COURSE 3:

Food Production, Nutrition and Health

DON'T LOSE YOUR BALANCE

food and nutrition sciences

PREPARATION FOR TOMORROW

CONTENTS

Project Overview

DAY	CONCEPT/DESCRIPTION
1	Energy In – Energy Out Activity – students will create butter and determine if there will be more energy required to make the butter than gained by eating.
2	Food Labels and Nutrition – students analyze the attributes of common breakfast cereals using food labels.
3	Groups organized, Project Management Log instructions, engagement scenario and comprehension questions
4	Energy Density of your fast food meal - no money limit
5	Most Nutritious fast food meal - ranking each group member's meal from Day 2 - using all nutrition information
6	Reading a CDC article learning terms- satiety, macronutrients, palatable
7	Create new fast-food meal- Most nutritious possible
8	Continue most nutritious fast food meal considering a Calorie limit, Nutrition, Satiety
9	Groups post most nutritious fast food meal - Gallery Walk for peer feedback
10	Teams prepare responses to peer feedback and present arguments

DAY	CONCEPT/DESCRIPTION
11	Why are Calories important web research- Credible Source Writing Lab
12	Basal Metabolic Rate, Introduced -Appalachian Trail Hiking Energy Challenge-comprehension questions
13	Appalachian Trail Energy Challenge-readiness questions Project Management Log task assignments Students see expectations from rubrics for grading
14	Research food items - prepare hike menu, presentation, and blog
15	Receive menu rough draft back- continue to research food items- prepare hike menu, presentation, and blog
16	Continue to research food items- prepare hike menu, presentation, and blog
17	Presentations of Appalachian Trail Energy Challenge - menu, turn in blog, students observe presentations and provide feedback
18	Presentations of Appalachian Trail Energy Challenge - menu, turn in blog, students observe presentations and provide feedback

Key Question of the Day:
Will it take more Calories to create butter than the Calories you will get from eating the butter?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Know how to churn heavy cream into butter
- Hypothesize on energy (Calories) required to make butter
- Calculate the amount of energy (Calories) in butter
- Form a conclusion of their hypothesis
- Identify qualitative and quantitative data

Required Materials

- Appendix 16 – Energy In-Energy Out (Teacher)
- Appendix 17- Energy In-Energy Out (Student)

Per group of three:

- 50 mL of emulsified colloid of liquid butterfat in H20 (heavy cream)
- 0.25 g of sodium chloride, NaCl (salt)
- 500 mL chilled H20
- Graduated cylinder, 100 mL
- Balance or electric scale
- Filter paper
- One plastic jar with lid, or test tube with stopper
- Plastic knife
- Crackers

Bell-Work

(Each day the Bell-Work question should be prominently displayed and used to open the lesson)

- Read through the Energy In – Energy Out lab today.

OPENING

*(Designed to **prepare** students for learning. Students are prepared for learning by activating an **overview** of the **upcoming** learning experience, their **prior knowledge**, and the **necessary vocabulary**.)*

- Bell Work- Read through the Energy In –Energy Out lab today.
- Teacher – Reads or goes over the Calorie or calorie section.
- Teacher- solicits some student hypotheses
  Teacher- goes over supply locations and procedures.
- Ask for questions to check for understanding of the lab.

MIDDLE

*(Designed to provide a **structure** for learning that actively promotes the **comprehension and retention** of knowledge through the use of **engaging strategies** that acknowledge the brain's limitations of **capacity and processing**.)*

- Energy In – Energy Out procedures
- Teacher circulates

PROCEDURE

1. Read through the entire Procedures section before beginning.
2. Gather all your materials at your lab station. If you notice any of the materials are dirty or discolored, notify your teacher.
3. Using the balance, find the mass of your container without the lid and record the mass in your data table.

4. Measure 50 mL of emulsified colloid of liquid butterfat in H2O in the 100 mL graduated cylinder.

5. Pour the 50 mL of emulsified colloid of liquid butterfat in H2O into your container (plastic jar or test tube with stopper)

6. Cap the container with the lid and seal it tight

7. Before you begin shaking, start a stop watch.

8. Shake the container about 20 times. Open the top slightly to relieve the pressure, and then reseal.

9. Continue to shake the container until all the liquid appears to have solidified. Once you have a complete solid, stop the stop watch and record the time in the data table.

10. Open the container and inspect the contents. Use the edge of your knife or your finger to taste a small amount of the contents. Describe the taste and texture of the contents in the data table.

11. Close your container tightly, start the stop watch, and continue to shake until lumps of solid fat form surrounded by a thin and opaque liquid. The liquid is known as buttermilk. Record the time in the data table when you reach this phase.

12. Open the container and taste the liquid buttermilk. Record your observations in the data table.

13. Pour the liquid buttermilk out of the container, being careful not to lose any of the solidified fat.

14. Add fresh, cold water until the container is about one-third full. Replace the lid and shake about five times. Pour off the wash water and repeat the washing until the water pours off clean. Record the number of rinses you completed.

15. Once the water pours off clean, use the balance to record the mass of the container with the butter and record this in your data table. Complete the calculations necessary to determine the mass of the butter you created.

16. Place the butter on a cracker and eat.

17. Clean your lab area and answer the Data Analysis and Conclusion and Connections questions that follow.

CLOSING

*(Designed to promote the **retention of knowledge** through the use of engaging strategies designed to **rehearse** and **practice skills** for the purpose of **moving knowledge into long-term memory**.)*

- Was your hypothesis correct or incorrect? Explain using data to support your answer.

Key Question of the Day:
What is in our food we eat?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Examine the Nutrition Facts panela of different products and record the information called for in your data table.
- Determine how do the foods compare in Calories, total fat, and cholesterol
- Express a current understanding of nutrition

Required Materials

- Appendix 18 – Food Labels and Nutrition
- Nutrition Facts panels from two different food packages

Bell-Work

- "***Have you ever looked at a nutrition label? If you have, what information were you looking for and why?"***

OPENING *5 minutes*

- Go over Bell-Work
  - › Have you ever looked at a nutrition label? If you have, what information were you looking for and why?
  - › Read through procedures for the Food Labels and Nutrition activity with the class

MIDDLE *40 minutes*

PROCEDURE

1. Obtain one Nutrition Facts panel from a container of oatmeal and one from a container of ready-to-eat cereal from your teacher.
2. In your data table, identify the products you're using.
3. Examine the Nutrition Facts panel on each product and record the information called for in your data table.

CLOSING *5 minutes*

ANALYZING RESULTS

1. How do the foods compare in Calories, total fat, and cholesterol?
2. Which food has the highest Calories per gram?
3. Which of the two products was higher in vitamins and minerals?
4. How do you account for differences in nutritional value?
5. Based on your current understanding of nutrition, what advantages and disadvantages do you see in eating each food item?

Key Question of the Day:
What things do you think make up a nutritious meal?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Provide the teacher with their current understanding of nutrition.
- Explain factors that are considered nutrition.
- Expose misconceptions about nutrition.

Required Materials

- Appendix 1 – Engagement Scenario and Comprehension Questions
- Appendix 15 – Project Management Log
- Appendix 13 – Daily Bell Work Template
- Appendix 14 – Exit Ticket Template

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"What things do you think make up a nutritious meal?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses.
- Students will reveal their prior knowledge with nutrition. They may express the understanding for needing micronutrients such as vitamins and minerals or macronutrients such as carbohydrates, proteins, fats
- May not include fats due to common misconceptions

MIDDLE *40 minutes*

- Arrange the students into the ideal group size of three. If the numbers do not work out, make one group of four if necessary. These groups will be working together for the next few weeks on challenges that will expose their misconceptions of nutrition and provide the opportunity for students to discover factors to maintain a healthy weight.
- On day one, they are to read the engagement scenario and complete the comprehension questions for the engagement scenario (Appendix 1). The answers to the comprehension questions are to be in each student's Project Management Log.
- Each student is to keep up a Project Management Log that notates the development of each task, who is responsible, and current status of the task. As the challenges get more involved this management log becomes a valuable tool of organization (for the students) and assessment (for the teacher).
  - ✓ **TEACHER TIP!** Review the eight comprehension questions with the class. Model how the information from the comprehension questions can be inserted into the Project Management Log.

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
  - ***What things do you think make up a nutritious meal?***
  - ***Are these the same things you listed in the beginning of class? Circle anything you added that was not on your original list from the beginning of class.***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
What is Energy Density?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Identify the serving size and Calories of different fast-food items from *selected fast-food restaurant*
- Calculate Energy Density of selected food items
- Understand 1 Calorie = 1,000 calories or 1 kcal and the Calorie is used in nutrition

Required Materials

- Calculator for each student
- Menu (same for all groups) of a local fast-food restaurant that the students are familiar with.
- The nutritional information of the selected fast-food restaurant (hard copy or website link)- Major fast-food restaurant chain is recommended
- Appendix 2- What Would You Eat?
- Appendix 3 – CDC Article: –"Low-Energy-Dense Foods and Weight Management: Cutting Calories While Controlling Hunger" http://www.cdc.gov/nccdphp/dnpa/nutrition/pdf/r2p_energy_density.pdf

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"If a person's suggested Calories per day is 2,000 Calories or 2,000 kcal/day to be healthy and each energy bar is 1000 Calories, how many energy bars can they eat?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses. Teacher may want to hold up two energy bars* as a visual aide during this opening discussion.
- Possible answers may include:
  - Two energy bars – because two energy bars equals 2,000 Calories
  - None because you will not feel full
  - As many as they want- because there are no food police are there?
- The point to be made:
  - ***The energy bars are very dense with Calories. The whole day's typical Calorie intake could be fulfilled by these two bars.***
  - ***Bring up the Calorie = 1,000 calories or 1 kilocalorie (kcal). The Calorie is what we use in nutrition. This is prior knowledge from Course 1.***

✓ **TEACHER TIP!** Mention in science you have learned Density = Mass/Volume. Today we are going to begin to learn about Energy Density of food Calories/gram.

**a typical energy bar is 200-300 Calories each.*

MIDDLE *40 minutes*

- Students should receive Appendix 2 "What Would You Eat?"
  - ✓ **TEACHER TIP!** The teacher should select a major fast-food chain that has nutritional information readily online and is familiar with the students.
- Teacher: ***"If you had no limit to how much money you could spend, what would you order from teacher inserts selected fast-food restaurant for lunch/dinner today?"***

- Students will start filling out Appendix 2 listing their meal. Do not hand out or give access to nutritional information until these are completely filled out.

- Have a few students share their selections. This may help other students fill out their selections and increase engagement. Teacher- ***"Is this really a meal you would eat?"***

- Students receive the nutritional information from *selected fast-food restaurant*

- Break students into their teams of 3 students (the team they will be working on "Hiking the Appalachian Trail Energy Challenge" determined on Day 1) and share their fast-food meals with each other.

- Individually each student is responsible for completing Appendix 2. The teammates can assist each other in locating the servings (grams) and the Calories. They should make sure each teammate has the correct calculations and assist each other if any conversions are necessary (i.e. ounces to grams.)

- Totaling the number of Calories and dividing by total grams will give each student an Energy Density for their meal. Note: there are two calculations, one without the beverage and one with the beverage.

- After students have had time to calculate the total kcal/g or Total Energy Density of their meal open a discussion on what happens mathematically when you include a beverage. The density gets lower due to the increase of mass per Calorie because of the beverage's water content. This point is developed later on whether beverages should be included when calculating Energy Density.

- **Collect Appendix 2 from the students**

- If time permits have the students read the first page of Appendix 3. CDC Article –"Low-Energy-Dense Foods and Weight Management: Cutting Calories While Controlling Hunger" Students should underline words they do understand and circle words they would not be able to pronounce. http://www.cdc.gov/nccdphp/dnpa/nutrition/pdf/r2p_energy_density.pdf

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
  - ***Define or show the formula for calculating Energy Density***
  - ***Explain in words, the mathematical steps you took to calculate your meal's total Energy Density***
  - ***What item in your meal had the highest individual Energy Density***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
Who selected the most nutritious meal?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Use nutrition information and evaluate their own meal selection for nutrition
- Develop ranking of most nutritious meal to least nutritious (in the team) and explain why

Required Materials

- The nutritional information of a teacher-selected fast-food restaurant (hard copy or website link)
- Appendix 2 - What Would You Eat?
- Appendix 3 – CDC Article: –"Low-Energy-Dense Foods and Weight Management: Cutting Calories While Controlling Hunger" as a resource
- Chart paper, markers, tape

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"What does the amount of Calories have to do with nutrition?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses.
- Students may remember from the previous day that there are a suggested amount of Calories per person, this is not an unlimited number.

MIDDLE *40 minutes*

- Students are to sit with their teammates and work together using the resources from the previous day. Appendix 2, Appendix 3, and the nutritional information from the selected restaurant from Day 1.
- Using all the nutritional information, figure out who has the most nutritious meal and rank them from most nutritious to least nutritious. Be prepared to share with the class your team's reasoning on why you ranked the meals the way you did.
- Have the teams informally present the meals in their group and their rankings from most nutritious to least nutritious. (The use of chart paper is recommended)
  - ✓ **TEACHER TIP!** Facilitate a discussion identifying what common things team's agreed on that made a nutritious meal (why they ranked something higher and lower)

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).
- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
  - ***Based on each team's approach to ranking what makes a nutritious meal?***
  - ***Did all teams agree on what makes a nutritious meal?***
  - ***What does the amount of Calories have to do with nutrition?***
- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
What is satiety and how does it play a role in nutrition choices?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Define satiety
- List examples of macronutrients
- Composition of foods effect on energy density

Required Materials

- Appendix 3 – CDC Article: –"Low-Energy-Dense Foods and Weight Management: Cutting Calories While Controlling Hunger" http://www.cdc.gov/nccdphp/dnpa/nutrition/pdf/r2p_energy_density.pdf

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"Do you think there is a need for a standard guideline for nutrition? A guideline we can all use as a resource on what is nutritious. Why or Why not?"***
- ***"Have you ever felt really full after a big meal? How does it feel?"***

OPENING *10 minutes*

- Open the discussion using BELL WORK question 1 on the need for standard guidelines for nutrition. Based on the EXIT TICKET answers from Day 3, you can prompt the discussion with examples as to what the students think about nutritious meals. If most of the groups developed different approaches to ranking their nutritious meals in Day 3, this will be time to discuss the need for the Dietary Guidelines for Americans. These are published every five years.
- The second question of the BELL WORK has students refer to a time their stomach felt full. Have them explain the feeling. This will encourage some engagement and possible stories of wonderful meals they have had in the past. Teacher will mention that the full feeling is a *satisfying* feeling or not hungry anymore.

MIDDLE *35 minutes*

- **Using Appendix 3** - CDC Article: –"Low-Energy-Dense Foods and Weight Management: Cutting Calories While Controlling Hunger"
- Have the students read the first 12 paragraphs. During this they are to underline words they do not understand and circle words they cannot pronounce. They may underline and circle the same word. These will be an indicator on comprehension as the teacher circulates around the room.
  - ✓ **TEACHER TIP!** When the students are complete, teacher will read aloud the first 12 paragraphs. The teacher will model the reading and add commentary as appropriate.

- Key points to be made during the reading that may end up as answers on their EXIT TICKET:
  - Paragraph 1: word, satiety - sə-ˈtī-ə-tē- the quality or state of being fed or gratified to or beyond capacity
  - Paragraph 3: strategies used to consume fewer Calories. Also, identify macronutrients mentioned (carbohydrates and fats) Ask what macronutrient is not mentioned. (protein)
  - Teacher: this maybe the first time the students are exposed to the term macronutrient and connected to proteins, carbohydrates, and lipids (or fats). This is worth the time to expand a little discussion while including other essential nutrients: vitamins, minerals, water.
  - Paragraph 6: you can relate their calculations of Energy Density from Day 2 adding in their beverages lowered the Energy Density of their meal. Foods with more water in them have a lower Energy Density.
  - Paragraph 11: word, palatable - ˈpa-lə-tə-bəl - agreeable to the palate or taste
  - Paragraph 12: Ask the students ***what is meant by "maintained satiety"***

- Tease tomorrow – Remember that meal you selected from teacher selected fast-food restaurant, tomorrow your team will have to figure out the most nutritious meal possible from there.

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"Write at least three things they learned today. This should be turned in prior to leaving class."***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
What strategies can be used to select the most nutritious meal?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Identify strategies to select the most nutritious meal possible at a fast-food restaurant

Required Materials

- Chart paper and markers or access to desktop publishing programs and printers
- Appendix 2, Appendix 3, for reference
- Dietary Guidelines of America 2010 - hardcopy or Internet access http://health.gov/dietaryguidelines/dga2010/DietaryGuidelines2010.pdf
- Appendix 15 - Project Management Log

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"What things must be considered to select the most nutritious meal possible?"***

OPENING *5 minutes*

- Go over the BELL WORK question. During the discussion students may bring up Calories, macronutrient examples, micronutrient examples, energy density, satiety. These are all terms that the previous day's reading identifies and were also possible answers on the students' EXIT TICKETS.
  - ✓ **TEACHER TIP!** Say the following to set-up up the day's expectations. ***"Today your team is going to use the same menu and nutrition information as we did on Day 2 to create the most nutritious meal possible from teacher selected fast-food restaurant."***

MIDDLE *35 minutes*

- The teams of students will create a lunch that is the most nutritious possible in their estimation. The meal will be for a 16 year old female student that has a moderately active lifestyle. The Dietary Guidelines of America 2010 (or latest available if 2015) should be made available. In this, they will see a 16 year old moderately active female should have 2,000 Calories a day. (See pg. 14 in 2010 guidelines) Prepare this information for the team activity on a chart paper. The team will prepare a presentation of their meal and why it is the most nutritious selection.
  - › Requirements: The meal must include at the minimum one entre (or sandwich), one drink, and one side item. Nutritious qualities should be identified and Calorie total should be included. Will she feel full? Satiety. (note: this is just one meal of the day)

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).
- Students will turn in th'eir Exit Ticket for that day. They will respond to the following prompt: ***"Write at least three things they learned today. This should be turned in prior to leaving class."***

Key Question of the Day:
What strategies can be used to select the most nutritious meal?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Identify strategies to select the most nutritious meal possible at a fast-food restaurant

Required Materials

- Chart paper and markers or access to desktop publishing programs and printers
- Appendix 2, Appendix 3, for reference
- Dietary Guidelines of America 2010 - hardcopy of Internet access http://health.gov/dietaryguidelines/dga2010/DietaryGuidelines2010.pdf
- Appendix 15 - Project Management Log from previous day (each person)

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"According to the 2010 Dietary Guideline of America, how many Calories should a moderately active 16 year old female consume daily? How many milligrams of sodium should be consumed daily?"***

OPENING *5 minutes*

- Bell-Work – Students should answer 2,000 Calories. This is based on information on page 14.
- People often consume as much as 3,500 mg/day. 1,500-2,300 mg is recommended (pg. 22 in Dietary Guidelines of America 2010).

✓ **TEACHER TIP!** Discussion ideas to lead the teams back to work are:

- The lunch you are selecting is one meal of the day. Is knowing 2,000 Calories important? Why or why not?
- Are you considering satiety as a factor in this meal? Why or Why not?
- Teacher should also use the EXIT TICKET from Day 5 to make sure teams are considering a vast number of things in the selection of a nutritious meal. Satiety should be included, that way "she" is satisfied when the meal is finished and not going to pursue more food.

MIDDLE *40 minutes*

- Today you should continue the selection of your lunch food items and developing your position as why this meal you selected is the most nutritious lunch possible. The meal should be clearly listed and the attributes that make it a nutritious meal on a chart paper by the end of class.
- Turn in Project Management Log to teacher for feedback on task allocations

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
  - ***Name one reason the meal your team has selected will be considered the most nutritious meal possible.***
  - ***How much sodium is the Recommended Daily Allowance?***

Key Question of the Day:
What are the qualities of a nutritious meal?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Identify strategies to select the most nutritious meal possible at a fast-food restaurant and defend the group's meal decision based on nutrition guidelines and satiety.

Required Materials

- Chart paper, sticky notes, and markers or access to desktop publishing programs and printers
- Appendix 2, Appendix 3, for reference
- Dietary Guidelines of America 2010 - hardcopy of Internet access http://health.gov/dietaryguidelines/dga2010/DietaryGuidelines2010.pdf
- Appendix 15 - Project Management Log

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"What are the qualities of a nutritious meal?"***

OPENING *5 minutes*

- Discuss BELL WORK question: Have students share out their ideas of a nutritious meal. Write these ideas on the board. You will want them to include the macronutrients, micronutrients, Calories, and satiety (you will keep eating if you are not satisfied). This list on the board will become the standards they will use when defending their selection of a meal.

MIDDLE *40 minutes*

Gallery Walk (30 min. and debrief 10 min.)

- Students post their chart paper that can be identified by a number (like GROUP 1). This chart paper has their meal items identified with each item's nutrition attributes around the room.
- The students will visit each other group's chart paper to view the other meals selected and to post comments and questions using sticky notes on the chart paper. It is everyone's job to find flaws in the claim that it is the most nutritious meal possible from teacher selected fast-food restaurant.
- After all rotations, students return to their seats with their group to view feedback from the sticky notes and prepare a defense. They need to rank most nutritious to least by GROUP NUMBER.
  - ✓ **TEACHER TIP!** Teacher should facilitate rotations by signaling to move to the next chart paper. Time allotted will depend on number of groups and time in class.
    - » *Retain chart paper for Day 8.*

CLOSING *5 minutes*

- Teacher uses EXIT TICKETS to find top meal. Each student will provide their GROUP NUMBER so if all just vote for their own, teacher can look at the second ranking.

- Provide each student with the weekly Exit Ticket handout (Appendix 14).

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
  - ***Write your GROUP NUMBER in today's activity***
  - ***Do you still think you selected the most nutritious meal after viewing the other groups' meals? Why or why not?***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
What are the quantities of a nutritious meal?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Identify strategies to select the most nutritious meal possible at a fast-food restaurant and defend the group's meal decision based on nutrition guidelines and satiety.

Required Materials

- Chart paper and markers or access to desktop publishing programs and printers
- Appendix 2, Appendix 3, for reference
- Dietary Guidelines of America 2010 - hardcopy of Internet access http://health.gov/dietaryguidelines/dga2010/DietaryGuidelines2010.pdf

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"What are the quantities of a nutritious meal? (Distinguish between qualities and quantities)"***

OPENING *5 minutes*

- Discuss BELL WORK question: What are the quantities of a nutritious meal? (Distinguish between qualities and quantities) This is an opportunity to distinguish the quantities suggested of nutrients in the Dietary Guidelines verses qualities of a nutritious meal. Qualities such as satiety, smells, colors, taste, and other reasonable suggestions from students.

MIDDLE *40 minutes*

10 minutes to prepare a defense, 30 minutes all group present a defense

- Students will use their chart paper from Day Six that can be identified by a number (like GROUP 1). This chart paper has their meal items identified with each item's nutrition attributes around the room and sticky notes with comments and questions challenging their group's claim that the meal is the most nutritious.
- Groups receive ten minutes to prepare an argument of each sticky note comment and question to convince the other students their selection is the most nutritious meal.
- After a ten minute preparation time, groups need to be allowed five minutes to state the comments and questions from the sticky notes and argue their meal's nutritional value.
- After all groups present their defense, all students will need to rank most nutritious to least by GROUP NUMBER.
  - ✓ **TEACHER TIP!** – This is a good time to provide feedback about Project Management Logs.

CLOSING *5 minutes*

- Teacher uses EXIT TICKETS to find top meal. Each student will provide their GROUP NUMBER so if all just vote for their own, teacher can look at the second ranking.

- Provide each student with the weekly Exit Ticket handout (Appendix 14).

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
  - ***Write your GROUP NUMBER in today's activity.***
  - ***Rank all the meals in the room from most nutritious to least nutritious using the GROUP NUMBERS.***
  - ***Name an important quality of a nutritious meal.***
  - ***Name an important quantity of a nutritious meal.***

- Collect the Exit Ticket for the day as students leave the classroom

Key Question of the Day:
Why are Calories important?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Identifying credible sources of information
- Calories in should be equal to Calories out to maintain weight.

Required Materials

- Internet for research
- Appendix 4 - Credible Source Writing Lab

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"What was the most important factor when deciding the most nutritious meal from teacher selected fast-food restaurant?"***

OPENING *10 minutes*

- BELL WORK – Discuss BELLWORK question and share the "winner" of the most nutritious meal based on class voting with the EXIT TICKETS.
- Use this time to discuss the Calorie as a factor in a nutritious meal. It is possible that the Calorie is looked at in a negative way due to the fast-food activity.
  - ✓ **TEACHER TIP!** Ask the class ***"Why are Calories important?" Today you will research the answer to that question***

MIDDLE *35 minutes*

- Groups are to work on the question - "Why are Calories important?" by searching on the Internet. They are to choose and article and prepare to share the answer to the question. This task is also about selecting a credible source of information.
- Students will use Appendix 4 – Credible Source Writing Lab.
- Have the reporter from each group share what sources their team used prepared to answer the question, "Why are Calories important?"
  - ✓ **TEACHER TIP!** Discussion points:
    - » *Calories are important as they are the measure of energy in our food and we need energy to function.*
    - » *We eat Calories and burn Calories.*
    - » *To maintain weight Calories in should equal Calories out.*
    - » *To lose weight we need to burn more Calories than we eat.*
    - » *To gain weight we need to eat more Calories than we burn.*
- Ask students about their sources. Authors should be cited and a thorough understanding of their educational background should be understood. This should open up a dialogue to credibility. What is the author's purpose for writing the article? How current is the article? Why should we be skeptical of sources on the Internet?

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"How are the number of Calories required for a person to maintain weight affected by their activity?"***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
What foods contain the most energy (Calories)?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Access prior knowledge about energy balance. Calories in = Calories out
- Understanding the importance of menu planning to meet the needs of special diets.

Required Materials

- Appendix 5 - Energy Balance worksheet from: http://www.feedingminds.org/fileadmin/templates/feedingminds/pdf_nu/EWell_09_00-06.pdf
- Internet to research Basal Metabolic Rate (BMR), food and their mass and Calories
- Appendix 5 - Energy Balance worksheet ANSWERS: http://www.feedingminds.org/fileadmin/templates/feedingminds/pdf_nu/EWell_09_00-07.pdf
- http://www.youtube.com/watch?v=VzYRv74ebXc
- Appendix 6 - Hiking the Appalachian Trail Energy Challenge
- Appendix 7 - Hiking the Appalachian Trail Energy Challenge Comprehension questions/answers

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"How are the number of Calories required for a person to maintain weight affected by their activity?"***

OPENING *15 minutes*

- BELL WORK: Use this question to review the need to consume Calories to maintain weight.
  - ✓ **TEACHER TIP!** The students may remember using this Energy Balance worksheet from Food, Nutrition Science Course 1. This is intentionally to access prior knowledge.
- Have the students select one of the three people in the Energy Balance worksheet and answer the three questions for their selected person.
- Teacher can use the answer sheet link to go over the answers for each person or make a PowerPoint visual aide to assist in the discussion.
- Discussion should focus on how to maintain weight Calories in = Calories out. It would be appropriate to discuss what happens when it becomes unbalanced. Either weight gain or weight loss.

MIDDLE *30 minutes*

- Show the YouTube video about the Appalachian Trail Hike. http://www.youtube.com/watch?v=VzYRv74ebXc
- Share with the students things to listen for during the 4 minute video:
  - › How many Calories per day will a hiker be expected to use? (5000-6000)
  - › What are some of the foods the hikers explain they eat? (doughnuts, cream cheese…)
  - › Why do they select the foods that they do? (they are high in fat)
  1. Hiking the Appalachian Trail Energy Challenge – See Appendix 6
  2. Students should read quietly and underline words they do not understand and circle words they would not be able to pronounce.
  3. Teacher reads aloud the "Hiking the Appalachian Trail Energy

Challenge" after circulating around during the student silent reading.

4. Teams complete the Comprehension Questions for the challenge and will turn in to the teacher at the end of class.

✓ **TEACHER TIP!** Here are specifications of the challenge:

- Each team is to plan the meals for a hiker for a five day hike on the Appalachian Trail (AT). The hiker will burn 4,000 Calories per day of energy not including his Basal Metabolic Rate (BMR), read below for total. Total weight of the food is limited to 2 lbs. per day or 10 lbs. total and 2,000 cubic inches total space.
- It is important to note the students receive volume limits in cubic inches while the back pack volume is provided in Liters (65 Liters). 65 Liters converts to 4,000 cubic inches so approximately one half of the backpack is available for food.
- The output of energy (daily activity Calorie requirements) each day of hiking is 4,000 per day. His Basal Metabolic Rate (BMR) should be added to the 4,000 Calories. A 28 year old male, weighing 140 lbs. and is 6 feet 1 inch tall has a BMR around 1,600 Calories. BMR can be calculated using an Internet search. A total of 5,600 Calories per day for the hiker should be determined by the team of nutritionists. 28,000 Calories total for five days.
- In summary, this challenge is about packing 28,000 Calories of food in 2,000 cubic inches, within a limit of 10 lbs. or 4,536 grams. This is a feasible number with a high energy density food such as macadamia nuts but other qualities evaluated of the food plan such as variety, nutritional needs, and satiety should discourage a food plan of ten pounds of macadamia nuts. Also, to potentially rank higher on the nutritional needs category, a daily multivitamin could be included. Little mass and volume could go a long way. Will any group think of this addition to the menu?

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
  - ***List some food items you think you will pack for the 5 day hike on the Appalachian Trail.***
  - ***Why did you choose the food items that you did?***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
What foods contain the most energy (Calories)?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Complete understanding of the challenge and the grading criteria for the challenge.

Required Materials

- Appendix 6 – Hiking the Appalachian Trail
- Appendix 7 – Hiking the Appalachian Trail Energy Challenge Comprehension Questions
- Appendix 8 – Hiking the Appalachian Trail Readiness Questions/Answer sheet
- Appendix 9 – Presentation Rubric
- Appendix 10 – Observation Sheet Rubric
- Appendix 11 – Observation Sheet
- Appendix 15 – Project Management Log

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)

- ***"What do you think will be the most challenging part of the Hiking the Appalachian Trail Challenge?"***

OPENING *5 minutes*

- BELL WORK: Use this question gauge the comfort level of the teams.
  - ✓ **TEACHER TIP!** Today's activity is to make sure each team understands everything needed to successfully take on the challenge.

MIDDLE *40 minutes*

- Have each group answer the readiness questions on Appendix 8 - Hiking the Appalachian Trail. They will also need Appendices 6, 7, and 9, 10 & 11 to answer all of the questions. The team is also expected to identify and assign tasks on the Appendix 15 - Project Management Log.
  - ✓ **TEACHER TIP!** Go over these answers after about twenty minutes making sure the teams understand everything that is expected of them. This is the time to introduce the Observation Sheets and Rubric. All students are expected to be good observers as well as nutritionists.

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
  - › ***What do you think will be the most challenging part of the Hiking the Appalachian Trail Challenge?***
  - › ***Is this the same answer you had in the beginning of the class today?***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
What foods contain the most energy (Calories)?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Access prior knowledge about energy balance. Calories in = Calories out
- Understanding the importance of menu planning to meet the needs of special diets.

Required Materials

- Appendix 6 - Hiking the Appalachian Trail
- Internet to research food and their mass and Calorie
- Appendix 12 -Microsoft Excel, Microsoft PowerPoint,
- Chart paper (optional)

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"There are five elements when considering the menu of Hiking the Appalachian Trail Energy Challenge: Calories, volume, nutritional needs, variety, and satiety. Which does your team rank as most important? Why?"***

OPENING *5 minutes*

- Go over BELL WORK and open the discussion as to the students' thoughts on what of the menu elements are most important. Let different teams respond and justify their thoughts.
  - ✓ **TEACHER TIP!** It is important to allow the students to justify their thoughts and as the teacher, not offer any emphasis to one menu element or another.

MIDDLE *40 minutes*

- Student teams will prepare a rough draft menu for presentation on paper. This will become a PowerPoint or similar visual aide tomorrow. It is the team's decision on what will be on the menu for five days.
- All of the elements described in the challenge may or may not be addressed in their menu. The menus must include details on the specifications of the challenge – total volume, 2,000 cubic inches, 5,000 Calories/day, and 10 lbs. total weight.
- The food items selected will be inserted into the Appendix 12 Excel Spreadsheet. This will be printed and turned in at the end of class as a rough draft of the team's menu ideas.

Using Appendix 12

- ✓ **TEACHER TIP!** Total Calories and conversions from grams to pounds are automatically calculated using the spreadsheet. The total volume is not calculated because of the many possible units that may be involved. Directions are included on the spreadsheet on how to calculate the total volume. Convert units to cubic inches. Add all cubic inches together. This is not to exceed 2,000 cubic inches.

- The unit conversions are automatically calculated because it is expected the students, being proficient in 21st Century Skills, would use the Internet to determine the conversions. This is not an expected mathematical standard during this project.

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"What elements of the Hiking the Appalachian Trail Energy Challenge did your team consider most important? Did it change? Why or why not?"***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
What foods contain the most energy (Calories)?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Access prior knowledge about energy balance. Calories in = Calories out
- Understanding the importance of menu planning to meet the needs of special diets.

Required Materials

- Appendix 6 – A.T. Challenge
- Appendix 12 – Excel Spreadsheet
- Internet to research food and their mass and Calories
- Microsoft Excel, Microsoft PowerPoint,
- Chart paper (optional)

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"There are five elements when considering the menu of Hiking the Appalachian Trail Energy Challenge: Calories, volume, nutritional needs, variety, and satiety. Which does your team rank as least important? Why?"***

OPENING *5 minutes*

- Go over BELL WORK and open the discussion as to the students' thoughts on what of the menu elements are least important. Let different teams respond and justify their thoughts.
  - ✓ **TEACHER TIP!** It is important to allow the students to justify their thoughts and not offer any suggestions.

MIDDLE *40 minutes*

- Students receive rough draft back (Appendix 12).
- Teams continue to research food and work on menu.
- Make a presentation using PowerPoint of your five day menu featuring each element from the challenge.
- Write a detailed blog of the hike including the five day menu with time and place the food is eaten. This will continue tomorrow if time is needed.

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).
- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"What elements of the Hiking the Appalachian Trail Energy Challenge did your team consider least important? Did it change? Why or why not?"***
- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:

What are the most important things to consider nutritionally, when preparing for a five day hike?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Access prior knowledge about energy balance. Calories in = Calories out
- Understanding the importance of menu planning to meet the needs of special diets.
- Speaking and Listening skill development
- Evidence of teamwork

Required Materials

- Appendix 6 – A.T. Challenge
- Appendix 12 – Excel Spreadsheet
- Internet to research food and their mass and Calories
- Microsoft Excel, Microsoft PowerPoint
- Chart paper (optional)

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"What food item on your menu has the highest energy density and what is the energy density?"***

OPENING *5 minutes*

✓ **TEACHER TIP!** If students still need time to prepare their Hiking the Appalachian Trail Energy Challenge menus for presentation and detailed blog, allow them this day to complete.

- Today do not go over the BELL WORK because at this point, this is their secret and they probably will not want to share so other teams can steal their idea. You can explain this as a business concept and proprietary process unique to their company.
  - ✓ **TEACHER TIP!** You could bring up other businesses that also keep their secrets about their food.

MIDDLE *40 minutes*

- Teams continue to research food and work on menu.
- Make a presentation using PowerPoint of your five day menu featuring each element from the challenge.
- Write a detailed blog of the hike including the five day menu with time and place the food is eaten.

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).
- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"Restate the three reasons you thought your five day food plan for the challenge was the best idea in the room. Did any of the presentations today change your mind on your team's food plan? Why or why not?"***
- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:

What are the most important things to consider nutritionally, when preparing for a five day hike?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Access prior knowledge about energy balance. Calories in = Calories out
- Understanding the importance of menu planning to meet the needs of special diets.
- Speaking and Listening skill development
- Evidence of teamwork

Required Materials

- Appendix 6 – A.T. Challenge
- Appendix 12 – Excel Spreadsheet
- Internet to research food and their mass and Calories
- Microsoft Excel, Microsoft PowerPoint,
- Chart paper (optional)

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"Write down three reasons you think your five day food plan for the Hiking the Appalachian Trail is the best idea in the classroom."***

OPENING *5 minutes*

- Today do not go over the BELL WORK because what they select will be also included in today's EXIT TICKET.
- Today is presentation day of the Hiking the Appalachian Trail Energy Challenge. Teams will present their five day food plan.
- The other students will provide feedback to each team's presentation in regards to the five elements and the specifications of the challenge. See Appendix 11.

MIDDLE *40 minutes*

- Teacher selects order of student presentations.
- Students will present their food plan for the five day Appalachian Trail hike.
- The student audience will score and make comments on the team's decisions for food using Appendix 11.
- At the end of each presentation there should be an opportunity for the audience to ask questions. It will be expected from the audience to ask questions. This is a part of the Appendix 11 format.
- Teams are to turn in the blog to teacher before the presentation so the teacher has it while they present to the audience.
- *In a class of 30 (10 groups) try to complete 5 presentations today (8 minutes each).*

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"Restate the three reasons you thought your five day food plan for the challenge was the best idea in the room. Did any of the presentations today change your mind on your team's food plan? Why or why not?"***

- Collect the Exit Ticket for the day as students leave the classroom

Key Question of the Day:

What are the most important things to consider nutritionally, when preparing for a five day hike?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Access prior knowledge about energy balance. Calories in = Calories out
- Understanding the importance of menu planning to meet the needs of special diets.
- Speaking and Listening skill development
- Evidence of teamwork

Required Materials

- Appendix 6 – A.T. Challenge
- Appendix 12 – Excel Spreadsheet
- Internet to research food and their mass and Calories
- Microsoft Excel, Microsoft PowerPoint,
- Chart paper (optional)

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 13)
- ***"Name one food item that you heard on another team's food plan that you didn't think of and thought it was a good idea."***

OPENING *5 minutes*

- Today do not go over the BELL WORK because what they select will be also included in today's EXIT TICKET.
- Today is presentation day of the Hiking the Appalachian Trail Energy Challenge. Teams will present their five day food plan.
- The other students will provide feedback to each team's presentation in regards to the five elements and the specifications of the challenge. See Appendix 11.

MIDDLE *40 minutes*

- Teacher selects order of student presentations.
- Students will present their food plan for the five day Appalachian Trail hike.
- The student audience will score and make comments on the team's decisions for food using Appendix 11.
- At the end of each presentation there should be an opportunity for the audience to ask questions. It will be expected from the audience to ask questions. This is a part of the Appendix 11 format.

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout (Appendix 14).
- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"Name one food item that you heard in today's or yesterday' presentations that your team did not think of and thought it was a good idea. Why did you think it was a good idea?"***

Essential Question:

What are the factors in maintaining a healthy weight?

Engagement Scenario:

The Appalachian Trail is a 2,181 mile- (3,510 km) long trail that stretches from Georgia to Maine in the eastern United States. Although two million to three million people hike portions of the trail each year (section hikers), only fifteen hundred to two thousand attempt to hike the entire length (thru hikers) and only two hundred to three hundred of those people succeed. Hiking the Appalachian Trail can be very challenging due to changing weather conditions, levels of remoteness and the physicality of the hiking.

Your team has been identified as potential nutritionists to be hired for a very popular hiking company's website. The website currently offers different levels of coaching to prepare a hiker for the Appalachian Trail. Currently they offer gear, physical training, budgeting, and trail guidebooks. Your team is expected to add a nutritional coaching feature. This new website feature will provide plans for section hikers to meet their caloric and nutritional needs while hiking.

All teams competing for this job will be presented with the "Hiking the Appalachian Trail Energy Challenge." This will be your job interview for the company. Your team will be challenged to meet certain Calorie and nutrition requirements for a section hiker of the Appalachian Trail (AT). There will also be strict limitations of both volume and weight.

Before you receive the "Hiking the Appalachian Trail Energy Challenge," your team will research qualitative and quantitative aspects of food including but not limited to: energy density, satiety, and nutritional needs. Your team will also do an activity in determining credible sources from the Internet using informational texts, blogs, and data tables. During the challenge, the information your team gathers, will be in a blog format. This is to test out your ability to appeal to the website users.

A presentation, based on your blog, will be presented to the company's hiring team. You will need to include all the required energy and nutritional information from the blog.

Your nutrition team has to compete with the other teams in the room for the best overall food plan for the AT section hiker. The team with the best food plan will be hired to this great company. In addition to a fun and rewarding work environment, the starting salary for each team member is 1.5 times the industry average for nutritionists!

Good luck!

Project 1 – Don't Lose Your Balance! Comprehension Questions

ANSWER THESE IN YOUR PROJECT MANAGEMENT LOG

1. How many people hike portions of the Appalachian Trail each year and what are they called?
2. What job is your team interviewing for in this Engagement Scenario?
3. What will be asked of your team to produce?
4. What is the title of the challenge that will be your job interview?
5. What will your team do before the challenge is given to you?
6. What does AT stand for?
7. Who is your team competing with?
8. What is the starting salary for this job position for each member of the team?

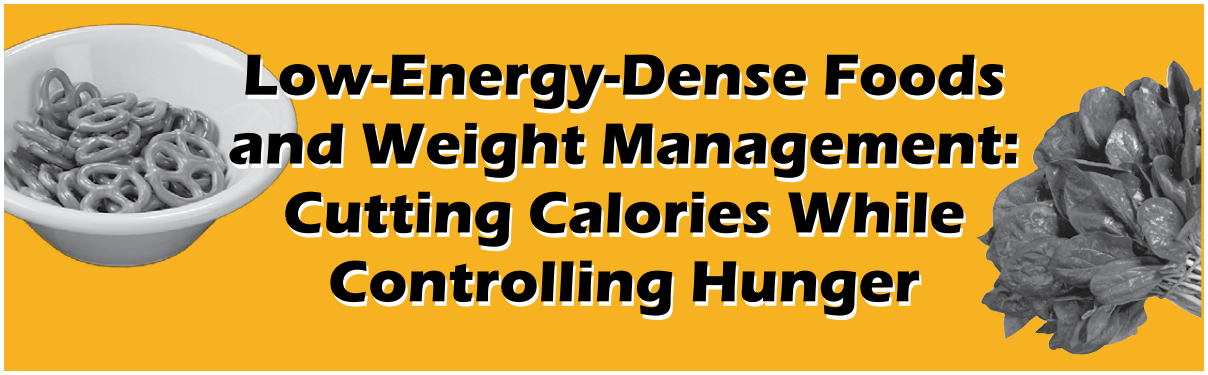
What Would You Eat?

Name _____ Project _____ Date _____

If you had no limit to how much money you could spend, what would you order from teacher inserts selected fast-food restaurant for lunch/dinner today?

FOOD ITEM		CALORIES OR KCAL		MASS IN GRAMS		ENERGY DENSITY (E.D.) = CALORIES/ MASS (GRAMS)
TOTALS	TOTAL CALORIES		TOTAL MASS		AVG. TOTAL E.D.	
BEVERAGES		CALORIES		(29.57)(FL OZ)= GRAMS		
TOTALS WITH BEVERAGES	TOTAL CALORIES		TOTAL MASS		AVG. TOTAL E.D.	

1 fl oz = 29.57 grams (water at 4°C) 454 grams = 16 oz = 1 lbs.



Summary

Yes, calorie intake can be reduced while controlling hunger. This research brief investigates the impact of eating low-energy-dense foods on calories consumed, satiety, and body weight.

Achieving and maintaining a healthy body weight can be challenging. A person must sustain a careful balance between calories consumed and energy expended in order to maintain his or her recommended body weight and must consume fewer calories than expended in order to lose weight. To reverse the current U.S. trend toward overweight and obesity, many Americans need to consume fewer calories and be more active.

Americans have used many dietary strategies to consume fewer calories including limiting portion sizes, food groups, or certain macronutrients such as carbohydrates or fats. While these strategies can help moderate calorie intake, particularly during the short-term, they do have limitations. These approaches may compromise diet quality or cause feelings of hunger and dissatisfaction, which can limit their acceptability, sustainability, and long-term effectiveness. The research in this brief supports an alternative strategy for managing calorie intake based on encouraging people to eat more foods that are low in calories for a given measure—that is, are low in energy density (kcal/g).

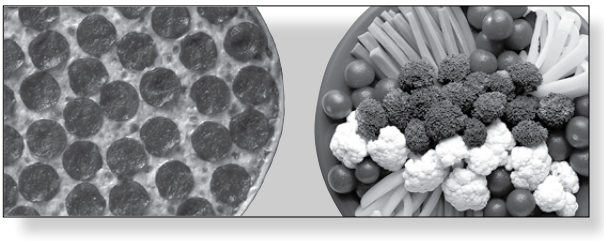
Research shows that people eat a fairly consistent amount of food on a day-to-day basis (1-8). This finding holds true whether the amount of food contains many or few calories. Therefore, the number of calories in a particular amount or weight of food (i.e., the food's energy density) affects the total number of calories a person consumes.

This research brief:

- Provides an introduction to energy density.
- Examines the scientific evidence supporting the use of diets rich in low-energy-dense foods for managing weight.
- Provides practical approaches for practitioners to use when counseling people on lowering the energy density of the food they eat.

What is energy density?

Energy density is the amount of energy or calories in a particular weight of food and is generally presented as the number of calories in a gram (kcal/g). Foods with a lower energy density provide fewer calories per gram than foods with a higher energy density. For the same amount of calories, a person can consume a larger portion of a food lower in energy density than a food higher in energy density.



Research to Practice Series, No. 5

National Center for Chronic Disease Prevention and Health Promotion
Division of Nutrition, Physical Activity and Obesity

Figure 1. 100 kcal portions of foods differing in energy density

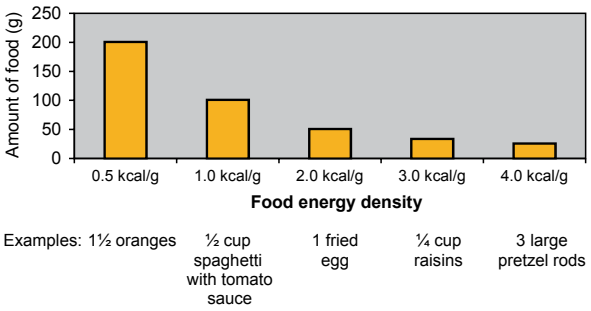
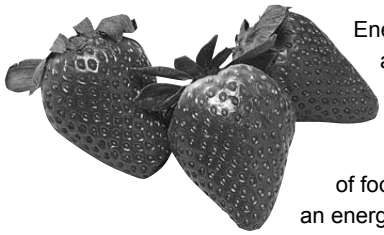


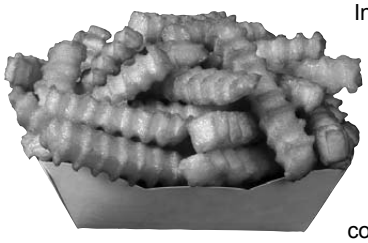
Figure 1 shows the weight of different foods that contain 100 calories. As shown, 1½ oranges weighing 200 g yield 100 calories, whereas only 3 pretzel rods weighing 25 g with an energy density of 4.0 kcal/g yield 100 calories.

How does the composition of foods affect energy density?



Energy density values are influenced by the composition of foods. Water lowers the energy density of foods, because it has an energy density of 0 kcal/g and contributes weight but not energy to foods. Fiber also has a relatively low energy density (1.5–2.5 kcal/g) and helps lower energy density.

On the opposite end of the energy density spectrum, fat (9 kcal/g) is the most energy dense component of food, providing more than twice as many calories per gram as carbohydrates or protein (4 kcal/g).



In general, foods with a lower energy density (i.e., fruits, vegetables, and broth-based soups) tend to be foods with either a high water content, lots of fiber, or little fat. While most high-fat foods have a high energy density, increasing the water content lowers the energy density of all foods, even those high in fat. For example, adding water-rich vegetables, such as spinach, zucchini, celery, and carrots, to mixed dishes such as chili and casseroles lowers the energy density of these dishes.

Research Review: Eating a diet rich in low-energy-dense foods can help manage body weight.

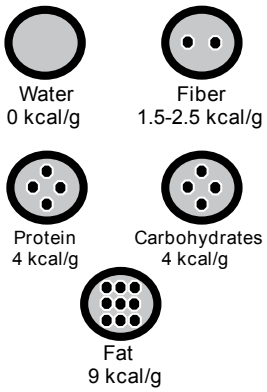
Low-energy-dense diets help people lower their caloric intake while maintaining feelings of satiety and controlling feelings of hunger.

Research studies indicate that consuming a low-energy-dense diet—one that is rich in fruits, vegetables, whole grains, lean meats, and low-fat dairy products—helps people lower their calorie intake. At the same time, eating low-energy-dense foods helps people control their hunger and maintain feelings of satiety, or the feeling of fullness and satisfaction experienced at the end of a meal. Satiety and hunger control are important for long-term satisfaction and compliance with an eating plan.

Observational studies focusing on the foods people typically eat have found that energy density is related to calorie intake and the amount of food consumed. A recent study by Ledikwe and colleagues found that among a nationally representative group of U.S. adults, men and women who reported eating a lower-energy-dense diet ate fewer calories yet consumed more food by weight than people who ate a higher energy dense diet (9). Other studies from countries around the world have reported similar findings (10-13). The results from these studies show that a diet low in energy density allows people to reduce their energy intake without necessarily decreasing the amount of food they consume.

Experimental studies in laboratories with dining facilities not only confirm that consuming foods lower in energy density is an effective strategy for reducing short-term calorie intake but also show that calorie intake can be reduced without increasing feelings of hunger. In these studies, the energy density of the foods served to study participants was carefully manipulated so that all the foods were equally palatable. The researchers then measured the participants' food intake and ratings of hunger and satiety. In one of these studies by Rolls and colleagues, participants were given a standard lunch on different occasions preceded each time with either a first-course salad of differing energy density or by no salad (14). Participants consumed fewer calories when the meal started with the lower-energy-dense salad and they reported feeling just as full as participants who had no first-course salad or had a salad that was higher in energy density.

Other types of foods that are low in energy density have also been found to help people decrease calorie intake



Water and fiber provide little, if any, energy to foods. Eating more water-rich and fiber-rich vegetables and fruit can decrease the energy density of the diet.

Protein and carbohydrates provide less than one-half the energy of fat per gram.

Fat has a high energy density. Reducing fat intake can decrease the energy density of the diet.

Figure 2. Energy density values vary from 0 to 9 kcal/g, as illustrated by the above ovals. Each oval represents 1 gram of a nutrient. The number of dots on each oval indicates how many calories are provided by each gram of that nutrient.

without increasing feelings of hunger. For example, in another study from the same laboratory, researchers found that consumption of a low-energy-dense soup as a first course in a meal maintained satiety while reducing energy intake (15).

Longer-term studies provide more evidence that reductions in energy density can significantly decrease calorie intake while maintaining fullness. These studies indicate that over the course of a few days, people generally consume a fairly consistent amount of food. Therefore, calorie intake is lower when research subjects eat foods low in energy density than when they eat foods higher in energy density.

In a study by Bell et al., normal weight women were provided with all of their meals over 2 days on three different occasions. On each occasion, the meals were modified by varying the amounts of vegetables offered (1) so that the 2-day diets differed in energy density. Although the participants could eat as much or as little as they liked, they ate similar amounts of food by weight during the 2 days. Consequently, reducing the energy density of the diet by adding extra vegetables led to a reduction in energy intake. Despite the reduced calorie intake, participants rated themselves equally full and satisfied.

In another study, Duncan and colleagues found that providing people with a reduced-fat diet that contained substantial amounts of fruits, vegetables, whole grains, and beans over 5 days led to the participants consuming fewer calories than when they were provided with a diet containing large amounts of high-fat meats and desserts (2). Again, the participants consumed comparable weights of food during each 5-day session, and they reported that each diet satisfied their hunger similarly. In a study lasting 3 weeks, Shintani et al. provided participants with a traditional Hawaiian diet that was rich in fruits and vegetables (3, 4). This diet was substantially lower in energy density than the participants' habitual diet. Participants consumed a similar weight of food with both diets, which led to a reduction of their daily energy intake on the low-energy-dense traditional diet. Despite the reduced energy intake, which was sufficient to lead to weight loss during the 3 weeks, the subjects reported the diet to be moderately to highly satiating.

These (1-4) and other studies (5-8) indicate that over the course of a few days, the weight of food a person consumes is fairly consistent and is more consistent than energy intake. Therefore, encouraging people to eat more foods low in energy density and to substitute these foods for those higher in energy density helps them decrease their caloric intake while eating satisfying portions of food and controlling hunger.

Low-energy-dense diets may help manage body weight.

Many studies have confirmed that consuming a lower-energy-dense diet can be an effective strategy to control hunger while reducing calorie intake. An important question that follows is whether reductions in energy density can be successfully employed to manage body weight.

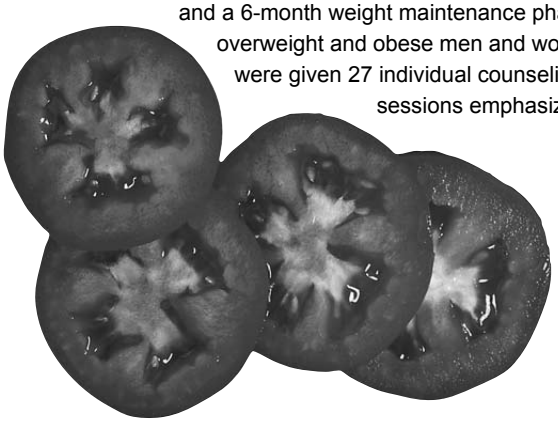
While the influence of dietary energy density on body weight has not been extensively investigated, several observational studies suggest that a relationship exists

between consuming an energy dense diet and obesity (9, 11, 16-18). For example, one study with a nationally representative group of adults found that normal weight individuals consumed diets that were lower in energy density than obese individuals (9). In a similar study, diets with higher energy density were found to be predictive of higher body mass index values (18). However, this type of cross-sectional data cannot determine causality.

Additional evidence supporting the use of diets rich in low-energy-dense foods comes from clinical interventions investigating the effectiveness of lower-energy-dense diets for weight loss and maintenance. Several trials, which did not specifically assess the energy of the diet, found that diets emphasizing foods low in energy density, such as fruits, vegetables, and other low-fat foods, as part of a reduced-energy diet were associated with weight loss (19-22).

In a study that provided participants with 18 individual and group counseling sessions over 7 months, Fitzwater and colleagues (19) encouraged overweight individuals to consume a reduced-energy diet emphasizing foods that were low in energy density, such as fruits, vegetables, whole grains, and beans. The participants lost an average of 7.3 kg. More than half (53%) of the subjects were able to maintain this weight loss over 2 years. While this study did not include a comparison group or the collection of detailed food intake information, it does suggest that advice to consume a diet rich in lower-energy-dense foods as part of an energy-restricted diet is an effective strategy for weight loss.

In another study, Rolls and colleagues (23) examined the effectiveness of incorporating either a low-energy-dense food (broth-based soup) or a high-energy-dense food (dry snack food) into a reduced-energy diet. During this year long clinical trial that included a 6-month weight loss phase and a 6-month weight maintenance phase, overweight and obese men and women were given 27 individual counseling sessions emphasizing consumption of an energy-reduced diet. They were also provided with one of the following items to incorporate into their daily diet: one serving of soup, two servings of soup, two servings of a dry snack food, or no special food. Each soup and dry snack serving, which provided 100 kcal, was incorporated in the diet using an exchange-based system so that the diets prescribed to each group were similar in calories. When all intervention groups were combined, a mean loss of 7.6 kg occurred during the weight loss phase, followed by a mean gain of 1.1 kg during the weight maintenance phase. The researchers found that the strongest predictor of weight loss at 1 and 2 months was the overall decrease in the energy density of the diet. After participating in the intervention for 1 year, participants who consumed two servings per day of low-energy-dense soup experienced 50% greater weight loss than participants who consumed two servings per day of high-energy-dense dry snacks (7.2 kg vs. 4.8 kg).



In the previously discussed weight-loss trials, participants were encouraged to consume a reduced-energy diet. Ello-Martin and colleagues (24) took a novel approach to exploring the effect of reducing the energy density of the diet on weight loss. They tested two strategies to reduce the energy density of the diet without providing the subjects with specific calorie limits. The researchers provided counseling for one group of obese women in 38 individual and group sessions. The women were advised to decrease the energy density of their diets by increasing their consumption of water-rich foods, such as fruits and vegetables, and choosing reduced-fat foods. The other group was counseled only on reducing fat intakes. Both groups lowered the energy density of their diets, and both groups lost weight. However, after 12 months, the group counseled to eat more fruits and vegetables while also reducing fat intake experienced a greater reduction in the energy density of their diets and lost significantly more weight (7.9 kg vs. 6.4 kg) than the group told just to eat less fat. Even though they lost more weight, those participants eating the lower-energy-dense diet reported consuming more food by weight and experiencing less hunger.

These limited studies (19, 23, 24) suggest that dietary advice to reduce the energy density of the diet may be an effective strategy for weight loss. This finding was demonstrated even when obese individuals were not instructed specifically to reduce their calorie intake, which suggests that following this type of eating pattern can lead to a concomitant decrease in calorie intake. Additional studies are needed to confirm these positive findings. A benefit of this type of eating plan is that it allows people to eat

Figure 3: To calculate the energy density from the Nutrition Facts Panel of a food label, divide the calories by the weight.

This is the Nutrition Facts Panel on a package of fat-free chocolate pudding.

Nutrition Facts	
Serving Size 1 container (110 g)	
Servings Per Container 1	
Amount Per Serving	
Calories	100

$$\textit{Energy Density} = \frac{\textbf{100 Calories/serving}}{\textbf{110 Grams/serving}}$$

The energy density is 0.9 kcal/g.

An extra large bar of chocolate, which has a much higher energy density because of less moisture and more fat, provides more than twice as many calories per serving than fat-free chocolate pudding. It is important to note that many foods, such as this extra large candy bar, contain more than one serving in a package.

Nutrition Facts	
Serving Size 1 bar (45 g)	
Servings Per Container 2	
Amount Per Serving	
Calories	230

$$\textit{Energy Density} = \frac{\textbf{230 Calories/serving}}{\textbf{45 Grams/serving}}$$

The energy density is 5.1 kcal/g.

The low-energy-dense pudding, which weighs twice as much as the candy bar, would provide a more filling, lower-calorie snack. While high-energy-dense foods, such as chocolate do not need to be completely eliminated from the diet, choosing a smaller portion is a good strategy to control the calorie content. A full-sized chocolate bar and a miniature bar of chocolate both have the same energy density and therefore provide the same number of calories per gram, but the smaller bar contains fewer total calories.

satisfying amounts of food while restricting their energy intake. Furthermore, this type of eating plan uses positive messages (i.e., eat satisfying portions of low-energy-dense foods), which has been shown to result in greater dietary changes than restrictive messages (i.e., eat small portions of all foods) (20).

Diets low in energy density can be nutritionally sound.

Some people may think that consuming a diet low in energy density decreases the nutritional value of the diet. On the contrary, diets low in energy density can be nutritionally sound. While a decrease in body weight is a primary goal of a weight-loss diet, nutritional quality is equally important. People who limit their caloric intake and do not eat a variety of nutrient-rich, low-energy-dense foods may have inadequate micronutrient intakes (25, 26).

Getting adequate micronutrients is important for maintaining health. Data from a nationally representative survey of U.S. adults (27) indicate that people consuming a lower-energy-dense diet eat a balanced diet by making specific choices within each food group, generally choosing foods that are low fat, are dense in micronutrients, or have high water content (28). These choices have led to higher intakes of fiber, vitamin A, vitamin C, and folate than with foods consumed in a higher-energy-dense diet. Therefore, a lower-energy-dense diet can be consistent with a healthy diet based on the Dietary Guidelines for Americans (29).

From Research to Practice: Practical approaches to lowering the energy density of the diet.

Calculating energy density

People can reduce caloric intake without strictly limiting food portions by consuming a diet low in energy density. The energy density of packaged food can be calculated easily by using information that is readily available on the Nutrition Facts Panel of food labels.

Creating a diet low in energy density

People can follow several steps in order to create a diet low in energy density:

1) Try to incorporate a large portion of fruits and vegetables into meals. Choose spinach, cruciferous vegetable, tomatoes, citrus fruits, and melons, just to name a few. Broth-based soups, which are also low in energy density, are filling, low-calorie food choices. Also choose these foods as snacks and appetizers.

2) Round out meals by adding starchy fruits and vegetables, whole grains, legumes, lean meats, and low-fat dairy food. These foods are important for creating a healthy, balanced diet.

3) Pay attention to portion sizes of fried foods, including vegetables; non-whole grains; dairy foods that are not reduced in fat; and fatty cuts of meat. These foods can be part of a healthy diet when consumed occasionally in small portions.

4) Consume infrequently, with particular attention to portion size, foods with little moisture, such as crackers, cookies, and chips as well as high-fat foods like croissants, margarine, and bacon. These foods provide a large number of calories relative to their weight and can easily be overconsumed. Foods such as nuts and olives, which have a relatively high amount of polyunsaturated and monounsaturated fatty acids, can be part of one's diet as long as they are consumed in moderate portions.

Strategies to lower energy density

A brochure, "*Eat More, Weigh Less*" has been developed in conjunction with this brief for practitioners to use with their patients and clients. Another research brief and brochure in this Research to Practice Series—Can Eating Fruits and Vegetables Help People to Manage Their Weight?—provide information on substituting fruits and vegetables for higher-energy-dense foods.

Several practical strategies that people can use to lower the energy density of their diet are as follows:

- **Start with what is already on the plate.** Palatability and food preferences play critical roles in food selection. Helping people modify the energy density of their existing diet may increase the likelihood of achieving lasting changes. When providing guidance for decreasing dietary energy density, the main goals should be to increase fruit and vegetable intake while limiting intake of foods high in fats and oils. Keep total fat intake between 20% and 35% of calories, with most fats deriving from sources of polyunsaturated and monounsaturated fatty acids, such as fish, nuts, and vegetable oils.

- **Lower the energy density of frequently consumed foods.** The energy density of many foods can be lowered with slight modifications that are unlikely to compromise palatability. While energy density can be lowered by reducing the amount of fat or increasing the amount of water-rich foods, the most substantial reductions in energy density are achieved when both of these strategies are used simultaneously.

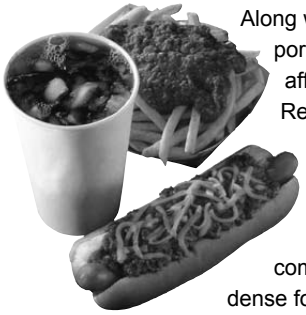
Example: Main dishes
The energy density of many main dishes can be reduced by adding extra vegetables or by reducing the amount of added fat. Many different vegetables (e.g., chopped spinach, shredded carrots, diced green pepper, shredded zucchini, broccoli, or mushrooms) can be added to omelets, lasagna, pizza, chili, soups, and other hot dishes. Using lower fat meat and cheese or simply using less of the higher fat ingredients can reduce the fat content.

Example: Dessert
Instead of having 1 cup of ice cream for dessert, have ½ cup of reduced-fat ice cream topped with ½ cup of fruit.

- **Substitute foods lower in energy density for items higher in energy density.** Encourage people to identify some of the foods they consume that are high in energy density and help them come up with acceptable alternatives that are lower in energy density.

Example: Lunch at a fast food restaurant
Compared to a fried chicken sandwich, a grilled chicken salad with lettuce, tomatoes, and a low-fat dressing can provide a tasty alternative with more water-rich vegetables, less fat, and fewer calories.

- **Avoid large portions of foods that are high in energy density—BUT encourage foods low in energy density to be consumed in portions that are appropriate for calorie needs.**



Along with energy density, food portion size has been shown to affect calorie intake (14, 30-35). Recent studies have shown that when either the energy density or the portion size of foods is increased, calorie intake increases. Given how common large portions of energy dense foods are in today's society, this may be a problem for weight management. However, recent studies have shown that even modest reductions in the energy density and portion size of popular foods could have a significant beneficial impact on energy intake (14, 30, 31). In one study (31), participants were provided with a variety of popular, commercially available foods over 2 consecutive days on four occasions and allowed to eat as much as they wanted. The foods were varied in energy density and presented in two portion sizes. Participants consumed the least amount of energy when provided with the smaller portions of the lower-energy-dense foods and the greatest amount of energy when provided with the larger portions of the higher-energy-dense foods. Specifically, the researchers found that a 25% decrease in energy density led to a 24% decrease in energy intake and that a 25% decrease in portion size led to a 10% decrease in energy intake. Over the 2 days, this led to a reduction of 1,625 kcal when both portion size and energy density were decreased.

Foods low in energy density, such as vegetables, fruits, and broth-based soups, can aid in weight management by providing satisfying portions that are appropriate for calorie needs. While energy dense foods do not need to be completely eliminated from the diet, they should be consumed in moderate portions along with foods that are predominantly low in energy density in order to create a balanced eating plan. Understanding how energy density and portion size work together can lead to more effective nutrition education messages than simply encouraging people to eat less. People should be encouraged to meet their calorie needs by eating satisfying portions of foods with a low energy density.

- **Prepare fruits, vegetables, and other foods without excess fat and sugar.** Frying vegetables or covering them in butter or cream sauce will increase their energy density. The same holds true for fruits with added sugar, syrup, or fat.

- **Choose meats and cheeses that are lower in fat.** When selecting and preparing meat, poultry, dry beans, and milk or milk products, make choices that are lean, low fat, or fat-free.

- **Consume an appetizer low in energy density.** A practical approach to help moderate calorie intake is to consume a low-energy-dense food, such as a 100-kcal serving of a broth-based soup or a green salad, at the start of a meal. If a person pays attention to satiety cues, this practice may help reduce his or her overall calorie intake at the meal.

- **Have plenty of foods low in energy density readily available.** Making food more readily available can increase consumption. Having plenty of low-energy-dense food at home and at the office makes it easier to choose these foods over higher-energy-dense options. Frozen and canned fruits and vegetables are good options when fresh produce is not available or affordable. However, choose items without added sugar, syrup, or fat.

- **Choose water and other low-calorie beverages to quench thirst.** Most beverages have a low energy density, even beverages that are relatively high in calories. While increased consumption of water-rich foods such as fruits, vegetables, and broth-based soups can help control hunger while moderating calorie intake, increased beverage consumption is not likely to promote satiety. When Rolls and colleagues (15) gave study participants either a chicken-rice casserole with a glass of water or a chicken-rice soup prepared by adding water to the ingredients used in the casserole, they found that eating the soup significantly increased the feeling of fullness and reduced the participants' hunger and calorie intake at the meal. Drinking a glass of water with the casserole had no additional effect on total calories consumed or on ratings of fullness than eating the casserole alone. Drinking beverages may reduce thirst, but they will most likely not contribute to feeling full (satiety). Choosing water and other low-calorie beverages can help moderate calorie intake and reduce thirst, but they will most likely not contribute to feeling full (satiety).

6

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CS116327

Credible Source Writing Lab

Name _____ Date _____Class Period _____

Assign one person to each job role. For a group of four, assign two people to share the reporting out to the class.

Job roles- Technician- uses the computer _____
Recorder- writes down the answers _____
Reporter(s)- report out to the class _____

What is the phrase or question you searched? _____

How many results did the search engine find? _____

What is the title of the article or source you chose to investigate? _____

_____

Who is/are the author(s) of the article? _____

What is the author's job or position? (Do a search of the author.) _____

What is the author's educational background? _____

_____

After your investigation of the author of your chosen article, do you still wish to use the article?

↑ **If no, go back to your original search and follow the same steps with another article.**

↓ **If yes, prepare your answer to the question, "Why are Calories important?"**

According to your article, why are Calories important? _____

_____

What is the author's purpose for writing the article? _____

_____

_____

When was the article written? _____

ASK YOURSELF WORK SHEET

Calculating energy balance

Are these people in energy balance?
For each example, calculate the person's energy expenditure by adding calories burned through BMR and daily activities. Compare this number to the amount of calories consumed (food energy intake).
Determine whether these people are likely to lose weight, gain weight or remain at a constant weight if they continue this lifestyle. Make recommendations for improving each situation.

Henry is 28 and works as a builder on a construction site. He weighs 89 kg and is 190 cm tall. Can you calculate his BMI?

Henry awakes at 5.30 every morning, gets ready for work and has a large breakfast. This usually takes 30 minutes, burning 70 calories. He then rides his bike to work for one hour, burning 300 calories. He works an 8-hour shift, burning 200 calories per hour and takes a short break mid-morning for a snack and something to drink. At work, he has one hour to rest and have a cooked lunch he brings from home; this burns 50 calories.

After work, he rides his bike home again for one hour, burning 300 calories. At home, he has a snack and spends an hour playing with his children, burning 150 calories and then helps them with their homework for an hour, burning 70 calories. The rest of the evening he relaxes with his family, reads the newspaper and has dinner; this burns 70 calories per hour. At 10.00 pm he goes to bed. He burns 53 calories per hour until he wakes up again.

We know that Henry:
- has a BMR of 2045 calories per day
- burns at least 3000 calories in daily activity
- consumes an average of 5000 calories a day

1. What is Henry's overall energy balance? (BMR + calories burned from daily activity compared with calorie intake (food and beverages consumed)
2. Is he likely to gain weight, lose weight or maintain the same body weight if his food intake (calories) and activity level remain the same?
3. What advice would you give to Henry, taking into consideration his BMI and current energy balance status?

EATING WELL FOR GOOD HEALTH
LESSON NINE
ACHIEVING HEALTHY BODY SIZE AND WEIGHT
1 of 3

'BMR' is the amount of energy required for basic body functions.

The calculations used here are:
Men: (13.7 x wt in kg) +(5 x ht in cm) - (6.8 x age in years) + 66
Women: (9.6 x wt in kg) + (1.8 x ht in cm) - (4.7 x age in years) + 655

BMI Formula: weight (kg) / [height (m)]^2

09_00/06

ASK YOURSELF WORK SHEET

Calculating energy balance *(cont.)*

Irene is 19 and works as a radio DJ. She weighs 71 kg and is 161 cm tall.
Can you calculate her BMI?

She gets up every morning at 6 am, eats breakfast and rushes out of her house so she can be on time for her morning radio programme which starts at 7 am. Her colleague who lives next door, gives her a lift to work every day; sitting in the car for 30 minutes burns about 30 calories. Irene's radio programme lasts 4 hours starting at 7 am and finishing at 11 am, burning 70 calories per hour. She snacks and drinks various beverages throughout her programme. When her programme is finished, she works for two hours on her computer, updating the radio's web-site and replying to emails. This burns 80 calories per hour. She takes a 1 hour break to eat a big lunch, relaxing and talking with her colleagues; this burns 70 calories. After lunch she spends another 2 hours in the office, preparing her next programme, listening to music and looking for interesting stories about the latest music stars. This burns 80 calories per hour.

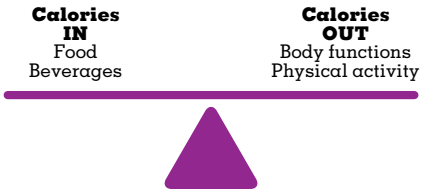
After work, Irene usually meets some friends for 2-3 hours to get something to eat for dinner; sometimes they go to a local pub or the cinema, burning 70 calories an hour. She goes to bed at around 11 o'clock. She burns 50 calories an hour until she wakes up again.

We know that Irene:

- has a B.M.R. of 1537 calories per day
- burns at least 1260 calories in daily activity
- consumes an average of 3200 calories a day

1. **What is Irene's overall energy balance? (BMR + calories burned from daily activity compared with calorie intake (food and beverages consumed)**
2. **Is she likely to gain weight, lose weight or maintain the same body weight if her food intake (calories) and activity level remain the same?**
3. **What advice would you give Irene, taking into consideration her BMI and current energy balance status?**

EATING WELL FOR GOOD HEALTH
LESSON NINE
ACHIEVING HEALTHY BODY SIZE AND WEIGHT
2 of 3



09_00/06

ASK YOURSELF WORK SHEET

Calculating energy balance *(cont.)*

Marie is 35 and she is a farmer. She weighs 50 kg and is 168 cm tall.
Can you calculate her BMI?

In the morning she awakes at 6 am, takes one hour to prepare breakfast for her family, do a few household chores and eats her own breakfast; this burns 120 calories. She then walks to her fields for half an hour, burning 130 calories. She ploughs, plants, weeds and digs for 6 hours each day. This burns 200 calories per hour. At noon she has a 2 hour break to have a little food and rest; this burns 70 calories per hour. When she has finished her work for the day, she walks home again (130 calories).

At home, she spends one and a half hours taking care of her chickens and preparing the evening meal for her family, burning 110 calories an hour. After dinner she spends some time with her husband and children, finishes her household chores (burning 120 calories) and goes to bed around 10.30 pm. She burns 50 calories an hour while she is sleeping.

We know that Marie:

- has a B.M.R. of 1273 calories per day
- burns at least 2380 calories in daily activity
- consumes an average of 1800 calories a day

1. **What is Marie's overall energy balance? (BMR + calories burned from daily activity compared with calorie intake (food and beverages consumed)**
2. **Is she likely to gain weight, lose weight or maintain the same body weight if her food intake (calories) and activity level remain the same?**
3. **What advice would you give Marie, taking into consideration her BMI and current energy balance status?**

EATING WELL FOR GOOD HEALTH
LESSON NINE
ACHIEVING HEALTHY BODY SIZE AND WEIGHT

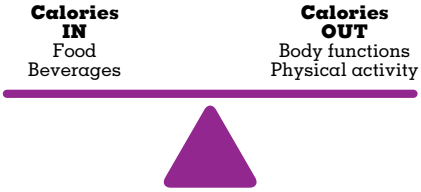
You can check your answers on Answer Work sheet **Calculating energy balance**

09_00/06

ANSWER WORK SHEET

Calculating energy balance

Even though we do not have complete information on the total food intake, total daily expenditure (daily activities) or health status of Henry, Irene and Marie, we have enough information to make an approximate assessment of their **energy balance** and make **some reasonable observations and recommendations for each of them.**



BMI Weight Status Categories

BMI	Weight status
Below 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30.0 and Above	Obese

Henry has a BMI of 24.6, which puts him in the normal weight range. He is also in energy balance, because the calories he takes in are equal to the calories he uses for his normal body processes (BMR) and for daily movement and activities. If he continues his current pattern of eating and activity, he is likely to maintain his healthy body weight and BMI. However, Henry may need to be careful, because he is at the top of the normal weight range for his height and it will not take much for him to slip into the overweight category. If he eats only a little bit more each day or moves a little bit less, over time his weight and BMI will increase.

EATING WELL FOR GOOD HEALTH
LESSON NINE
ACHIEVING HEALTHY BODY SIZE AND WEIGHT
1 of 2

Use this Answer Work sheet to check your answers on the *Ask yourself Work sheet* ***Calculating Energy Balance***

09_00/07

ANSWER WORK SHEET

Calculating energy balance *(cont.)*

Irene has a BMI of 27.4, which means that she is overweight. She is also in positive energy balance, because she is consuming more calories than she burns for her body processes (BMR) and for daily movement and activity. If she continues her current eating pattern and lack of physical activity, she will continue to gain weight. Irene has a job that requires many hours of sitting and she does not seem to be very physically active outside of work. To lose weight, Irene will need to reduce the amount of calories she consumes and find ways to increase her physical activity, such as walking part way or all the way to and from work, taking a short walk during her lunch break and doing some more vigorous activities after work or on the weekends. Being more physically active will also have many other health benefits for Irene.

Marie has a BMI of 17.7, which means that she is underweight. She is also in negative energy balance, because she is consuming fewer calories than she needs to cover her body processes (BMR) and her daily movement and activity. If she continues her current pattern of under eating and heavy physical labour and activity, she will continue to lose weight. Marie's health is at risk; as she continues to lose weight, she will become more underweight, she will be less able to fight infections and will become ill more easily and more seriously. She needs to immediately increase her food consumption. It would be good for her to see a health care professional and try to reduce her physical work load, if possible.

You can read more about the importance of physical activity for good health in *Lesson 10* ***Keeping fit and active***

You can read more about the health problems related to underweight and undernutrition in *Lesson 3* ***Understanding problems of poor nutrition***

You can read more about the health problems related to overweight and obesity in *Lesson 3* ***Understanding problems of poor nutrition***

EATING WELL FOR GOOD HEALTH
LESSON NINE
ACHIEVING HEALTHY BODY SIZE AND WEIGHT
2 of 2

09_00/07

Hiking the Appalachian Trail Energy Challenge

NUTRITIONIST POSITION TEAM CHALLENGE

Your team is preparing a backpack for an Appalachian Trail section hiker. He is twenty-eight years old, 6'1", and 140 lbs. His hike is five days from the Nolichucky River to Overmountain. You will need to prepare a backpack for this client of the website and his nutritional needs for five days. While hiking, he is expected to burn 4,000 Calories per day, this does not include his Basal Metabolic Rate (BMR), and you have limited space in your 65 Liter backpack. After packing camping supplies, cooking supplies, and hygiene products, only 2,000 cubic inches are available for your food. The weight limit for the food in your hiker's backpack is 10 pounds total.

Your team's challenge is to research food that you will pack within the Calorie requirements and the volume and weight limitations. You can assume the hiker will be able to resupply with water along the way and this is not part of your challenge. Your team's food plan will be written in the form of a blog. Blogging is very popular among hikers and the hiring team would like to see your attention to detail. Each meal and snack should be blogged about and address the important quantitative and qualitative attributes. Each meal/snack should include Calories, weight, and volume. A six minute presentation, based on your blog, will be presented to the company's hiring team. You will need to include all the required energy and nutritional information from the blog. There will be a question and answering session after the presentation.

Your nutrition team has to compete with the other teams in the room for the best overall food plan for the AT section hiker. The team with the best food plan will be hired to this great company. In addition to a fun and rewarding work environment, the starting salary for each team member is 1.5 times the industry average for nutritionists!

You will be in competition for this position with the other the teams in the room. Good luck!
Below is a short blog of the hike to assist in your planning. Good luck!

Nolichucky River to Overmountain

If variety is the spice of life, then this five-day stretch is the spiciest backpacking trip on the A.T. You'll start at the Nolichucky River where rafting companies bank the class IV river, climb through dense spruce forests, apple orchards, and wildflower patches before reaching 6,000 feet in elevation where you'll do some classic "bald hopping."

"You hit this open bald and get 360-degree views. Then you hit another, and another," says Jacob Mitchell, hike leader for the Tennessee Eastman Hiking and Canoe Club, which is responsible for maintaining this stretch of the A.T.

Plan your hike so you spend at least one night at the Overmountain Shelter, a converted red barn perched in a meadow with dramatic views. And save enough energy to tackle Little Hump and Big Hump mountains, with long exposed walks through tall grass and views that rival anything on the trail.

Day One

Trailhead — Start at the Chestoa Bridge in Erwin at the Nolichucky River. Start hiking the white-blazed A.T. north, crossing Jones Branch several times.
Mile 4.2 — Pass the side trail to the Curley Maple Shelter.
Mile 8.3 — Walk through Indian Grave Gap, tracing the North Carolina/Tennessee border.
Mile 10.5 — Hit Beauty Spot, an open meadow with a view that lives up to its name: lots of wildflowers during the spring, ripe berries in late summer, and an ideal campsite for your first night.

Day Two

Mile 13.6 — Summit the 5,180-foot Unaka Mountain, which is covered by a dense spruce forest.
Mile 16.3 — Pass the Cherry Gap shelter.
Mile 19 — Cross Iron Mountain Gap, then pass through an apple orchard at Weedy Gap.
Mile: 25.4 — Bed down at the Clyde Smith Shelter (4,400 feet), making sure to wake early for the sunrise view over the mountain to the east.

Day Three

Mile 26.3 — Summit Little Rock Knob, which is just shy of 5,000 feet, but has tremendous views of the mountains you'll soon be crossing from a rock outcropping on the summit.
Mile 30.1 — Cross the Cloudland Hotel site, an open area with awesome views and spring wildflowers, and a side trail to Roan High Bluff. Take the short detour to the Roan High Bluff overlook.
Mile 32.8 — Call it a night at Roan High Knob Shelter. At 6,285 feet, the converted fire warden cabin is the highest shelter on the entire A.T. Find the true summit of Roan High Knob at a rocky patch nearby.

Day Four

Mile 34.3 — Cross Carver's Gap (5,512 feet), then begin the easy climb to Round Bald. Soon after Round Bald, you'll hit Jane Bald, another open meadow with panoramic views.
Mile 36.2 — Arrive at the intersection with the Grassy Ridge Side Trail. Take the 0.5 mile blue-blazed path that leads to yet another 6,000-foot grassy bald.
Mile 37.6 — Pass the trail to the Stan Murray Shelter.
Mile 39.2 — Walk into the Overmountain Shelter, below Yellow Mountain Gap at the junction of the Overmountain Victory Trail. The big red barn overlooks Roaring Creek Valley for what some say is the best view from any shelter on the trail.

Day Five

Mile 40.8 — Cross Little Hump Mountain, your first bald for the day.
Mile 43.6 — Summit Hump Mountain, a 5,587-foot towering grassy bald with the requisite big views.
Mile 46 — Cross through Doll Flats, a popular primitive campsite.
Mile 47.5 — Reach the Apple House Shelter, which was originally designed to hold explosives for a nearby quarry.
Mile 48 — Hit the pavement of US19E, which is your hiking terminus. Shuttles can be found a few miles west at the community of Roan Mountain.

From: http://hikinginthesmokys.blogspot.com/2010/04/best-of-appalachian-trail-guide.html

HIKING THE APPLACHIAN TRAIL ENERGY CHALLENGE

Comprehension Questions

Group_____Class Period _____

1. What is the age, sex, height, and weight of your client?

2. How long is the hike of your client?

3. The daily activity of the hike is expected to burn approximately how many Calories?

4. What does BMR stand for? What do you suspect it will be used in calculating?

5. How much volume does the total backpack have?

6. What is the volume limit for food?

7. What is the weight limit for food?

8. What will you provide as evidence of your food plan?

9. What should your food plan include?

10. How long is your presentation to the hiring team?

11. What happens after your presentation to the hiring team?

12. What is the expectation of the salary for this position?

HIKING THE APPLACHIAN TRAIL ENERGY CHALLENGE

Comprehension Questions

TEACHER ANSWER SHEET

1. What is the age, sex, height, and weight of your client? **28, male, 6'1", 140 lbs.**
2. How long is the hike of your client? **Five days**
3. The daily activity of the hike is expected to burn approximately how many Calories? **4,000**
4. What does BMR stand for? What do you suspect it will be used in calculating? **Basal Metabolic Rate – Reasonable answers should state total Calories burned while hiking.**
5. How much volume does the total backpack have? **65 Liters**
6. What is the volume limit for food? **2,000 cubic inches**
7. What is the weight limit for food? **10 lbs.**
8. What will you provide as evidence of your food plan? **A blog and a presentation**
9. What should your food plan include? **Quantitative and qualitative attributes, Calories, weight, volume**
10. How long is your presentation to the hiring team? **6 minutes**
11. What happens after your presentation to the hiring team? **A question and answer session**
12. What is the expectation of the salary for this position? **1.5 times the industry average for nutritionist**

HIKING THE APPLACHIAN TRAIL ENERGY CHALLENGE

Readiness Questions

Group_____Class Period _____

1. How many Calories per day will the hiker burn? Include the BMR to the Calories burned from the hiker's daily activity.

2. How many Calories total will the hiker burn for five days?

3. What is the weight limit of food in pounds per day?

4. What percentage of the backpack will be used for food?

5. What are the units you will use in your food plan blog and the presentation?

    a. For energy

    b. For volume

    c. For weight

    d. For height

6. What qualitative attributes of your food plan will you be graded on? (See Presentation Rubric)

7. What quantitative attributes of your food plan will you be graded on? (See Presentation Rubric)

8. What presentation skills will your team be graded on? (See Presentation Rubric)

9. When others are presenting, what is your job role as an observer? (See Observation Sheet and Observation Sheet Rubric)

10. What tasks will be necessary to complete this challenge and what job roles will each team member have?

HIKING THE APPLACHIAN TRAIL ENERGY CHALLENGE

Readiness Questions

TEACHER ANSWER SHEET

1. How many Calories per day will the hiker burn? Include the BMR to the Calories burned from the hiker's daily activity. **BMR= 1,600 +4,000 = 5,600 /day**

2. How many Calories total will the hiker burn for five days? **28,000 five day total**

3. What is the weight limit of food in pounds per day? **2 lbs. / day**

4. What percentage of the backpack will be used for food? **2,000 cubic inches (given) converts to 32.77 Liters or 50% of 65 Liter backpack.**

5. What are the units you will use in your food plan blog and the presentation?

    a. For energy= **Calorie**
    b. For volume = **cubic inches**
    c. For weight= **pounds**
    d. For height = **feet and inches**

6. What qualitative attributes of your food plan will you be graded on? **(See Presentation Rubric) Variety, Satiety**

7. What quantitative attributes of your food plan will you be graded on? **(See Presentation Rubric) Calories, weight, volume, US Daily Recommended Allowances,**

8. What presentation skills will your team be graded on? **(See Presentation Rubric) Comprehension, Time-Limit, Posture and Eye Contact, Volume**

9. When others are presenting, what is your job role as an observer? **(See Observation Sheet and Observation Sheet Rubric) note daily and total Calories, total weight, total volume, score variety, satiety, nutrition needs, write 3 questions and provide 3 comments to the group.**

10. What tasks will be necessary to complete this challenge and what job roles will each team member have? **Accept all reasonable answers: there will be many conversions of units, food to research, volumes to calculate and determine best packing techniques.**

    Suggested job roles:

Presentation Rubric

Team Name/Number _____ Period _____

CATEGORY	4	3	2	1
TOTAL CALORIES	Team came up with a plan that met the total five-day Calorie requirement of 25,000 Calories and averaged 5,000 Calories per day.	Team came up with a plan that met the total five-day Calorie requirement of 25,000 Calories and averaged close to 5,000 Calories per day.	Team came up with a plan that did not meet the total five-day Calorie requirement of 25,000 Calories but had days that met the 5,000 Calorie requirement.	Team came up with a plan that did not meet the total five-day Calorie requirement of 25,000 Calories or the 5,000 Calories per day.
TOTAL WEIGHT	The weight was converted to pounds for the presentation and the food supplies were at or below 10 pounds.	The weight was converted to pounds for the presentation and the food supplies were 10.1-10.5 pounds.	The weight was converted to pounds for the presentation and the food supplies were 10.6-11.0 pounds.	The weight was converted to pounds for the presentation and the food supplies were above 11.0 pounds.
TOTAL VOLUME	The volume was converted to cubic inches for the presentation and the volume of the food supplies were at or below 2,000 cubic inches.	The volume was converted to cubic inches for the presentation and the volume of the food supplies were at or below 2,001-2,005 cubic inches.	The volume was converted to cubic inches for the presentation and the volume of the food supplies were at or below 2,006-2,010 cubic inches.	The volume was converted to cubic inches for the presentation and the volume of the food supplies is above 2,010 cubic inches.
VARIETY	The food items selected were not duplicated during the five-day hike. This kept the hiker's palate interested.	The food items selected were only duplicated one or two times during the five-day hike.	The food items selected were duplicated more than three times.	The food selected offered no variety. The hiker had to eat the same thing every day.
SATIETY	The food items were successfully argued with facts to having the quality to produce the feeling of being fed or gratified.	The food items selected were argued with facts to having the quality to produce the feeling of being fed or gratifided.	The food items selected were not presented with facts to produce the quality or feeling of being fed or gratifided.	The quality of satiety was not addressed during the presentation.
NUTRITIONAL NEEDS	The food items selected were successfully argued with facts having the quantities needed for the US Daily Recommended allowances of micronutrients.	The food items selected were argued with facts having the quantities needed for the US Daily Recommended allowances of micronutrients.	The food items selected were not presented with facts having the quantities needed for the US Daily Recommended allowances of micronutrients.	The quantities of micronutrients were not addressed during the presentation.

Observation Sheet Rubric

Student _____ Period _____

CATEGORY	4	3	2	1
LISTENS TO OTHER PRESENTATIONS	Listens intently. Does not make distracting noises or movements.	Listens intently but has one distracting noise or movement.	Sometimes does not appear to be listening but is not distracting.	Sometimes does not appear to be listening and has distracting noises or movements.
EVALUATES PEERS	Fills out Observation Sheet completely and always gives scores based on the presentation rather than other factors (e.g., person is a close friend).	Fills out almost all of the Observation Sheet and always gives scores based on the presentation rather than other factors (e.g., person is a close friend).	Fills out most of the Observation Sheet and always gives scores based on the presentation rather than other factors (e.g., person is a close friend).	Fills out most of the Observation Sheet but scoring appears to be biased.
QUESTIONS	Observation sheet has three questions written to ask the group that are on topic of the nutrition and energy concerns during the five-day hike.	Observation sheet has two questions written to ask the group that are on topic of the nutrition and energy concerns during the five-day hike.	Observation sheet has one question written to ask the group that are on topic of the nutrition and energy concerns during the five-day hike.	Observation sheet has no questions written to ask the group that are on topic of the nutrition and energy concerns during the five-day hike.
COMMENTS	Observation sheet has three comments written on topic of the nutrition and energy concerns during the five-day hike OR presentation skills.	Observation sheet has three comments written on topic of the nutrition and energy concerns during the five-day hike OR presentation skills.	Observation sheet has one comment written on topic of the nutrition and energy concerns during the five-day hike OR presentation skills.	Observation sheet has no comments written on the topic of nutrition and energy OR presentation skills.

Observation Sheet

Name ____ Period __________

Directions: Complete the table below during each presentation. A one to five scale is provided (five being the most favorable score) for the elements of the food plan challenge. You must write three questions to ask the group AND provide three comments.

Group ____

DAY	DAILY CALORIES	TOTAL CALORIES	TOTAL WEIGHT IN POUNDS	TOTAL VOLUME IN CUBIC INCHES	VARIETY	SATIETY	NUTRITIONAL NEEDS	QUESTIONS TO ASK THE GROUP
1					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
2					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
3					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
4					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
5					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	

Group ____

DAY	DAILY CALORIES	TOTAL CALORIES	TOTAL WEIGHT IN POUNDS	TOTAL VOLUME IN CUBIC INCHES	VARIETY	SATIETY	NUTRITIONAL NEEDS	QUESTIONS TO ASK THE GROUP
1					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
2					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
3					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
4					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
5					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	

Group ____

DAY	DAILY CALORIES	TOTAL CALORIES	TOTAL WEIGHT IN POUNDS	TOTAL VOLUME IN CUBIC INCHES	VARIETY	SATIETY	NUTRITIONAL NEEDS	QUESTIONS TO ASK THE GROUP
1					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
2					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
3					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
4					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
5					1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	

Appalachian Trail Hiker Energy Challenge Menu

Download: Appendix 12 Appalachian Trail Hiker Energy Challenge Menu and edit in Microsoft Excel

The Appalachian Trail Hiker Energy Challenge Menu

Food item	ENTER Calories	ENTER Mass in grams	ENTER Estimated Volume	ENTER Volume Unit (mL or cm^3)	AUTO CALCULATION Total Calories in Menu	AUTO CALCULATION Total weight (lbs.) in backpack	AUTO CALCULATION Total volume mL to $inch^3$	
example	375	500	946	mL	375 this is auto calc	1.1 this is auto calc	57.9 this is auto calc	
whole wheat penne pasta	1260	376	1082	cm3	**1260**	**0.8**	**66.3**	WATCH THESE AUTO CALCULATE AS YOU ENTER DATA
								1. Enter all MASS in grams (3rd column)
								2. Total muct not exceed 10 pounds (cell G:5)
								1. Enter all VOLUME in milliliters or cm^3 (4th column)
								2. Total must not exceed 2,000 cubic inches (cell H:5)

Daily Bell-Work Journal

MONDAY **DATE**_____

TUESDAY **DATE**_____

WEDNESDAY **DATE**_____

THURSDAY **DATE**_____

FRIDAY **DATE**_____

Daily Exit Tickets

DAY EXIT TICKET Name: (First, Last) _____

Date: _____ Period: _____

Topic:

Continue your answer on the back if necessary

DAY EXIT TICKET Name: (First, Last) _____

Date: _____ Period: _____

Topic:

Continue your answer on the back if necessary

DAY EXIT TICKET Name: (First, Last) _____

Date: _____ Period: _____

Topic:

Continue your answer on the back if necessary

DAY EXIT TICKET Name: (First, Last) _____

Date: _____ Period: _____

Topic:

Continue your answer on the back if necessary

DAY EXIT TICKET Name: (First, Last) _____

Date: _____ Period: _____

Topic:

Continue your answer on the back if necessary

Project Management Log: Team Tasks

Project Name _____

Team Members _____

TASK	WHO IS RESPONSIBLE	DUE DATE	STATUS	DONE

Energy In – Energy Out

Adaptation from Butter Battle in Gourmet Lab by Sarah Reeves Young, pgs. 3-17

Key Question of the Day:

Will it take more Calories to create butter than the Calories you will get from eating the butter?

Learning Objectives

As a result of this lesson, students will be able to:

- Know how to churn heavy cream into butter
- Hypothesize on energy (Calories) required to make butter
- Calculate the amount of energy (Calories) in butter
- Form a conclusion of their hypothesis
- Identify qualitative and quantitative data

Required Materials for Daily Lesson

Per group of three:

- 50 mL of emulsified colloid of liquid butterfat in H20 (heavy cream)
- 0.25 g of sodium chloride, NaCl (salt)
- 500 mL chilled H20
- Graduated cylinder, 100 mL
- Balance or electric scale
- Filter paper
- One plastic jar with lid, or test tube with stopper
- Plastic knife
- Crackers

Estimated Instructional Time

One, 50-minute class period

Opening – 5 minutes

- Bell Work- Read through the Energy In –Energy Out lab today.
- Teacher – Reads or goes over the Calorie or calorie section.
- Teacher- solicits some student hypotheses
- Teacher- goes over supply locations and procedures.
- Ask for questions to check for understanding of the lab.

Middle – 40 minutes

- Energy In – Energy Out procedures
- Teacher circulates

Closing – 5 minutes

- Teacher will close this day with a discussion of Connection to Future Project section.

Preparation

1. It is important that the cream is at room temperature, around 16.6°C (62°F). If the cream is too cold, students will end up with whipped cream rather than butter. Depending on the day, set out the cream 20-30 minutes before the lab is to begin. Only set out sealed containers, as open containers are more likely to spoil.
2. Place water into plastic bottles and place in a refrigerator to cool. Wash bottles or dropper bottles work well, and keep the science equipment theme of the lab, but you can use any container that is available. I do not recommend placing these in freezer.
3. Students can use test tubes and stoppers, plastic jars with lids, or baby food jars to create butter.

Materials (for each group)

- 50 mL of emulsified colloid of liquid butterfat in H20 (heavy cream)
- 0.25 g of sodium chloride, NaCl (salt)
- 500 mL chilled H20
- Graduated cylinder, 100 mL
- Balance or electric scale
- Filter paper
- One plastic jar with lid, or test tube with stopper
- Plastic knife
- Crackers

Start by reading about the lab together. It is important to connect the Calorie or calorie section to their prior knowledge. (see Student Handout)

Procedure

1. Read through the entire Procedures section before beginning.

2. Gather all your materials at your lab station. If you notice any of the materials are dirty or discolored, notify your teacher.

3. Using the balance, find the mass of your container without the lid and record the mass in your data table.

4. Measure 50 mL of emulsified colloid of liquid butterfat in H2O in the 100 mL graduated cylinder.

5. Pour the 50 mL of emulsified colloid of liquid butterfat in H2O into your container (plastic jar or test tube with stopper)

6. Cap the container with the lid and seal it tight

7. Before you begin shaking, start a stop watch.

8. Shake the container about 20 times. Open the top slightly to relieve the pressure, and then reseal.

9. Continue to shake the container until all the liquid appears to have solidified. Once you have a complete solid, stop the stop watch and record the time in the data table.

10. Open the container and inspect the contents. Use the edge of your knife or your finger to taste a small amount of the contents. Describe the taste and texture of the contents in the data table.

11. Close your container tightly, start the stop watch, and continue to shake until lumps of solid fat form surrounded by a thin and opaque liquid. The liquid is known as buttermilk. Record the time in the data table when you reach this phase.

12. Open the container and taste the liquid buttermilk. Record your observations in the data table.

13. Pour the liquid buttermilk out of the container, being careful not to lose any of the solidified fat.

14. Add fresh, cold water until the container is about one-third full. Replace the lid and shake about five times. Pour off the wash water and repeat the washing until the water pours off clean. Record the number of rinses you completed.

15. Once the water pours off clean, use the balance to record the mass of the container with the butter and record this in your data table. Complete the calculations necessary to determine the mass of the butter you created.

16. Place the butter on a cracker and eat.

17. Clean your lab area and answer the Data Analysis and Conclusion and Connections questions that follow.

Data Analysis Answer Key

For each of the following questions, be sure to explain using detail and complete sentences. If the question requires you to complete calculations, show all of your work.

1. How much time did it take you to transform your cream into butter? Use the recorded times in your data table.

   On average, it takes students 15-20 minutes total to go from the heavy cream to the butter. This number depends on the speed of their agitation, and the starting temperature of their cream.

2. If the average person burns 135 Calories while shaking for 30 minutes, how many Calories did you burn while making the butter? If you shared the shaking job, calculate this if one person did this to determine Energy In (measured in Calories).

   135 Calories ÷ 30 minutes = 4.5 Calories/minute

   Students' answers will vary based on the time it took them to create butter, which was calculated in Data Analysis question 1. A student group that took 18 minutes to create its butter would have the following calculations:

   18 minutes x 4.5 Calories/minute = 81 Calories burned

3. If butter contains 1,628 Calories per cup (227 g), then how many Calories are in a single gram of butter?

   1,628 Calories (227 g) = 7.172 Calories/gram

4. How many grams of butter did you transform from the original cream? How many Calories are in that butter? Energy Out (measured in Calories)

   The amount of butter created will depend on the students, but averages around 30-35 grams of butter. To find the Calories in the butter they created, students need to multiply the mass of butter by 7.172 Calories/gram. For example, a team who made 30 g of butter would have the following calculations:

   30g x 7.172 Calories/gram = 215 Calories

Conclusion and Connections

1. Was your hypothesis correct or incorrect? Explain using data to support your answer.

CONNECTION TO FUTURE PROJECT

1. Give at least one example of a quantitative data during this experiment.

   Time to make butter, any calculations from the data analysis, any mass measurements

2. Give at least one example of a qualitative data during this experiment.

   Any taste, texture, appearance observations

3. What may explain the reason a person's weight is maintaining but they are increasing their level of activity through exercise?

   Weight balance is a result of energy in equaling energy out. If weight is maintaining but a person is increasing their activity through exercise they must be also increasing the energy in (Calories).

Energy In – Energy Out

Adaptation from Butter Battle in Gourmet Lab by Sarah Reeves Young, pgs. 3-17

Name _____ Period _____

Calorie or calorie?

Many of you are already familiar with the term Calorie, but why the capital C? A calorie is a unit of energy: The energy it takes to raise one gram of water by one degree Celsius. When the word calorie is used to describe food in the United States, it is actually referring to kilocalories (1,000 calories). It is supposed to be represented by writing Calorie with a capital C, but is often not. In an effort to be correct, this lab will use Calorie meaning kilocalorie or the amount of energy to raise 1000 grams of water (1 Liter) one degree Celsius. Yes, this means your candy bar is 250,000 calories! That's lowercase c, calories.

Butter Background

Butter is created from warm cream through a process known as churning. Our current understanding states that when air is mixed into the cream, foam is formed. Within that foam, fat globules collect in the bubble walls. If you begin with cream that is chilled and stop when the foam is formed, then you end up with a final product of whipped cream. If you begin with warm cream, then the fat globules liquefy to some degree. Further agitation through churning breaks down the protective membrane around the fat globules and causes them to congregate into a solid mass. The liquefied fat helps to cement the exposed fat droplets together into butter. The final product is about 80% milk fat, 18% water, and 2% milk solids. The remaining liquid is buttermilk.

Form a Hypothesis

For this experiment, you will be generating the energy necessary to create butter. Make a hypothesis stating "Do you think it will take more Calories to create the butter than the Calories you will get from eating the butter?"

Write your hypothesis and share with your team: ____

_____

_____

_____

_____

Materials (for each group)

- 50 mL of emulsified colloid of liquid butterfat in H20 (heavy cream)
- 0.25 g of sodium chloride, NaCl (salt)
- 500 mL chilled H20
- Graduated cylinder, 100 mL
- Balance or electric scale
- Filter paper
- One plastic jar with lid, or test tube with stopper
- Plastic knife
- Crackers

Start by reading about the lab together. It is important to connect the Calorie or calorie section to their prior knowledge. (see Student Handout)

Procedure

1. Read through the entire Procedures section before beginning.
2. Gather all your materials at your lab station. If you notice any of the materials are dirty or discolored, notify your teacher.
3. Using the balance, find the mass of your container without the lid and record the mass in your data table.
4. Measure 50 mL of emulsified colloid of liquid butterfat in H2O in the 100 mL graduated cylinder.
5. Pour the 50 mL of emulsified colloid of liquid butterfat in H2O into your container (plastic jar or test tube with stopper)
6. Cap the container with the lid and seal it tight
7. Before you begin shaking, start a stop watch.
8. Shake the container about 20 times. Open the top slightly to relieve the pressure, and then reseal.
9. Continue to shake the container until all the liquid appears to have solidified. Once you have a complete solid, stop the stop watch and record the time in the data table.
10. Open the container and inspect the contents. Use the edge of your knife or your finger to taste a small amount of the contents. Describe the taste and texture of the contents in the data table.
11. Close your container tightly, start the stop watch, and continue to shake until lumps of solid fat form surrounded by a thin and opaque liquid. The liquid is known as buttermilk. Record the time in the data table when you reach this phase.
12. Open the container and taste the liquid buttermilk. Record your observations in the data table.
13. Pour the liquid buttermilk out of the container, being careful not to lose any of the solidified fat.
14. Add fresh, cold water until the container is about one-third full. Replace the lid and shake about five times. Pour off the wash water and repeat the washing until the water pours off clean. Record the number of rinses you completed.
15. Once the water pours off clean, use the balance to record the mass of the container with the butter and record this in your data table. Complete the calculations necessary to determine the mass of the butter you created.
16. Place the butter on a cracker and eat.
17. Clean your lab area and answer the Data Analysis and Conclusion and Connections questions that follow.

Name _____Period _____

Data and Observations

BALANCE MEASUREMENTS	
	Mass (g)
Mass of container without lid	
Mass of container with butter	
Mass of butter created	

TIME AND TASTE OBSERVATIONS		
PHASE	TIME (MINUTES)	OBSERVATIONS
Initial solidification of liquid		Taste of solid
Secondary solidification and liquefaction of buttermilk		Taste of liquid Number of rinse cycles

Name _____Period _____

Data Analysis

For each of the following questions, be sure to explain using detail and complete sentences. If the question requires you to complete calculations, show all of your work.

1. How much time did it take you to transform your cream into butter? Use the recorded times in your data table.

2. If the average person burns 135 Calories while shaking for 30 minutes, how many Calories did you burn while making the butter? If you shared the shaking job, calculate this if one person did this to determine **Energy In** (measured in Calories).

3. If butter contains 1,628 Calories per cup (227 g), then how many Calories are in a single gram of butter?

4. How many grams of butter did you transform from the original cream? How many Calories are in that butter? **Energy Out** (measured in Calories)

Name _____Period _____

Conclusion and Connections

1. Was your hypothesis correct or incorrect? Explain using data to support your answer.

CONNECTION TO FUTURE PROJECT

1. Give at least one example of a quantitative data during this experiment.

2. Give at least one example of a qualitative data during this experiment.

3. What may explain the reason a person's weight is maintaining but they are increasing their level of activity through exercise?

Food Labels and Nutrition

Adapted from Lab Manual Food Science- The Biochemistry of Food and Nutrition pgs. 51-52

Name _____ Date _____Period _____

Nearly all packaged foods sold in the United States are required by law to display nutritional information on their containers for the benefit of consumers. You can find this information on the Nutrition Facts panel typically printed on the side or back of a package. Food scientists have contributed to the formulation of this information.

To begin evaluating the contributions of food science to your diet, compare the labels on two products that appear regularly at many breakfast tables.

Equipment and Materials

Nutrition Facts panels from two different food packages

Procedure

1. Obtain one Nutrition Facts panel from a container of oatmeal and one from a container of ready-to-eat cereal from your teacher.
2. In your data table, identify the products you're using.
3. Examine the Nutrition Facts panel on each product and record the information called for in your data table.

Analyzing Results

1. How do the foods compare in Calories, total fat, and cholesterol?

2. Which food has the highest Calories per gram?

3. Which of the two products was higher in vitamins and minerals?

4. How do you account for differences in nutritional value?

5. Based on your current understanding of nutrition, what advantages and disadvantages do you see in eating each food item?

Data Table

	Product One _____		Product Two _____	
Nutrient	**Amount per Serving**	**% Daily Value**	**Amount per Serving**	**% Daily Value**
Calories				
Total fat (lipids)				
Cholesterol				
Carbohydrates				
DIetary fiber				
Sugars				
Protein				
Vitamins (List)				
Minerals (List)				