Name Period 1 / 2 / 4 / 5

Lesson 3.2 Marathon snack








Engage


Imagine that you are in a long race. Your body is rapidly depleting its energy reserves. You need energy. You grab a snack.

1. Thinking back to Unit 2, what kinds of macromolecules would you want to have in the snack?

2. Why would you want these macromolecules in the food?

3. What kinds of macromolecules do you think are easiest for the body to break down and release stored energy?

Explore

4) You have been hired by a company to create a delicious snack for marathon runners. First, you and your business partner(s) must brainstorm 3 essential ingredients for your snack. You may choose from the 8 foods shown in the photographs above (dried bananas, chocolate chips, raisens/craisens, pumpkin seeds, marshmallows, oat squares, pretzels and /or beef jerky).

a)

b)

c)

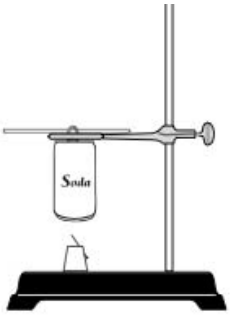
6) Why would these three ingredients help marathon runners?

a)

b)

c)

The company has asked you to run tests on the nutritional value of your snack before your product is put on the store shelves. Complete the following food tests to provide the necessary nutritional facts on your product project.

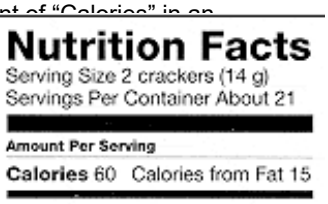


In this activity you will experimentally measure the energy stored in the chemical bonds of several foods by burning the foods and measuring the amount of energy gained by a sample of water heated as the chemical bonds in the food are broken when you burn it. You will use a **calorimeter** to determine the amount of Calories in each food sample. When you look at nutrition labels, you see the amount of "Calories" in an amount of food.

1 Calorie = 1 kilocalorie = 1,000 calories

The capital "C" is used to distinguish this amount as a kilocalorie

The Calories in this food sample is = to 60,000 calories →



1. Name the first food on your list to test.	**Name of food:**			
2. Record the Calories per serving for this item from the label *(food Calories on labels are actually kcals)*	**Calories per serving (kcal):**			
3. Record the serving size in grams per serving for this item.	**Serving size (g):**			
4. Calculate the Calories per gram for this food.	**Advertised Calories per gram (kcal/g):**	*		
5. Obtain a sample of one of your selected foods to test. 6. Find and record the initial mass of the sample for the appropriate trial.	**Initial mass of sample (g):**	**Trial 1**	**Trial 2**	**Average**
				[redacted]
7. Place 100 mL of water in the can. 8. Insert the thermometer in the water. Record the initial temp after 60 seconds.	**Initial temperature (°C):**			
9. Secure the food on the paperclip and ring. 10. Use the candle to ignite the food sample. 11. Record the final temperature of water after the food sample is burned.	**Final temperature (°C):**			
12. Calculate the change in temperature	**Change in temperature (°C):** **Change in T (°C) = Final T (°C) – Initial T (°C)**			
13. Record the final mass of the burned sample.	**Final mass (g):**			
14. Calculate the change in mass	**Change in mass (g):** **Change in Mass (g) = Initial Mass (g) – Final Mass (g)**			
15. Calculate the energy gained by the water	**Energy gained by water (cal):** Energy=(change in temp)(1cal/g•°C)(100g of water)			
16. Replace the water for the next trial. 17. Repeat 5-16 for a total of 3 trials. 18. Calculate the averages and place them in "average" column. 19. Calculate average energy gained/gram	**Average energy gained/gram** $\frac{\text{(Average energy grained by water)}}{\text{(average change in mass)}}$	cal/g		
20. Convert your average energy gained per gram from cal/g to kcal/g	**Experimental Calories per gram (kcal/g)** $\frac{\text{(average energy gained/gram)}}{1000}$	*		

1. Name the next food on your list to test.	**Name of food:**			
2. Record the Calories per serving for this item from the store label.	**Calories per serving (kcal):**			
3. Record the serving size in grams per serving for this item.	**Serving size (g):**			
4. Calculate the Calories per gram for this food.	**Advertised Calories per gram (kcal/g):**	*		
5. Obtain a sample of one of your selected foods to test. 6. Find and record the initial mass of the sample for the appropriate trial.	**Initial mass of sample (g):**	**Trial 1**	**Trial 2**	**Average**
				[redacted]
7. Place 100 mL of water in the can. 8. Insert the thermometer in the water. Record the initial temp after 60 seconds.	**Initial temperature (°C):**			
9. Secure the food on the paperclip and ring. 10. Use the candle to ignite the food sample. 11. Record the final temperature of water after the food sample is burned.	**Final temperature (°C):**			
12. Calculate the change in temperature	**Change in temperature (°C):** **Change in T (°C) = Final T (°C) – Initial T (°C)**			
13. Record the final mass of the burned sample.	**Final mass (g):**			
14. Calculate the change in mass	**Change in mass (g):** **Change in Mass (g) = Initial Mass (g) – Final Mass (g)**			
15. Calculate the energy gained by the water	**Energy gained by water (cal):** Energy=(change in temp)(1cal/g•°C)(100g of water)			
16. Replace the water for the next trial. 17. Repeat 5-16 for a total of 3 trials. 18. Calculate the averages and place them in "average" column. 19. Calculate average energy gained/gram	**Average energy gained/gram** $\frac{\text{(Average energy grained by water)}}{\text{(average change in mass)}}$	cal/g		
20. Convert your average energy gained per gram from cal/g to kcal/g	**Experimental Calories per gram (kcal/g)** $\frac{\text{(average energy gained/gram)}}{1000}$	*		

1. Name the final food on your list to test.	**Name of food:**			
2. Record the Calories per serving for this item from the store label.	**Calories per serving (kcal):**			
3. Record the serving size in grams per serving for this item.	**Serving size (g):**			
4. Calculate the Calories per gram for this food.	**Advertised Calories per gram (kcal/g):**	*		
5. Obtain a sample of one of your selected foods to test. 6. Find and record the initial mass of the sample for the appropriate trial.	**Initial mass of sample (g):**	**Trial 1**	**Trial 2**	**Average**
				[redacted]
7. Place 100 mL of water in the can. 8. Insert the thermometer in the water. Record the initial temp after 60 seconds.	**Initial temperature (°C):**			
9. Secure the food on the paperclip and ring. 10. Use the candle to ignite the food sample. 11. Record the final temperature of water after the food sample is burned.	**Final temperature (°C):**			
12. Calculate the change in temperature	**Change in temperature (°C):** **Change in T (°C) = Final T (°C) – Initial T (°C)**			
13. Record the final mass of the burned sample.	**Final mass (g):**			
14. Calculate the change in mass	**Change in mass (g):** **Change in Mass (g) = Initial Mass (g) – Final Mass (g)**			
15. Calculate the energy gained by the water	**Energy gained by water (cal):** Energy=(change in temp)(1cal/g•°C)(100g of water)			
16. Replace the water for the next trial. 17. Repeat 5-16 for a total of 3 trials. 18. Calculate the averages and place them in "average" column. 19. Calculate average energy gained/gram	**Average energy gained/gram** (Average energy grained by water) (average change in mass)	cal/g		
20. Convert your average energy gained per gram from cal/g to kcal/g	**Experimental Calories per gram (kcal/g)** (average energy gained/gram) 1000	*		

Explain – Please answer in complete sentences.

1. Which of your marathon snacks foods was most energy rich? How do you know this?

2. Which of your marathon snacks food was the least energy rich? How do you know this?

3. Class data. Record the *experimental average* results of your classmates for all 8 foods. Compare to the Kcal amounts calculated by the manufacturer's, provided to you by your instructor (last column).

Food	**Trial #1**	**Trial #2**	**Trial #3**	**Trial #4**	**Trial #5**	**Trial #6**	**Trial #7**	**Class Average**	Manufacturer Value (from teacher)
Dried Banana									
Chocolate chips									
Raisens / Craisens									
Pumpkin Seeds									
Oats									
Marshmallow									
Pretzels									
Beef Jerky									

4. Using the class data, which of the marathon snack foods was most energy rich? Was the least energy rich?

5. Is your data the same as the class average?

6. Why might our class derived average differ from the manufacturer?

7. What part of our experimental design may have been led to our values from the manufacturer's? Be specific.

8. How does the matter in the food become usable energy for a marathon run? *(In other words, what process occurs?)*

9. Look at the food labels from your items and record the macromolecules present (and relative amounts) for each of your three items in your snack (if you don't have the label here in class, you can do a Google search for the product to view the nutrition label).

Food Item	Lipids/Fats? *If yes, how many grams per serving?*	Proteins? *If yes, how many grams per serving?*	Simple Carbohydrates? (Listed as "Sugars" on labels) *If yes, how many grams per serving?*	Complex Carbohydrates? *If yes, determine the amount of grams: Total carbohydrate grams – sugar grams*

9. After completing your tests, do you still think the combination of your three foods is the best option for your marathon bar? Would you make any changes before presenting to the company? Explain.

10. How did your calorimetry data and your understanding of nutrition influence your decision to develop your snack?

11. For Homework, imagine you are attending the world's largest convention for marathon runners. You are bringing your bar to market and need to design a label for your bar to explain why people would benefit from eating your bar. In order to capture the market share, take the following things into consideration:

- You need something colorful, with a catchy title and / or tag line (i.e. Snickers . . . . it really satisfies)
- Be sure to explain all your ingredients and which macromolecules each one contains
- Be sure to explain the kcal values of each of your ingredients
- Your label should be neat and organized
- Feel free to use templates found online or do by hand.

	Exceeds Standards (6 points)	Meets Standards (5 - 4 Points)	Approaches Standards (3 - 2 Points)	Areas of Concern (1 - 0 Points)
Description of Ingredients and Energy Value	◊ Brochure clearly and effectively describes at least (3) foods in snack in text and visual form. ◊ Description includes a complete and accurate list of all the macromolecules present in each food. Description includes how much energy each ingredient contributes to the product	◊ Brochure describes (3) foods in snack in text and visual form. ◊ Description includes an accurate list of most of the macromolecules present in each food.	◊ Brochure describes (3) foods in snack in text or visual form. ◊ Description includes a list of some of the macromolecules present in each food.	◊ Brochure describes less than (3) foods in snack in text or visual form or is completely inaccurate.
Overall quality of Brochure	◊ The brochure is neat and organized and effectively uses color to capture the interest of the reader. The snack has a name and a tag line for marketing.	◊ The brochure is neat, and some color is used.	◊ The brochure has weak craftsmanship, may lack color.	◊ Craftsmanship is poor.