Lesson Three

Where do calories come from in your diet??

Overview
Students examine food labels, calculate the percentage of calories from macromolecules (protein, fat, and carbohydrates), and determine durations of physical activity required for balancing calories consumed and calories burned. Students will also consider factors that contribute to a balanced diet for people with, and without, type 2 diabetes.

Enduring understandings:
- Type 2 diabetes can be prevented: factors contributing to a person's risk include good nutrition and exercise.
- In is important to balance energy consumed with energy burned, as well as knowing the relative value of the calories consumed.

Essential question:
Where do calories come from in your diet and what does this have to do with type 2 diabetes?

Learning objectives
Students will be able to:
- Calculate from food labels the percentage of calories derived from fat, carbohydrates and proteins in that food.
- Display the relative caloric percentages on a graph.
- Use on-line tools to analyze food labels and quantify exercise.

Prerequisite Knowledge
Prior understanding of macromolecules such as carbohydrates, proteins, and fats is helpful, but not necessary.

Time: One 50-minute period

This lesson connects to the Next Generation Science Standards in the following ways:

Performance Expectation
HS LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy.

This lesson highlights the Practices of **Using Mathematics, Information, and Computer Technology, and Computational Thinking,** and the Crosscutting Concepts of **Scale, Proportion and Quantity**.

Materials

Materials	Quantity
Teacher *Copy Master* of blank bar graphs	1 per class
Computers for students with access to: • **SuperTracker**: www.supertracker.usda.gov/foodapedia.aspx • **Activity Calculator**: www.caloriecontrol.org/healthy-weight-tool-kit/lighten-up-and-get-moving	1 per student or group
A variety of food labels, including nutritional content	4 per student
Calculator	1 per student
Tape or glue	1 per group
Green, red, and purple markers	1 each per student
Student Resource Part A: *Calculating food labels* (can be copied back to back with Part B)	1 per group
Student Resource Part B: *Calculating physical activity*	1 per group
Student Sheet 3: *Balancing calories and exercise*	1 per student

Lesson Background and Preparation

- This lesson requires having a selection of food labels with nutritional information on hand for students to use. Ask students to bring in food labels from home, provide the labels for them, or make sure students have access to on-line nutritional information, such as through www.SuperTracker.usda.gov.

- This lesson focuses on the caloric contribution of different macromolecules in food and asks students to consider how much physical activity is needed to balance the caloric intake. If students haven't already learned about macromolecules in previous units, teachers may wish to teach about fats, proteins and carbohydrates, and their contributions to diet, role in the body, and how these macromolecules are stored. While helpful for the lesson, prior information about macromolecules is not crucial.

- While the balancing of "calories in = calories out" is a useful concept for students, it is helpful for students to know that not all calories are created equally. For example, 140 calories from a handful of nuts will digest slowly due to the fiber content, provide protein, and contribute to a feeling of fullness. 140 calories from a 12-oz can of sugared soda will dump 39 g of sugar into the blood stream without providing fiber or protein.

Presenting the Lesson

Remind students of the prior lesson which focused on carbohydrates. Tell students that carbohydrates are one type of ***macromolecule*** used by the body for fuel. Fats and proteins are also macromolecules that make up our food.

Procedures

Part 1 (Engage and Explain): Calories and Exercise (*10 minutes*)

Part A

1. Show students the collection of labels or food containers to be used in this lesson. Ask students, *"How can you tell what ingredients, nutrients and macromolecules foods contain?"* or *"How can you tell which foods are healthiest?"*

2. Pass out Student Resource Part A: *Calculating Food Labels.* This may be photocopied with Part B: *Calculating Exercise* on the back and reused from class to classes.

3. Tell students that they will be assessing the nutritional labels from different foods, and calculating the total number of calories from fats, carbohydrates, and proteins. They will then figure out how much physical activity is needed to balance the caloric intake from different foods.

4. Using the Student Resource as a guide, demonstrate for students how to convert the number of grams of fats, carbohydrates and proteins from a food label into calories.

   Grams of Fat x **9** cal/gram = _____ calories from fat

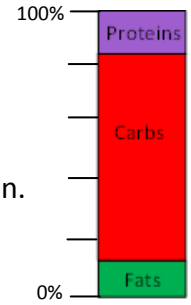
   Grams of Carbohydrate x **4** cal/gram = _____ calories from carbohydrates

   Grams of Protein x **4** cal/gram = _____ calories from proteins

   Total Calories: _____

5. Next, demonstrate for students how to find the relative percentage of calories that come from either fat, carbohydrates, or protein for that food.

$$\frac{\text{Number of [fat] calories}}{\text{Total calories}} \times 100 = \text{percent calories from [fat]}$$



6. Lastly, show students how to graphically represent the relative percentages of calories using the bar graph. Make sure that students know to use green for fat, red for carbohydrates and purple for protein.

Part B

7. Ask students, "How would you find out how many calories are in a McDonald's grilled chicken sandwich vs a McDonald's Big Mac?

8. Using Student Resource Part B: *Calculating Exercise,* demonstrate for students how to find the calories of each sandwich using the USDA's Food-A-Pedia section of the SuperTracker website (www.supertracker.usda.gov), as explained on the Student Resource.

Food-A-Pedia is useful for looking up nutritional values of foods that do not come packaged, such as fruits and vegetables. Encourage students to research these foods, too.

9. Next, demonstrate the Activity Calculator at www.caloriecontrol.org/healthy-weight-tool-kit/lighten-up-and-get-moving.

Note: Using the Activity Calculator, students may notice that a heavier person burns more calories than does a lighter person doing the same activity for the same amount of time. This is due to differences in ***basal metabolic rates***, or the number of calories required to sustain cellular respiration and bodily functions of a person when at rest. A heavier person requires more calories to maintain their weight, and burns more calories when exercising. As a person loses weight, their caloric needs decrease.

Part II (Explore): Balancing Calories and Exercise *(25 minutes)*

10. Pass out Student Sheet 3: *Balancing calories and exercise*. Let students work independently or in groups to record information from four different foods and calculate the amount of activity needed to burn off calories from various foods.

11. Using the copy master, provide additional bar graphs for each student to represent a different type of food they research. Challenge students to find foods that seem noteworthy or interesting (e.g., evenly distributed percentages, heavily unbalanced percentages, or particularly high or low caloric values).

12. After students have completed one bar graph to share with the class, have them fold back the bottom portion of the graph so that the name and calorie content of the food are not displayed. Have students post their graphs in a central location in the classroom.

13. Have students complete the questions on Student Sheet 3 as they proceed.

Part III (Evaluate): What food is that? *(10 minutes)*

14. As a class, consider all of the bar graphs posted in a central location. Find one with a predominant percentage of protein, for example, and ask student to predict what type of food it is.

15. Highlight a few more bar graph examples from which to make predictions before looking at the food name. It might be helpful to group similar-looking graphs into the same area, and then checking the food name to see how similar the types of foods are.

16. As a class, go over the answers to the questions on Student Sheet 3: *Balancing calories and exercise*.

    Part A: Do all calories in foods come from carbohydrates? If not, where else do calories in our food come from?

    No, not all calories in your diet come from carbohydrates. Fats and proteins also contribute calories. Each also contributes varying amounts of nutrients such as vitamins and minerals.

Part B:

4. What do you think happens to excess calories in all forms (i.e., carbohydrates fats, or protein) that are not burned during daily physical activity and metabolism?

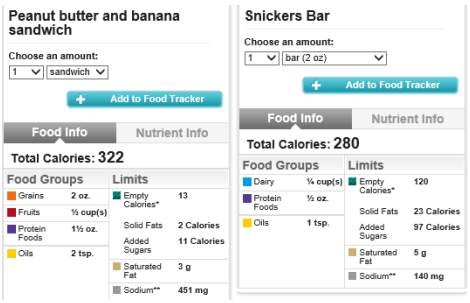
   Excess calories from carbohydrates that are consumed but not burned during metabolism of additional physical activity can be stored as glycogen in the liver or muscles, or stored in adipose tissue as fat. Excess fat could be stored in adipose tissue as fat. Excess protein is often eliminated from the body.

5. Based on your answer to the previous question, do you think it is important to be aware of the number of calories that you consume on a daily basis and whether you are getting a balanced diet of carbohydrates, fats and proteins? Why or why not?

   It is important to know your balance of calories consumed versus burned, and to be aware that excess calories in the form of carbohydrates, fat and proteins are not stored in the same way. It may also be important to know that different forms of exercise (e.g., exercise intensities) burn different energy storages (e.g., fat versus glycogen).

6. Explain the importance of balancing calorie intake and calories burned for someone who is pre-diabetic or has type 2 diabetes

7. Which snack would be a better choice? Give three reasons to support your answer.



While students might choose the Snickers Bar since it has fewer calories, it is important to note that the peanut butter sandwich 1) offers grains and fruit, both of which provide fiber which slows digestion and contributes to a feeling of fullness, 2) The sandwich has by far fewer empty calories, 3) The sandwich provides more protein. If students dig a bit deeper on Food-A-Pedia, the will find that the sandwich also provides more minerals and vitamins. However, the sandwich is much higher in sodium which could be noteworthy for certain groups of people, including diabetics.

Teacher Resource

A great resource for the role of micro-nutrients can be found at *The Linus Pauling Institute* at the University of Oregon: http://lpi.oregonstate.edu/

Part IV Closure *(8 minutes)*

17. Ask students how this lesson contributes to their understanding of the Driving Question: ***How can the growth of type 2 diabetes in the Yakima Valley be slowed?***

18. Revisit the Question Wall to see if any questions have been answered or more questions need to be added.

19. Have students consider possible Call to Action product that might grow from this lesson. For example, students could:
    - Explore various dietary or food claims for accuracy.
    - Research important nutritional habits for maintaining glucose levels for people with diabetes and create a specialized nutritional map.
    - Track their own diet and exercise over time in order to evaluate their own health status and potential risk for type 2 diabetes.
    - Chart a change in diet over time for a specific cultural or ethnic group and resulting impacts on health.

    Resources to support students in their Call to Action can be found in the *Assessment* section at the end of the curriculum.

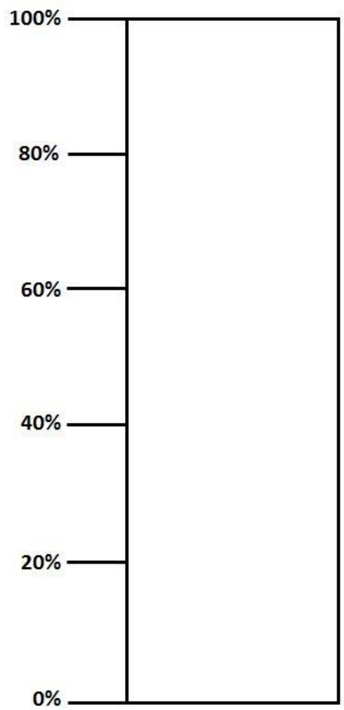
> ***Note:*** Students might also be interested to research where food labels come from, how food labels will change in the near future, who monitors them for accuracy, and what the acceptable margin of error is for the labels. It is interesting to note that although the labels are mandated by the FDA, the food company itself, not the FDA, is responsible for their accuracy. The law allows up to a 20% margin of error on food labels.

Glossary

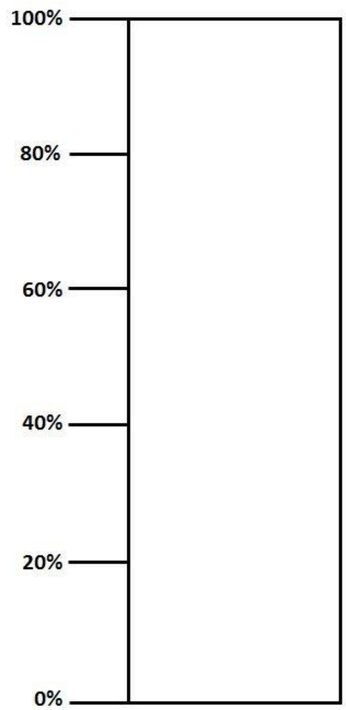
Basal metabolic rate: The rate at which an organism uses energy (burns calories) when at complete rest.

Copy Master

Additional bar graphs for representing percentages of food calories



Name:
Total cal:



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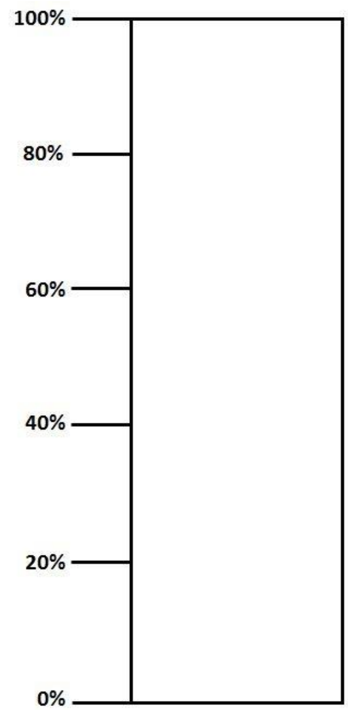

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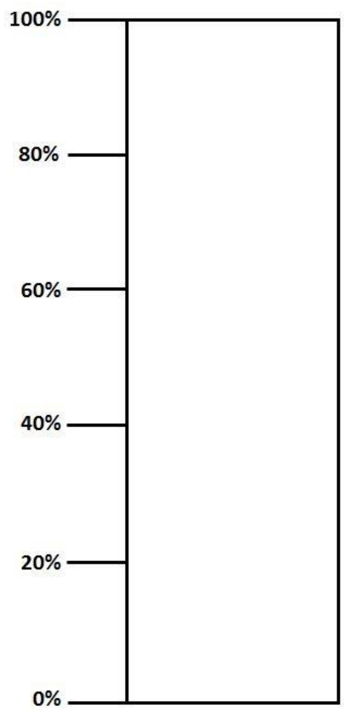

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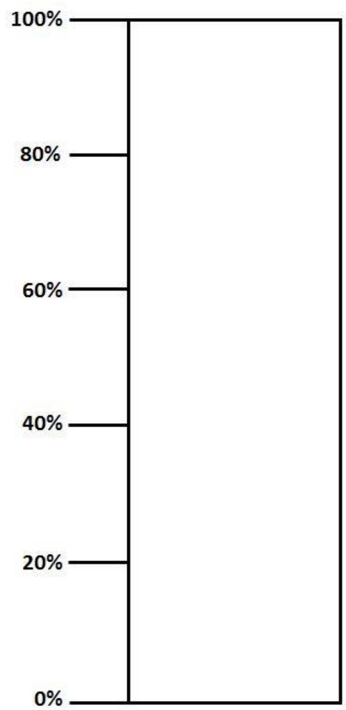

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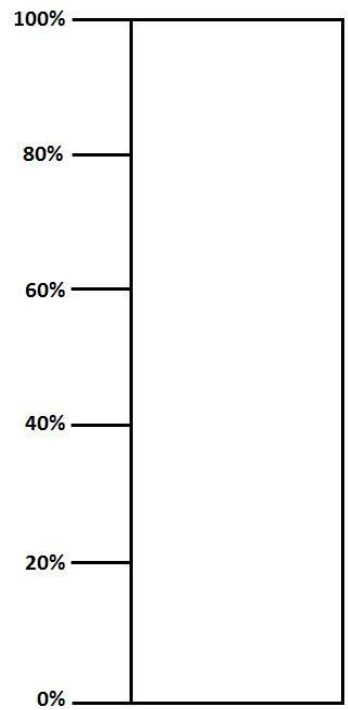


Name:
Total cal:

Part A Example: Calculating Food Labels

1. Using the above label, calculate the total calories in Green Giant Whole Kernel Sweet Corn

   a. Grams of Fat __1__ x 9 calories/gram = __9__ calories

   b. Grams of Carbohydrates __20__ x 4 calories/gram = __80__ calories

   c. Grams of Protein __2__ x 4 calories/gram = __8__ calories

   d. Total calories: __97__ calories

   Note: *the total calculated calories may not be identical to the label because grams of nutrients are rounded for label printing. Use your calculated number of calories to find the percentages of calories for each type of food, not the number from the label.*

2. Calculate the percent calories of each of the food types (fat, carbs, and protein):

   Remember: $\frac{\text{Part of calories}}{\text{Whole (total) calories}}$ X 100 = percentage

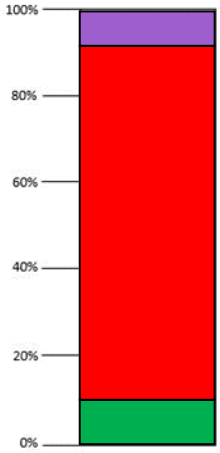
   a. % calories from fat = __9/97__ fat calories/total calories x 100 = __9.3__ %

   b. % calories from carbs = __80/97__ carb calories/total calories x 100 = __82.5__ %

   c. % calories from protein = __8/97__ protein calories/total calories x 100= __8.2__ %

3. Represent the percentages from Step 2 as a bar, as you see here. Label the name of the food and provide the total calories per serving. ***Note:*** make sure to use the following colors: fat (green), carbohydrates (red) and protein (purple).

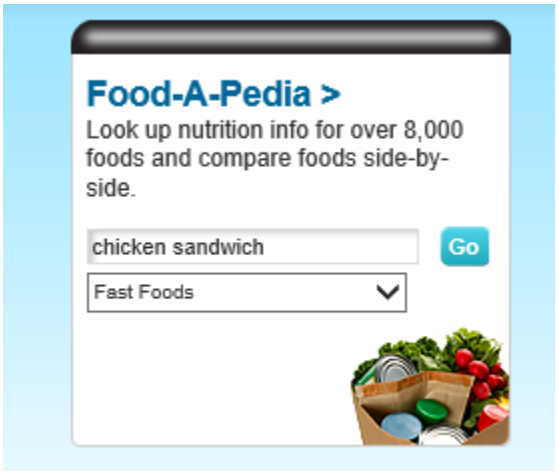
   Name: Sweet corn kernels, canned
   Calories: 97

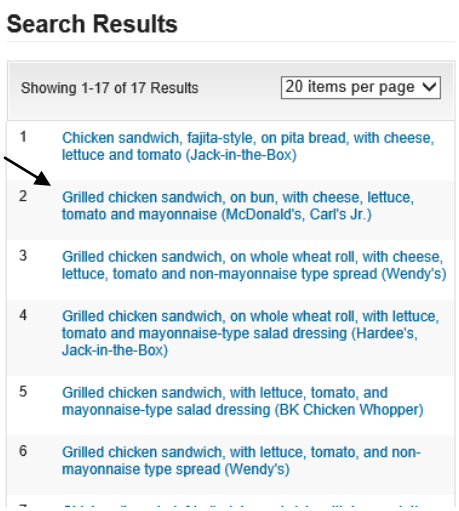


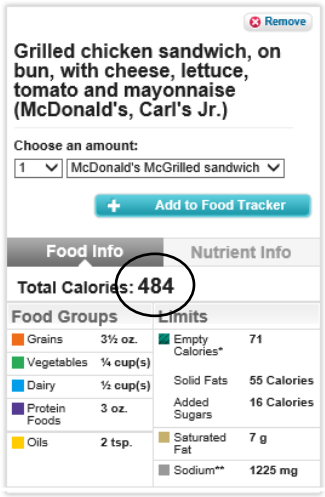
Part B Example: Calculating Physical Activity

1. How many calories are in a McDonald's Grilled Chicken Sandwich vs. a McDonald's Big Mac?

   Go to: www.supertracker.usda.gov and enter the food category and type into Food-A-Pedia. Enter the type of food from the drop-down menu, and then enter the type of food. Next, choose the correct food from the search results:



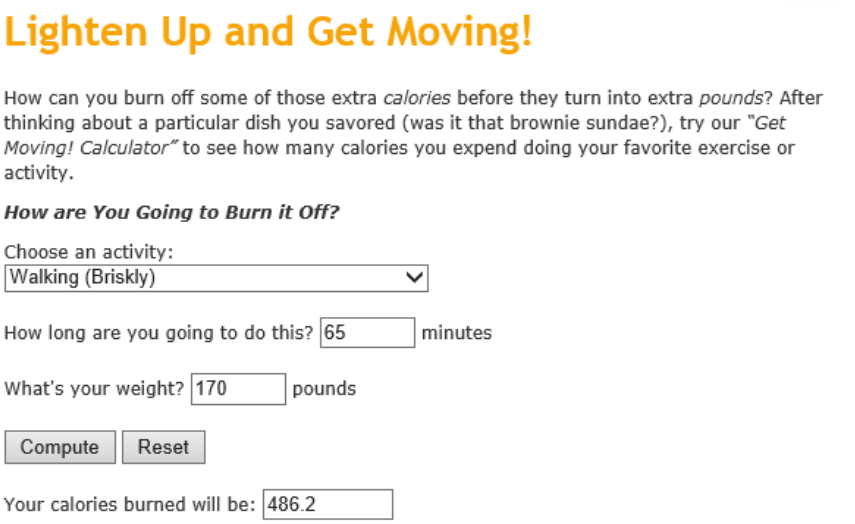




   - McDonald's Grilled Chicken Sandwich: 484 calories
   - McDonald's Big Mac: 585 calories

2. How long you would need to burn off the calories in the McDonald's Grilled Chicken Sandwich vs. the McDonald's Big Mac?

   Go to the Activity Calculator at: www.caloriecontrol.org/healthy-weight-tool-kit/lighten-up-and-get-moving: Choose your favorite physical activity, and determine the duration of activity needed to burn off the calories for each meal.



For example, a 170-pound person would need to walk briskly for just over an hour to burn 486 calories—enough for the Grilled Chicken Sandwich.

Name: _____ **Date:** _____ **Period:** _____

Part A: Using food labels or Food-A-Pedia (www.supertracker.usda.gov/foodapedia.aspx) choose four different foods to compare. Complete the calculations and fill out the bar graph.

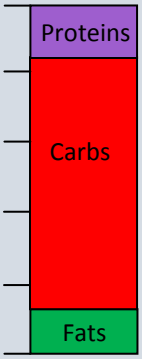
Things to remember…

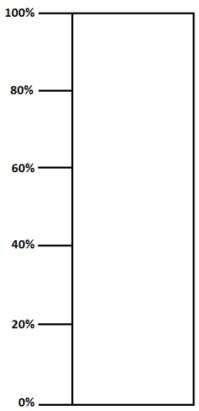
Grams of Fat x **9** cal/gram = _____ calories from Fat

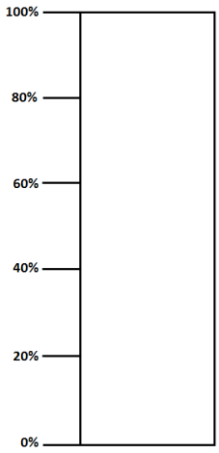
Grams of Carbohydrate x **4** cal/gram = _____ calories from Carbohydrates

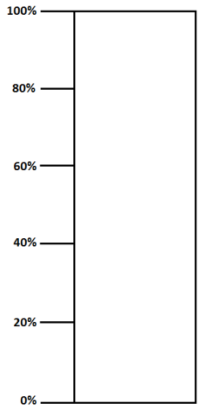
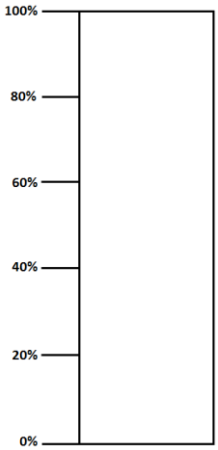
Grams of Protein x **4** cal/gram = _____ calories from Proteins

$$\frac{\text{Part of calories}}{\text{Total calories}} \times 100 = \text{percent calories}$$



Food #1:		**Total Calories:**	
From the label…	*Calculate the…*	*Calculate the…*	
Grams of Fat:	Calories From Fat:	% calories from Fat:	
Grams of Carbs:	Calories from Carbs:	% calories from Carbs:	
Grams of Protein:	Calories from Protein:	% calories from Protein:	
	Total calories:		

Food #2:		**Total Calories:**	
From the label…	*Calculate the…*	*Calculate the…*	
Grams of Fat:	Calories From Fat:	% calories from Fat:	
Grams of Carbs:	Calories from Carbs:	% calories from Carbs:	
Grams of Protein:	Calories from Protein:	% calories from Protein:	
	Total calories:		

Food #3:		**Total Calories:**	
From the label… Grams of Fat: Grams of Carbs: Grams of Protein:	*Calculate the…* Calories From Fat: Calories from Carbs: Calories from Protein: Total calories:	*Calculate the…* % calories from Fat: % calories from Carbs: % calories from Protein:	
Food #4:		**Total Calories:**	
From the label… Grams of Fat: Grams of Carbs: Grams of Protein:	*Calculate the…* Calories From Fat: Calories from Carbs: Calories from Protein: Total calories:	*Calculate the…* % calories from Fat: % calories from Carbs: % calories from Protein:	

Do all calories in foods come from carbohydrates (e.g., glucose)? If not, where else do calories in our food come from?

Name: _____ **Date:** _____ **Period:** _____

Part B:

1. Using the Activity Calculator found at www.caloriecontrol.org/healthy-weight-tool-kit/lighten-up-and-get-moving, choose your favorite physical activity, and determine how long you would need to participate in this activity to burn off the calories from one of the foods you chose in Part A.

    - Name of food:
    - Activity chosen:
    - Duration of activity needed to burn of the calories in the food:

2. Choose two snacks from the vending machine or from your home, and use Food-A-Pedia: www.supertracker.usda.gov/foodapedia.aspx or the labels to determine how many calories are in each of these snacks.

    Food-A-Pedia is useful for looking up nutritional values of unprocessed foods that do not come packaged, such as fruits and vegetables. How about including a piece of fruit or vegetable as a snack?

    - Snack #1 _____: _____ calories
    - Snack #2 _____: _____ calories

3. Using the Activity Calculator: www.caloriecontrol.org/healthy-weight-tool-kit/lighten-up-and-get-moving: Choose a physical activity, and determine how long you would need to participate in this activity to burn off the calories from each of the two snacks.

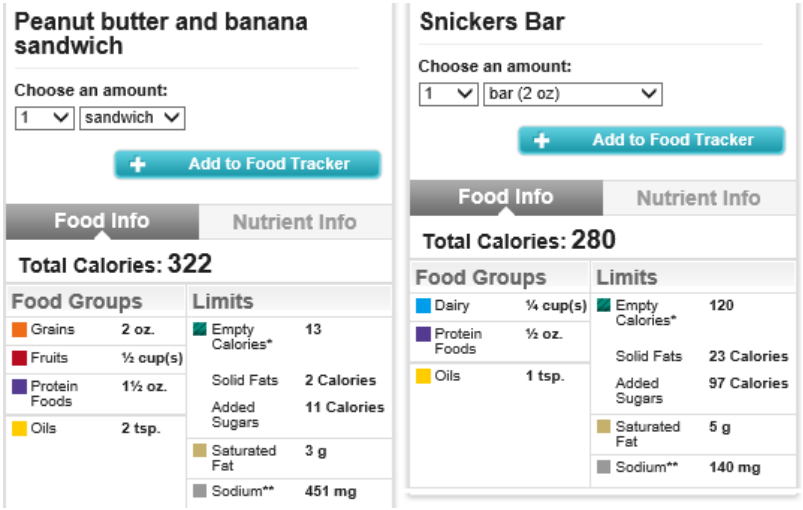
    - Activity chosen: _____
    - Duration of activity needed to burn of the calories in:
        - Snack #1 _____: _____
        - Snack #2 _____: _____

4. What do you think happens to excess calories (i.e., carbohydrates fats, or protein) that are not consumed (i.e., burned) during daily physical activity and metabolism?

5. Based on your answer to question 4, do you think it is important to be aware of the number of calories that you consume on a daily basis and whether you are getting a balanced diet of carbohydrates, fats and proteins? Why or why not?

6. Explain the importance of balancing calorie intake and calories burned for someone who is pre-diabetic or has type 2 diabetes

7. Which snack would be a better choice? Give three reasons to support your answer.



Peanut butter and banana sandwich

Choose an amount: 1 sandwich

+ Add to Food Tracker

Food Info | Nutrient Info

Total Calories: 322

Food Groups		Limits	
Grains	2 oz.	Empty Calories*	13
Fruits	½ cup(s)	Solid Fats	2 Calories
Protein Foods	1½ oz.	Added Sugars	11 Calories
Oils	2 tsp.	Saturated Fat	3 g
		Sodium**	451 mg

Snickers Bar

Choose an amount: 1 bar (2 oz)

+ Add to Food Tracker

Food Info | Nutrient Info

Total Calories: 280

Food Groups		Limits	
Dairy	¼ cup(s)	Empty Calories*	120
Protein Foods	½ oz.	Solid Fats	23 Calories
Oils	1 tsp.	Added Sugars	97 Calories
		Saturated Fat	5 g
		Sodium**	140 mg

* Calories from food components such as added sugars and solid fats that provide little nutritional value. Empty Calories are part of Total Calories.