order to choose one for a meal? _____
_____
_____
_____

8. How did you estimate the percent calories from carbohydrates for the taco?
_____
_____

9. How is it possible for the percent totals for the sub, the chicken, and the bacon cheeseburger to total somewhat below or above 100%? _____
_____
_____

10. Describe a general rule for finding the following missing values in the chart, assuming you know the two values in the other columns:
    A. grams per serving (first column) _____
    _____
    _____
    B. total calories (second column) _____
    _____

C. percent of total calories (third column) _____

_____

_____

Part C

You might have noticed that food labels include a column called "% DV" or "% Daily Value." These values are figured for a daily caloric intake of 2000 calories and are used as a reference in determining what percent of your daily total (i.e., 100%) each nutrient provides (of the daily total recommended for that particular nutrient). For example, a person on a 2000-calorie diet should have no more than 30% of those calories from fat. Thirty percent of 2000 is 600 calories, which—divided by (about) 9 calories per gram—yields a little less than 67 grams and is listed as 65 grams on food label reference charts. So, a person on a 2000-calorie diet should get no more than 600 calories, or 65 grams, of fat in her/his daily diet. Talk about this with your partner or group members and be sure you understand the concept before going on.

1. Assume a 2000-calorie diet for the following items.

A. About how many grams of carbohydrates should a person consume daily? (Refer to Activity 2, if needed, to recall what percent of a healthful diet comes from carbohydrates.) Explain how you get your answer.

_____

_____

_____

B. •One cup of Wheaties (dry) has 24 grams of carbohydrates. What percent of the daily value is that? Explain. _____

_____

_____

- What percent daily value of carbohydrates remains to be consumed on that day? _____

C. • If a person on a 2000-calorie diet eats one serving of Doritos (Nacho Cheesier brand) [1 oz., or about 11 chips], which has 7 grams of fat, what percent daily value does that represent? Explain how you found your answer—see if you can find more than one method. _____

_____

_____

_____

_____

- Approximately what fraction of the daily value is that? _____
- How many more grams of fat can she or he consume to reach her or his daily limit (Daily Value)? How do you know? _____

  _____

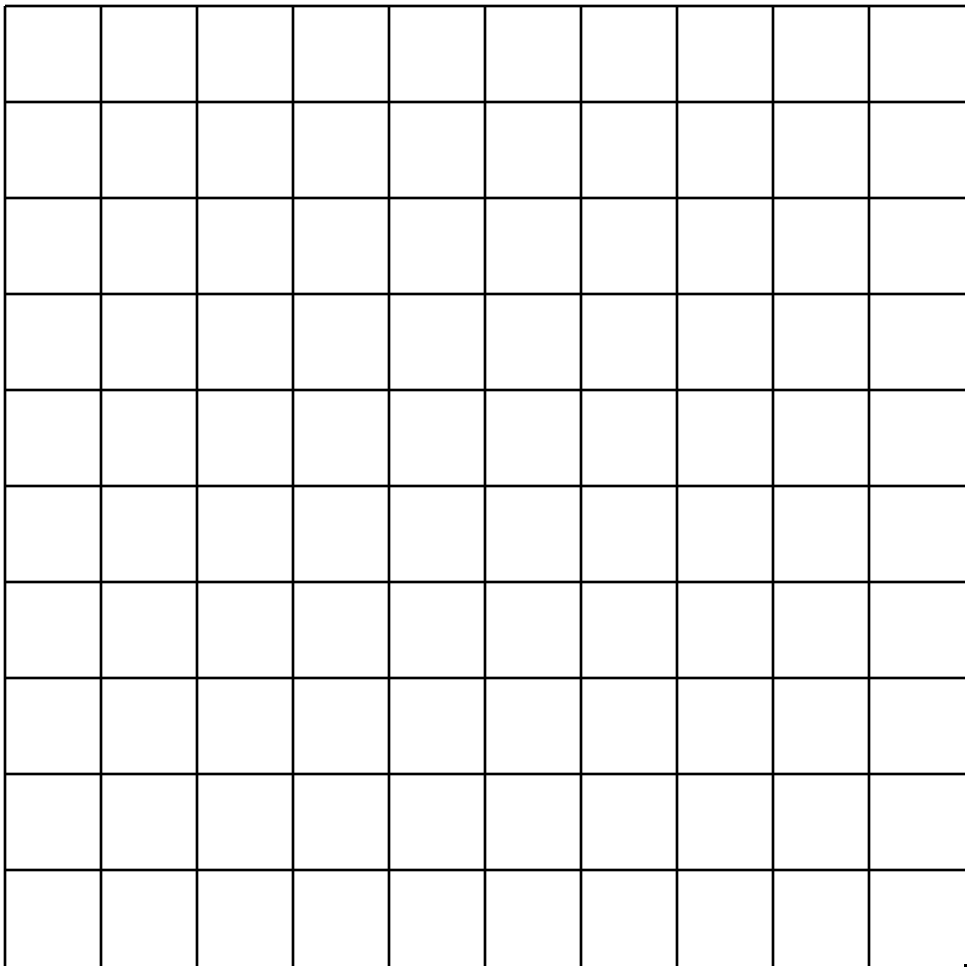
  _____
- What percent of the daily value for fat calories still remains? _____
  Explain. _____

  _____

  _____

Extension/Follow-Up

A. What do you think the Mystery Food is on R3 p. 5 letter V?
B. Determine the maximum number of calories and grams of fat, carbohydrates, and protein (Daily Values) recommended for a daily caloric intake that is appropriate for you (charts can be found that list recommended caloric intakes based on age, sex, body type, level of physical activity, etc.).
C. Is it possible for a %DV (percent Daily Value) to be higher than 100%? Explain.
D. Explain what you think $^1/_2$% means.
E. Alcohol is an energy source, but it is not a nutrient because it serves no required function. Nonetheless, alcoholic beverages rank third as a source of calories in the American diet. Find how many calories are in one gram of alcohol.



A. Snack Mix (Traditional)

Nutrition Facts

Serving Size 2/3 cup (34g)
Servings Per Container about 7

Amount Per Serving

Calories 150 Calories from Fat 45

	% Daily Value*
Total Fat 5g	**8%**
Saturated Fat 1g	**4%**
Cholesterol 0mg	**0%**
Sodium 410mg	**17%**
Total Carbohydrate 23g	**8%**
Dietary Fiber 2g	**7%**
Sugars 2g	
Other Carbohydrate 19g	
Protein 3g	

Vitamin A 0%	•	Vitamin C 10%
Calcium 0%	•	Iron 25%
Thiamin 20%	•	Niacin 20%
Vitamin B_6 15%	•	Folate 15%
Vitamin B_{12} 15%		

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

B. Crunchy Cheese Curls

Nutrition Facts

Serving Size 1 oz. (28g/About 21 pieces)
Servings Per Container About 2

Amount Per Serving

Calories 150	Calories from Fat 80
	% Daily Value*
Total Fat 9g	**14%**
Saturated Fat 2g	**11%**
Cholesterol 0mg	**0%**
Sodium 300mg	**12%**
Total Carbohydrate 16g	**5%**
Dietary Fiber less than 1g	**1%**
Sugars less than 1g	
Protein 2g	

Vitamin A 0%	•	Vitamin C 0%
Calcium 0%	•	Iron 2%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

C. Devil's Food Cookie Cakes

Nutrition Facts

Serving Size 1 cookie (16g)
Servings Per Container 12

Amount Per Serving

Calories 50	Calories from Fat 0
	% Daily Value*
Total Fat 0g	**0%**
Saturated Fat 0g	**0%**
Cholesterol 0mg	**0%**
Sodium 25mg	**1%**
Total Carbohydrate 13g	**4%**
Dietary Fiber Less than 1g	**1%**
Sugars 9g	
Protein 1g	

Vitamin A 0%	•	Vitamin C 0%
Calcium 0%	•	Iron 0%

D. Granola Bars

Nutrition Facts

Serving Size 1 granola bar (35 g)
Servings Per Container 8

Amount Per Serving

Calories 160 Calories from Fat 60

	% Daily Value*
Total Fat 7g	**11**%
Saturated Fat 3g	**15**%
Cholesterol 0mg	**0**%
Sodium 65mg	**3**%
Total Carb. 23g	**8**%
Dietary Fiber 2g	**7**%
Sugars 15g	
Sorbitol 1g	
Protein 2g	

E. Chocolate Almond Bites

Nutrition Facts

Serving Size 8 pieces (38g)
Servings Per Container about 7

Amount Per Serving

Calories 210	Calories from Fat 120
	% Daily Value*
Total Fat 13g	**20%**
Saturated Fat 7g	**36%**
Cholesterol 5mg	**2%**
Sodium 25mg	**1%**
Total Carbohydrate 19g	**6%**
Dietary Fiber Less 1g	**6%**
Sugars 17g	
Protein 4g	

Vitamin A 0%	•	Vitamin C 0%
Calcium 8%	•	Iron 4%

F. Low Fat Cupcakes

Nutrition Facts

Serving Size 2 Cakes (77g) • Servings Per Container 4

	Amount Per Serv.	%DV*	Amount Per Cake	%DV*
Calories	240		120	
Calories from Fat	25		15	
Total Fat	2.5g	**4%**	1.5g	**2%**
Saturated Fat	.5g	**3%**	0g	**0%**
Polyunsaturated	1g		.5g	
Monounsaturated	1g		.5g	
Cholesterol	0mg	**0%**	0mg	**0%**
Sodium	330mg	**14%**	170mg	**7%**
Total Carbohydrates	50g	**17%**	26g	**9%**
Dietary Fiber	2g	**8%**	Below 1g	**3%**
Sugars	34g		17g	
Protein	4g		2g	
Vitamin A		0%		0%
Vitamin C		0%		0%
Calcium		2%		**
Iron		10%		4%
Thiamin		2%		**
Riboflavin		8%		4%
Niacin		4%		**

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

** Contains less than 2% of the Reference Daily Intake for these nutrients.

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

FAT COMPARISON PER SERVING (77g) – 2 CAKES: 42 10 file-77-3
LIGHT CUPCAKES 2.5 GRAMS – REGULAR CUPCAKES* 9 GRAMS
*THE EIGHT OF 2 REGULAR HOSTESS CUPCAKES IS 91 GRAMS WITH 11g OF FAT.

G. Chunky Chocolate Chip Cookies

Nutrition Facts

Serving Size 1 cookie (17g)
Servings Per Container about 27

Amount Per Serving

Calories 80 Calories from Fat 40

	% Daily Value*
Total Fat 4g	**7%**
Saturated Fat 3g	**14%**
Cholesterol 10mg	**3%**
Sodium 60mg	**2%**
Total Carbohydrate 11g	**4%**
Dietary Fiber Less than 1 gram	**2%**
Sugars 7g	
Protein 1g	

Vitamin A 0% • Vitamin C 0%

Calcium 0% • Iron 2%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

H. Neapolitan Ice Cream

Nutrition Facts

Serving Size 1/2 cup (64g)
Servings Per Container about 16

Amount Per Serving

Calories 130	Calories from Fat 60
	% Daily Value*
Total Fat 7g	**10%**
Saturated Fat 3.5g	**19%**
Cholesterol 20mg	**7%**
Sodium 50mg	**2%**
Potassium 110mg	**3%**
Total Carbohydrate 17g	**6%**
Dietary Fiber 0g	**0%**
Sugars 9g	
Protein 2g	

I. Low Sodium Crackers

Nutrition Facts

Serving Size 7 ■afers (31g)

Servings Per Container About 9

Amount Per Serving

Calories 140 Calories from Fat 45

	% **Daily Value***
Total Fat 5g	**8**%
Saturated Fat 1g	**4**%
Polyunsaturated Fat 0.5g	
Monounsaturated Fat 1.5g	
Cholesterol 0mg	**0**%
Sodium 75mg	**3**%
Total Carbohydrate 22g	**7**%
Dietary Fiber 4g	**14**%
Sugars 0g	
Protein 3g	

J. Jumbo Cashews

Nutrition Facts

Serving Size 1/4 Cup (30g)
Servings Per Container 19

Amount Per Serving

Calories 190 Calories from Fat 140

	% Daily Value*
Total Fat 15g	**23%**
Saturated Fat 2.5g	**12%**
Cholesterol 0mg	**0%**
Sodium 120mg	**5%**
Total Carbohydrate 7g	**2%**
Dietary Fiber 2g	**8%**
Sugars 1g	
Protein 6g	

Vitamin A * • Vitamin C *

Calcium * • Iron 10%

* Contains less than 2% of the Daily Value of these nutrients.

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

K. Raisin Bran

Nutrition Facts

Serving Size 1 cup (59g)
Servings Per Container about 24

Amount Per Serving	Cereal	Cereal with 1/2 cup Skim Milk
Calories	190	230
Calories from fat	10	10
		% Daily Value**
Total Fat 1g*	**1%**	**1%**
Saturated Fat 0g	**0%**	**0%**
Cholesterol 0mg	**0%**	**0%**
Sodium 300mg	**12%**	**15%**
Potassium 380mg	**11%**	**17%**
Total Carbohydrate 46g	**13%**	**17%**
Dietary Fiber 8g	**32%**	**32%**
Soluble Fiber 1g		
Sugars 11g		
Other Carbohydrate 18g		
Protein 4g		
Vitamin A	35%	40%
Vitamin C	0%	2%
Calcium	2%	15%
Iron	35%	35%
Vitamin D	15%	30%
Thiamin	35%	40%
Riboflavin	35%	45%
Niacin	35%	35%
Vitamin B_6	35%	35%
Folate	35%	35%
Vitamin B_{12}	35%	45%
Phosphorus	25%	35%
Magnesium	25%	30%
Zinc	15%	20%
Copper	15%	15%

* Amount in Cereal. One half cup skim milk contains an additional 40 calories, 65mg sodium, 200mg potassium, 6g total carbohydrate (6g sugars), and 4g protein.

** Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

L. English Muffins

Nutrition Facts

Serving Size 1 muffin (57g)
Servings Per Container 6

Amount Per Serving

Calories 110	Calories from Fat 10
	% Daily Value*
Total Fat 1g	**2%**
Saturated Fat 0g	**0%**
Cholesterol 0mg	**0%**
Sodium 190mg	**8%**
Total Carbohydrate 24g	**8%**
Dietary Fiber 3g	**12%**
Sugars 2g	
Protein 5g	

Vitamin A 0%	•	Vitamin C 0%
Calcium 8%	•	Iron 6%

M. Frozen Concentrated Orange Juice

Nutrition Facts

Serving Size 1/4 cup (60 mL)
Servings Per Container 6

Amount Per Serving

Calories 110	Calories from Fat 0
	% Daily Value*
Total Fat 0g	**0**%
Saturated Fat 0g	**0**%
Potassium 430mg	**12**%
Total Carb 27g	**9**%
Sugars 23g	
Protein Less Than 1g	

Vitamin C 130% • Calcium 2%

N. Cream Cheese

Nutrition Facts

Serving Size 1 oz (28g)
Servings Per Container 8

Amount Per Serving

Calories 100	Calories from Fat 90
	% Daily Value*
Total Fat 10g	**15%**
Saturated Fat 6g	**30%**
Cholesterol 30mg	**10%**
Sodium 90mg	**4%**
Total Carbohydrate less than 1g	**0%**
Fiber 0g	**0%**
Sugars less than 1g	
Protein 2g	

Vitamin A 6%	•	Vitamin C 0%
Calcium 0%	•	Iron 0%

O. Light Wieners

Nutrition Facts

Serving Size 1 Link (45g)
Servings Per Container 10

Amount Per Serving	
Calories 90	Calories from Fat 60
	% Daily Value*
Total Fat 7g	**10%**
Saturated Fat 3g	**17%**
Cholesterol 40mg	**14%**
Sodium 670mg	**28%**
Total Carbohydrate 2g	**1%**
Dietary Fiber 0g	**0%**
Sugars 2g	
Protein 5g	

Vitamin A 0%	•	Vitamin C 10%
Calcium 4%	•	Iron 0%

P. French Onion Dip

Nutrition Facts

Serving Size 2 Tbsp (30g)
Servings Per Container 15

Amount Per Serving	
Calories 60	Calories from Fat 50
	% Daily Value*
Total Fat 5g	**8%**
Saturated Fat 3.5g	**18%**
Cholesterol 20mg	**7%**
Sodium 160mg	**7%**
Total Carbohydrate 1g	**1%**
Dietary Fiber 0g	**0%**
Sugars 1g	
Protein 1g	

Vitamin A 4%	•	Vitamin C 0%
Calcium 4%	•	Iron 0%

Q. Deep Dish Sausage and Pepperoni Pizza

Nutrition Facts

Serving Size 1 Pizza (182g)

Amount Per Serving

Calories 520	Calories from Fat 260
	% Daily Value*
Total Fat 29g	**45%**
Saturated Fat 10g	**50%**
Cholesterol 35mg	**12%**
Sodium 950mg	**40%**
Total Carbohydrate 47g	**16%**
Dietary Fiber 2g	**8%**
Sugars 4g	
Protein 19g	

Vitamin A 8%	•	Vitamin C 10%
Calcium 25%	•	Iron 20%

Q. Turkey Stuffing Mix

Nutrition Facts

Serving Size 1/6 box (28g)
Servings Per Container 6

Amount Per Serving	Dry Mix	1/2 Cup Prepared with Margarine
Calories	110	170
Calories from Fat	10	80
	% Daily Value	
Total Fat 1g	**2%**	**13%**
Saturated Fat 0g	**0%**	**8%**
Cholesterol 0mg	**0%**	**0%**
Sodium 490mg	**20%**	**23%**
Total Carbohydrate 20g	**7%**	**7%**
Dietary Fiber 1g	**4%**	**4%**
Sugars 3g		
Protein 4g		

R. Plain Bagels

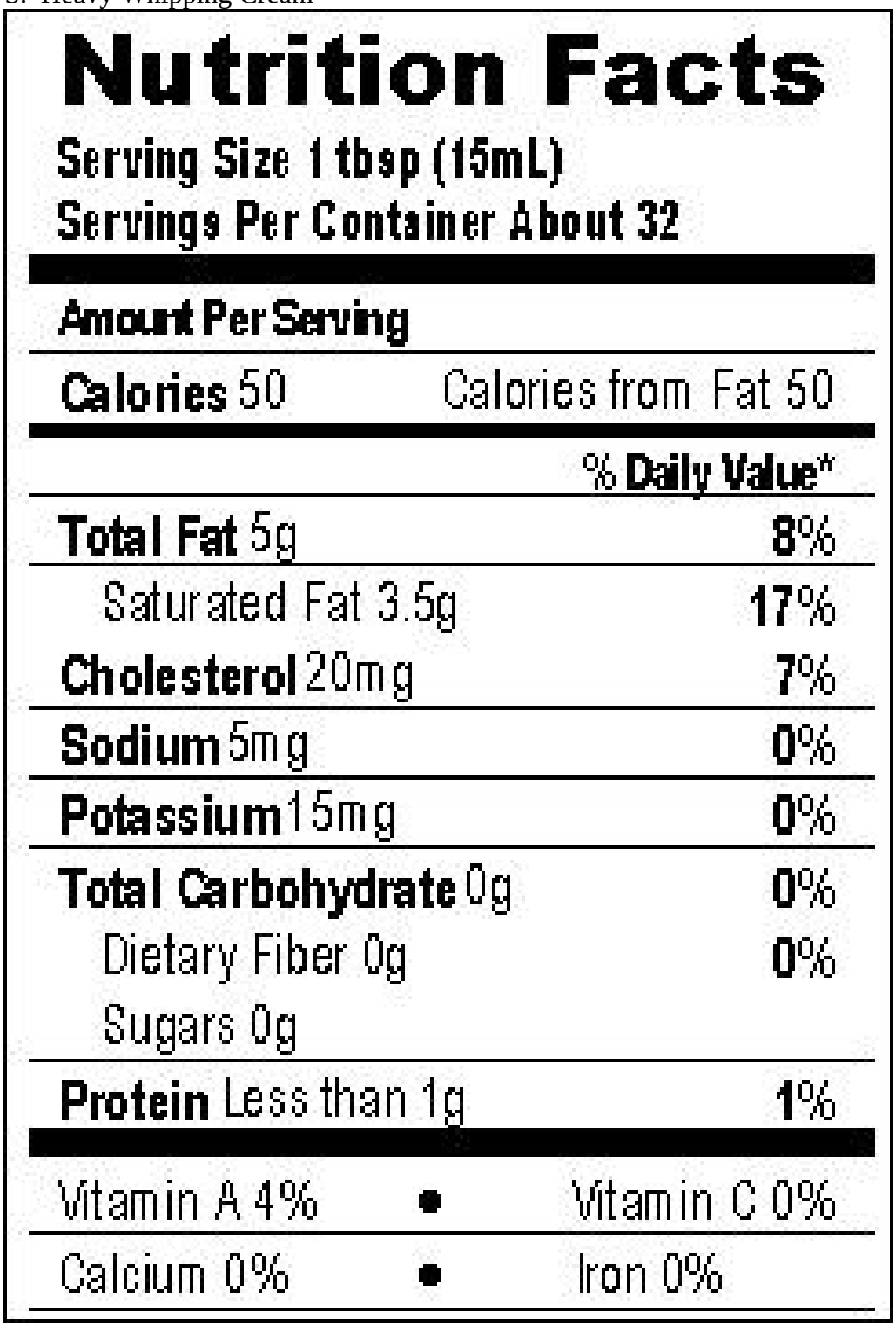
Nutrition Facts

Serving Size 1 bagel (85g/3oz)
Servings Per Container 5

Amount Per Serving	
Calories 220	Calories from Fat 15
	% Daily Value*
Total Fat 2g	**3%**
Saturated Fat 0g	**0%**
Polyunsaturated Fat 1g	
Monounsaturated Fat 0g	
Cholesterol 0mg	**0%**
Sodium 430mg	**18%**
Total Carbohydrate 43g	**14%**
Dietary Fiber 2g	**10%**
Sugars 7g	
Protein 8g	

Vitamin A 0%	•	Vitamin C 0%
Calcium 0%	•	Iron 15%
Thiamin 15%	•	Riboflavin 15%
Niacin 15%		

S. Heavy Whipping Cream



Nutrition Facts

Serving Size 1 tbsp (15mL)
Servings Per Container About 32

Amount Per Serving	
Calories 50	Calories from Fat 50
	% Daily Value*
Total Fat 5g	**8%**
Saturated Fat 3.5g	**17%**
Cholesterol 20mg	**7%**
Sodium 5mg	**0%**
Potassium 15mg	**0%**
Total Carbohydrate 0g	**0%**
Dietary Fiber 0g	**0%**
Sugars 0g	
Protein Less than 1g	**1%**

Vitamin A 4%	•	Vitamin C 0%
Calcium 0%	•	Iron 0%

T. Bean and Ham Soup

Nutrition Facts

Serving Size 1 cup (249g)

Servings Per Container about 2

Amount Per Serving	
Calories 180	Calories from Fat 25
	% Daily Value*
Total Fat 3g	**5%**
Saturated Fat 1g	**5%**
Cholesterol 5mg	**2%**
Sodium 460mg	**19%**
Total Carbohydrate 34g	**11%**
Dietary Fiber 10g	**40%**
Sugars 0g	
Protein 10g	

Vitamin A less than 2% • Vitamin C 4%

Calcium 10% • Iron 15%

U. Lowfat Yogurt

Nutrition Facts

Serving Size 1 Container

Amount Per Serving

Calories 250	Calories from Fat 30
	% Daily Value*
Total Fat 3.5g	**5**%
Saturated Fat 2.5g	**11**%
Cholesterol 15mg	**5**%
Sodium 120mg	**5**%
Potassium 430mg	**430**%
Total Carbohydrate 46g	**15**%
Fiber less than 1g	**3**%
Sugars 36g	
Protein 8g	

Vitamin A 2%	•	Vitamin C 15%
Calcium 30%	•	Iron 0%

V. Mystery Food

Nutrition Facts

Serving Size 8 oz. (240ml)
Servings Per Container 16

Amount Per Serving	
Calories	**0%**
	% Daily Value*
Total Fat 0g	**0%**
Sodium 0mg	**1%**
Total Carbohydrate 0g	**4%**
Protein 0g	

Not a significant source of calories from fat, saturated fat, cholesterol, dietaryfiber, sugars, vitamin A, vitamin C, calcium, and iron.

Materials

calculators

Activity Summary: Students will use nutrition formulas to learn more about their own health and nutrition, while learning to apply mathematical formulas and solve equations.

Objectives

- To identify and define mathematical formulas and equations.
- To use appropriate terminology in working with formulas and equations.
- To use mathematical formulas to learn more about personal health.
- To set up and solve mathematical equations.

Introduction

Ask students to tell you anything they know about ***formulas***. Ask them to do the same for ***equations***. See if students can give examples of these, define them in their own words, tell when or in what context they've heard of them, and so forth. (*A mathematical formula is a rule or principle that usually contains symbols and which can be used to find a particular numerical piece of information. An equation is a number sentence that contains an equal sign. A = l x w is a formula for finding the area of a rectangle, whereas 45 = 5 x w is an equation that might represent the area of a rectangle in which area and length measures are known.*)

Tell students that they just used formulas—though not in symbolic form—in the last activity. Have students try to guess what formulas ("rules" for finding given information) they used (*determining percent calories of total calories for the three macronutrients in given food products*). Once this is established, have students try to create a formula—a general rule in words or symbols, or preferably both—for finding the percent fat of total calories, using the number of grams of fat and the total calories for a given food product serving. You might want to have students first work on this in pairs or in small groups. Students should develop any formula such as the following:

$\%F = (G \times 9) \div TC$ or $F = 9G/C$ (etc.), where the symbol on the left represents percent fat and the expression on the right means grams of fat times 9 calories divided by total calories (in that order). Be sure students understand the meaning of "formula," a generalized rule that can always be applied to finding a numerical value for a particular type of information.

You might want to review or teach the following here or at an appropriate place:

A. Symbolic language. For example, multiplication can be represented by the "x" sign, by a raised dot (·), or by absence of a symbol (as in 4n), whereas division can be shown by a "÷" sign, by a "/" sign (front slash), or by a fraction bar. Include use of variables.
B. Rules for order of operations in solving equations.
C. Key terminology, showing examples of each term and attending to meaning more than to formal definitions. A ***variable*** is a symbol that represents one or more numbers. A number that a variable represents

is a ***value***. An expression that contains a variable (e.g., y x 2.4) is called a ***variable expression***. An expression that represents a particular number (e.g., 3.6 x 5) is a ***numerical expression***, and the number named by a numerical expression (e.g., "7" is named by 6 + 1) is the ***value of the expression***. Placing a numerical expression in its simplest form (again, "7" for 6 + 1) is called ***simplifying the expression***.

Distribute calculators. Assuming that students have decided on F = (9 x G) ÷ C as their formula for percent fat calories of total calories, work together as a class to find the percent fat calories for two ounces of chunk light Star-Kist tuna canned in oil, which has 170 calories and 13 grams of fat (*69% fat*). Students should understand why they substitute 170 for C and 13 for G, getting F = (9 x 13) ÷ 170. Help students to see that this is also an equation. In many cases a formula will also be an equation. However, "area of a rectangle is found by taking length times width" is a formula (in words, in this case) but not an equation (which uses symbols), and 53 = m + 39 is an equation but not necessarily a formula (e.g., it might simply be the solution to a particular word problem).

Ask students if they think tuna canned in water would be lower in fat. If so, how much? Using their formula, ask students how they would find the number of grams of fat in two ounces of chunk light Star-Kist tuna canned in water, which is 60 calories and 15% fat. Have students work in pairs or small groups to find the answer (*1 gram*) by substituting known values for the appropriate variables and computing the answers using their calculators. Work through the problem as a class. Note the very large difference in fat content between the same amount of tuna canned in oil versus that canned in water.

Have students find the total calories for a medium-sized order of McDonald's french fries, which has 17.1 grams of fat, making up 48% of the total calories. Work through the problem as above to arrive at an answer (*321 total calories*). You might want to ask students what fraction of a typical person's maximum daily fat intake the 17.1 grams of fat is (more than one-fourth of the 65-gram maximum for a person on a 2000-calorie diet).

Ask students if their formula could be written as (9 x G) ÷ C = F. (*Yes, the entire expression on the left of an equal sign can be exchanged with the entire expression on the right without affecting the outcome*.)

Answer Key

1. A. • *females (example): W = 100 + (5 x I) (where W is desirable body weight and I is height in inches <u>over</u> 5 feet)*
   • *males (example): W = 105 + (6 x I) (where W is desirable body weight and I is height in inches <u>over</u> 5 feet)*
   B. *Answers will vary*.
2. A. *Example: P = (W - D) ÷ D (where P is percent difference between actual and desirable body weight, W is actual body weight, and D is desirable body weight)*

B. See chart below. Spend adequate time discussing how students estimated percent differences. For the third row, note that some students might avoid working with negative numbers by using the absolute value of (W - D) in their formula above (which they should reflect in the formula) and then using common sense to determine if the percent difference is above or below the actual body weight.

Actual Body Weight	**Desirable Body Weight**	**Percent Difference (estim./actual)**	**Body Weight Classification**
177 lb.	140 lb.	(***varies***) / ***26%***	***mildly obese***
131 lb.	122 lb.	(***varies***) / ***7%***	***"normal"***
171 lb.	195 lb.	(***varies***) / ***-12%***	***underweight***

3. A. *Example: P = 0.8 x W (where P is an adult's RDA for protein and W is weight in kilograms) [Note that students must first convert their desirable weight in pounds to its equivalent in kilograms.]*
   B. *Answers will vary*.
4. A. *Example: C = 0.73 x W x M (where C is the number of calories expended, W is body weight in pounds, and M is number of miles)*
   B. *Example: C = 4 x (0.73 x W x M) (where C is the number of calories expended, W is body weight in pounds, and M is number of miles)*
   C. *Example: C = $^1/_3$ x (0.73 x W x M) or C = (0.73 x W x M) ÷ 3 (where C is the number of calories expended, W is body weight in pounds, and M is number of miles)*
   D. *Answers will vary*.
5. *Answers will vary*.
6. A. *Answers will vary, but they should be expressed in calories or calories per day*.
   B. • *Answers will vary*.
   • *Answers may vary, but the most obvious method probably is to find 2% of the calories in the BMR in letter A and subtract it from the BMR, then repeat this step two more times, each time using the newer/ newest and not the original BMR.* Ask students if the answer can be found by taking 6% of the BMR and subtracting (doing one step only). Discuss why this method will not yield the same answer (be sure students fully understand this).
   • *Even if a person consumes the same amount of calories daily and gets the same amount of exercise across time, she or he will gain weight with age. To maintain weight while aging, a person must eat less and/or exercise more*.

Materials

calculators

Part A

*<u>*In writing formulas, tell what each symbol you choose to use represents.*</u>

*<u>*For pertinent items, record variable measures—such as height and weight—that were used to arrive at answers.*</u>

1. A. Write formulas for females and males for the pounds-per-square-inch method for estimating desirable body weight.
   - <u>Females</u>: allow 100 pounds for the first 5 feet, then add 5 pounds for each inch thereafter _____

     _____
   - <u>Males</u>: allow 105 pounds for the first 5 feet, then add 6 pounds for each inch thereafter _____

     _____

   B. Estimate your body weight or that of a classmate using the method.

   _____

   Does the method seem to give a reasonable estimate of *desirable* body weight? Why or why not? _____

   _____

   Desirable body weight is only an estimate, because it does not account for factors such as body composition (fat versus muscle, the latter weighing more) or body frame size.

2. You might be considered to be overweight if your body weight is 10% or more above your desirable body weight, and you might be considered to be underweight if your body weight is 10% or more below your desirable body weight. A person whose body weight is 20-40% above her/his desirable body weight is considered to be mildly obese, whereas 41-99% above desirable body weight is moderately obese and 100% above is severely (morbidly) obese. Health risks are associated with being either too far above or below your desirable body weight.

   A. Construct a formula for determining the percent difference between actual and desirable body weight. _____

   _____

   B. Use your formula to complete the following chart. The third column shows the estimated then actual percent difference between the actual and desirable body weights (round to the nearest whole percent). <u>Estimate the percent difference</u>

before you find the actual difference. The last column tells whether the actual body weight is "normal," (less

than 10% from the desirable body weight), underweight, overweight (10-19% above desirable body weight), or one of the classifications of obese.

Actual Body Weight	Desirable Body Weight	Percent Difference (estim./actual)	Body Weight Classification
177 lb.	140 lb.	/	
131 lb.	122 lb.	/	
171 lb.	195 lb.	/	

3. The Recommended Dietary Allowance for protein for adults is 0.8 grams per kilogram (2.2046, or about 2.2, pounds) of desirable body weight.
   A. Write a formula for an adult's daily protein needs in grams.

      _____

      _____

   B. Using the *desirable* body weight for you or a classmate (found by using the method shown in #1 or by consulting a height/weight table), use your formula to determine how many grams of protein are recommended for your (or her/his) daily diet. _____

      _____

4. The approximate number of calories you expend by running a certain distance can be found by taking 0.73 times your body weight in pounds times the number of miles run.
   A. Write a formula for calories expended for running a certain distance.

      _____

      _____

   You do not need to tell what each symbol represents in B and C (i.e., give the formula only without explanation).

   B. Write a formula for swimming, which uses about four times as many calories as running. _____
   C. Write a formula for bicycling, which uses about one-third as many calories as running. _____
   D. Find the amount of calories that you or a classmate would expend for running, swimming, and bicycling 2.5 miles each (probably not all back-to-back!).

      running _____ swimming _____ bicycling _____

5. Harris-Benedict Estimated Basal Energy Expenditure (BEE)—tells how many calories you expend or use daily (and, thus, can ingest to maintain weight):
   females: BEE = 655.10 + (9.56 x weight in kg) + (1.85 x height in cm) - (4.68 x age in yrs.)
   males: BEE = 66.47 + (13.75 x weight in kg) + (5.0 x height in cm) - (6.76 x age in yrs.)
   Use the above formula to find the base energy expenditure for yourself or for a classmate. Now multiply your answer by a factor from 1.2 to 2.1 to allow for your activity and stress levels, which expend more energy (calories). The lowest number (1.2) represents the lowest level of activity and stress, whereas the highest number (2.1) represents the highest amount of activity and stress (estimate a number for the person for whom you are finding a BEE). Remember to convert your weight from pounds to kilograms (see #1) and your height from inches to centimeters (1 in. = 2.54 cm).

   _____

   _____

6. A simpler formula—used to estimate basal metabolic rate (BMR)—follows. BMR is the rate at which you use energy (measured in calories expended daily) when completely at rest.

   females: BMR = 21.6 x K, where K is body weight in kilograms
   males: BMR = 24 x K, where K is body weight in kilograms

   A. Find the estimated BMR for yourself or for a classmate. Remember to change your weight from pounds to kilograms. Also, remember that the answer should be listed as calories per day. _____

      _____

   B. Your BMR declines as you grow older, at the rate of about 2% per decade beginning with the 30s.
      - Find the BMR at age 50 for the person listed in A above. _____
      - Describe how you found your answer. _____

        _____

        _____

        _____
      - What meaning does the decline of BMR with age have in regard to your body weight?

        _____

        _____

        _____

        _____

Materials

varies by selected topic (see listed items below)

Summary: Topics and ideas are provided for completing the unit with individual and/or small-group projects/reports.

Objectives

- To investigate an area of personal interest related to nutrition/health.
- To determine how mathematics relates to understanding of a chosen nutrition/health topic.
- To develop reference and resource skills through completing an open-ended project.

Introduction

Have students work individually or in pairs or small groups to investigate a nutrition/health topic of interest, such as one of those listed below, or another topic that you approve. (You *might* want to find a fair way of monitoring student projects so that no more than one person/group is investigating the same topic.) Projects are intended to be open-ended, although you will need to provide guidance, such as giving ideas about where students might find resources for their topics (print and audio-visual materials, resource persons, etc.). For example, the *Encyclopedia of Associations* (check a public or college library) offers contact information for organizations.

Much work may need to be done outside of class, but students will also need class time for planning and other work that can be done in the classroom. (You might also be able to arrange a class visit to the school library.) Perhaps another teacher, such as the health teacher, would be willing to collaborate on the project (or the unit in general), allowing time in her/his class for working on the project and providing guidance to students. You might go on to another mathematics unit (minimizing homework), while students work on their projects outside of class and are given class time periodically for working on their projects. You will probably want to meet with each individual/group one or more times to discuss progress.

Criteria will need to be set for the projects so that students have some guidance in the expectations for their project and for how projects will be assessed. For example, students will need some guidance on how they should incorporate both nutrition and mathematics objectives into their projects (mathematics objectives might include proper use of graphs, percent, formulas/equations, or other defensible mathematics).

You will also need to determine what form the final product will take. Students might turn in a written report. They might also be expected to give an oral presentation (which might include role-playing, a skit, a TV commercial, a rap song, or conducting an activity with the class), create a bulletin board on their findings (at some point in the year), or summarize key information on 1-2 pages (including pertinent graphs, tables, or pictures) for a class book that is bound and available for students to see in their spare time

(perhaps make numerous copies—several for the classroom, one for the school library, and one for the public library). You might allow each student or student group to decide how they will share their information with the class (after getting your approval).

Selected Project/Report Topics and Ideas

Books and organizations listed among the resources provided on pages R6 and R7 will be useful for many of the following items.

1. malnutrition/undernutrition/world hunger
2. nutrition-related disease(s)/disorder(s), such as anemia, anorexia, bulimia, or diabetes
3. proper dieting (intentional gaining or losing of weight)
4. healthful snacking
5. vegetarianism
6. dietary needs of athletes
7. dietary needs of pets (or a given pet/animal) [possible resources: see pet food articles in the March 1991 and October 1994 issues of *FDA Consumer*; request dog food and cat food nutrient profiles from the Pet Food Institute, 1200 19th Street, NW, Washington, DC 20036-2401; also see labels on pet foods for actual contents]
8. nutrition/health needs specific to a certain category of people—adolescents, females, males, babies, etc.
9. nutrient and health content claims—meaning of labeling terms such as "fat free," "low calorie," etc., which must meet specific (often mathematical) criteria [as one possible resource, see Lesson 3 in the FDA's booklet *The New Food Label: There's Something in it for Everybody*]
10. one or more key nutrients not covered in the unit (e.g., cholesterol, sodium, calcium, or iron)
11. different kinds of fat (saturated, unsaturated, etc.) or of carbohydrates
12. school lunches (nutrition guidelines for preparing them, etc.)
13. dietary habits of people of a different culture (or comparing several cultures)—either within or outside of the United States
14. nutritional comparison by company/brand of a given food (e.g., ice cream—Ben & Jerry's, Dairy Queen, Jiffy Treet, White Mountain Creamery, etc., or grocery store brands)
15. monitoring one's own diet for a day or week, keeping track of calories and macronutrient percents; evaluating the diet and recommending changes
16. designing and defending a day's/week's healthful diet, or a healthful menu for a health-conscious restaurant

Selected Resources: Books

Ames, Evelyn E., Lucille A. Trucano, Julia C. Wan, and Margo H. Harris. *Designing School Health Curricula: Planning for Good Health*. Dubuque, IA: William C. Brown Publishers, 1992.

This book focuses on school health education curricula. Included are such areas as curriculum design and implementation, locating and selecting resources, and linking schools with the community.

Bowes, Anna De Planter. *Bowes and Church's Food Values of Portions Commonly Used*. 16th ed./revised by Jean A. T. Pennington. Philadelphia: J.B. Lippincott Publishers, 1994.

The main part of this book is a table that lists nutrient content (calories, protein, fats, vitamins, etc.) of foods categorized into 35 types. Other tables include recommended intake for various nutrients, and average height and weight data for particular groups of individuals.

Brouns, Fred. *Nutritional Needs of Athletes.* New York: John Wiley & Sons, 1993.

This book gives "a scientific overview of aspects related to nutrition and physical activity, especially of people involved in intensive sports performance" (Preface).

Clydesdale, Fergus M., and Frederick J. Francis. *Food, Nutrition, and Health*. Westport, CT: AVI Publishing Company, 1985.

This is an informational book about food and nutrition as they relate to human health. Includes sections on nutrients for athletes and on food supply.

Evans, Shirley King. *Nutrition Education Materials and Audiovisuals for Grades 7 through 12*. Beltsville, MD: National Agricultural Library, 1994.

This annotated resource list includes materials, audiovisuals, and textbooks for nutrition education. Teaching materials listed include food models, games, kits, videocassettes, and lesson plans.

Frank, Robyn C., and Holly Berry Irving, eds. *The Directory of Food and Nutrition Information*. 2nd ed. Oryx Press, 1992.

This book is a bibliography of many types of nutrition information resources—organizations, books, audiovisual materials, etc.

Human Nutrition Information Service. Home and Garden Bulletin Numbers 253-1 through 253-8. *Dietary Guidelines for Americans.* Hyattsville, MD: U.S. Department of Agriculture, July 1993.

These bulletins cover different nutrition topics and might be bound as a set in the government publications department of a library.

Jackson, Catherine G. Ratzin. *Nutrition for the Recreational Athlete.* Boca Raton: CRC Press, 1995.
This book addresses the needs of the recreational—as opposed to high-performance—athlete.

Laing, Susan J. *Into Adolescence: A Menu for Good Health.* Santa Cruz, CA: Network Publications, a division of ETR Associates, 1991.
This book, designed as a curriculum for grades 5-8, contains separate teacher and student sections, the latter of which includes blackline masters.

Mahoney, Beverly Saxton, and Larry K. Olsen, eds. *Health Education Teacher Resource Handbook: A Practical Guide for K-12 Health Education*. Millwood, NY: Kraus International Publications, 1993.
This practical reference provides information on the background of health curriculum, as well as current, comprehensive information on publications (including adolescent literature), standards, and special materials for K-12 health education.

National Association for Sport and Physical Education. *Nutrition for Sport Success*. Reston, VA: American Alliance for Health, Physical Education, Recreation and Dance, 1984.
This book was prepared as a practical and scientifically and medically sound guide to nutrition, food and athletic performance.

Schveibinz, Marcy. *Cultural Perspectives on Food and Nutrition*. Beltsville, MD: National Agricultural Library, 1994.
This annotated bibliography is useful for locating information about food, nutrition, and dietary habits of various cultural groups.

Rickert, Vaughn I. *Adolescent Nutrition: Assessment and Management.* New York: Chapman & Hall, 1996.
This book contains general information on adolescent nutrition and includes sections on psychosocial issues, eating disorders, adolescents with special needs (e.g., athletes and pregnant teens), and chronic diseases.

Toner, Patricia Rizzo. *Diet and Nutrition Activities. (Just for the Health of It!: Unit 2)*. West Nyack, NY: The Center for Applied Research in Education, 1993.
Developed for health teachers, this book provides 90 classroom-tested activities printed as full-page, visually appealing blackline masters ready for student use. It focuses on basic concepts and skills such as the four food groups, caloric balance or imbalance, the safety of diets, food additives, and vitamin deficiency diseases.

United States Department of Agriculture. *Cultural Perspectives on Food and Nutrition* [Special Reference Briefs: SRB 94-03]. Beltsville, MD: National Agricultural Library, 1994.
This bibliography is intended for educators, researchers, and the general public. Materials are divided into three broad categories: general, educational, and research.

United States Department of Agriculture. *Nutrition Education Materials and Audiovisuals for Grades 7 through 12* [Special Reference Briefs: SRB 94-10]. Beltsville, MD: National Agricultural Library, 1994.
This resource list is intended for secondary educators interested in nutrition education materials, audiovisuals, and resources for classroom use. Items listed provide various types of nutrition information and also teaching materials, such as food models, games, kits, videocassettes, and lesson plans.

Wardlaw, Gordon M., Paul M. Insel, and Marcia F. Seyler. *Contemporary Nutrition: Issues and Insights*. 2nd ed. St. Louis: Mosby, 1994.
A textbook appropriate for secondary and postsecondary students, this book is an excellent comprehensive resource on nutrition. Includes a section called "Nutrition: Athletics and Fitness" and a section on eating disorders.

Williams, Melvin H. 2nd ed. *Nutrition for Fitness and Sport.* Dubuque, IA: Wm. C. Brown Publishers, 1988.
This book is designed primarily for the physically active individual interested in the nutritional aspects of physical and athletic performance.

Williams, Sue Rodwell. *Essentials of Nutrition and Diet Therapy*. 6th ed. St. Louis: Mosby, 1994.
Intended for students and teachers in the health sciences, this book provides general nutrition information (including charts of recommended nutrient intake), with some attention to nutrition-related diseases and the relationship of nutrition to certain diseases.

Wootton, Steve. *Nutrition for Sport.* New York: Facts On File Publications, 1988.
This book explores the ways in which food can influence an athlete's ability to perform exercise, through first discussing basic principles of healthful eating and then how to apply them in the sporting context.

Selected References: Organizations

American Council on Science and Health, 1995 Broadway, 2nd Floor, New York, NY 10023-5860; 212-362-7044
Offers a booklet called *Food and Life: A Nutrition Primer*. Ask about other available resources.

American Dietetic Association, 216 W. Jackson Blvd., Ste. 800, Chicago, IL 60606; 312-899-0040
Largest group of food and nutrition professionals in the nation. May offer free nutrition information (e.g., pamphlets). Has yearly "Catalog of Products and Services."

Consumer Information Center, Pueblo, CO 81009
Will provide its most recent catalog, which lists free and low-cost publications.

Food and Nutrition Board, National Research Council, National Academy of Sciences, 2101 Constitution Ave. N.W., Washington, DC 20418; 202-334-1732
Contact for information about available resources.

Nabisco Foods Group, 100 DeForest Avenue, P.O. Box 1911, East Hanover, NJ 07936-1911; 800-622-4726
Offers free nutrition information pamphlets and posters, some items in individual copies and others in sets of up to 50.

Food and Nutrition Information Center, National Agricultural Library [of the U.S. Department of Agriculture], 10301 Baltimore Ave., Beltsville, MD 20705; 301-504-5719 [general phone number for referral to specific nutrition laboratories: 301-504-5755]
Contact for information about available resources.

National Dairy Council, 10255 W. Higgins Rd., Ste. 900, Rosemont, IL 60018-5616; 708-803-2000
Provides detailed charts for females and males entitled "How Many Calories Do I Need?" which considers (in addition to gender) age, weight, and level of exercise. Also has a "What's My Number?" chart for females and males that lists the number of recommended servings for each food group for different daily caloric intake needs. Ask about other available resources.

Nutrition Education & Training Program (NET), NET Program Coordinator, Div. of School Food and Nutrition Programs, Indiana Dept. of Education, State House, Room 229, Indianapolis, IN 46204; 317-232-0866
Provides bibliographic materials and other information.

U.S. Department of Health and Human Services, Room 1663, 5600 Fishers Lane, Rockville, MD 20857; 301-443-3170
Contact for information about available resources.

U.S. Food and Drug Administration [FDA], Office of Public Affairs, Communications Staff, 5600 Fishers Lane, Rm. 15A-19, Rockville, MD 20857; 301-443-3220
Offers free information pamphlets, up to 100 copies of up to 6 items and individual copies beyond the sixth item.