

Eating your Energy's Worth (Lesson Plan)

(Exploring energy consumption through food)

Suggested Grade Level 6-8

Overview

In this lesson, students will use the “Energy Calculator” to explore the consumption of energy. This lesson takes a novel approach to introducing the concept of energy consumption by starting an activity where students make predictions about the energy content of “student-friendly” food energy units and exercise. In the second part of the lesson, students make and test predictions with regards to home appliances. Students devise ways to use the Energy Calculator to test their predictions and use everyday quantities like food units to begin to grasp the relative magnitudes of energy use by appliances and the equivalent amount of work in terms of human exercise and physical activity. One 50-minute long class period is recommended to complete this lesson.

This lesson can be implemented in a stand-alone fashion to address the basic premise of connecting food energy units to more conventional and less conceptually accessible physical science energy and power units like the joule and the watt or in conjunction with other E21 lessons "Walk a Mile for a Burger?" and "Electricity Unplugged" which are located at <http://www.pspb.org/e21>.

Standard Statements

3.4.10. B Analyze energy sources and transfers of heat.

Content Objectives

Students will know that

1. There are different forms and sources of energy.
2. People get chemical energy from the food they eat.
3. Foods contain different amounts of energy.
4. People use electrical energy to power appliances.
5. Different physical activities burn food energy at different rates and different appliances use electrical energy at different rates.

Process Objectives

Students will be able to

1. Compare activities by how fast they burn calories.
2. Compare appliance use by the rate they use energy.
3. Calculate the amount of electrical energy used in a week in food units
4. Develop ways to reduce energy use.

Assessment Strategies

1. Evaluation of completed student handbook.
2. Participation in classroom discussion on energy conservation.

Materials

Per group:

- Computer with access to Microsoft Excel
- Excel file, “Energy Calculator,” that accompanies this lesson

Per student:

- Student handout

Procedures

Parts 1 & 2:

(1, 50 min Class Period)

1. This activity incorporates small group discussions. At the start of the lesson, frame the activity by introducing the first section that involves predicting the amount of energy in certain types of food.
2. As groups progress through the lesson, be sure to monitor student progress and facilitate discussions.
3. During part I, students will be using the blue section of the Energy Calculator. During part II, students will be using the yellow section of the Energy Calculator.
4. At the end of the activity, you can have the class discuss their explanations and predictions in a large group setting.

Eating your Energy's Worth (Teacher Notes)

(Exploring energy consumption through food)

General Lesson Notes

- **Group interaction.** This activity is designed so that group members discuss predictions and explanations. Encourage this interaction and move around the room to monitor student progress.

Part 1 Notes

- **Original ranking.** Students may have trouble predicting the amount of energy in each food item. Use questioning patterns to assist students with the thought process. Resist giving them the correct answers. Help students think about the factors that influence calorie content.
- **Section #8:** In this section, students are asked to devise a way to determine whether their original ranking is correct. Help students think about using the same exercise to compare each of the foods. This way, students can compare the lengths of time and easily figure out which foods have the most calories.

Part 2 Notes

- **Original ranking.** Again, students are asked to rank objects. This time students are asked to rank appliances based on the rate in which they use energy. Again, resist giving them the correct answers. Help students think about the factors that influence energy use.
- **Section #16:** In this section, students are asked to devise a way to determine whether their original ranking is correct. Help students think about using the same amount of time to compare each of the appliances. This way, students can compare the amount of energy (Whoppers, oranges, etc) and easily figure out which appliance uses energy the fastest.

Additional References

Websites:

- <http://www.exploratorium.edu/theworld/energy/joules.html>

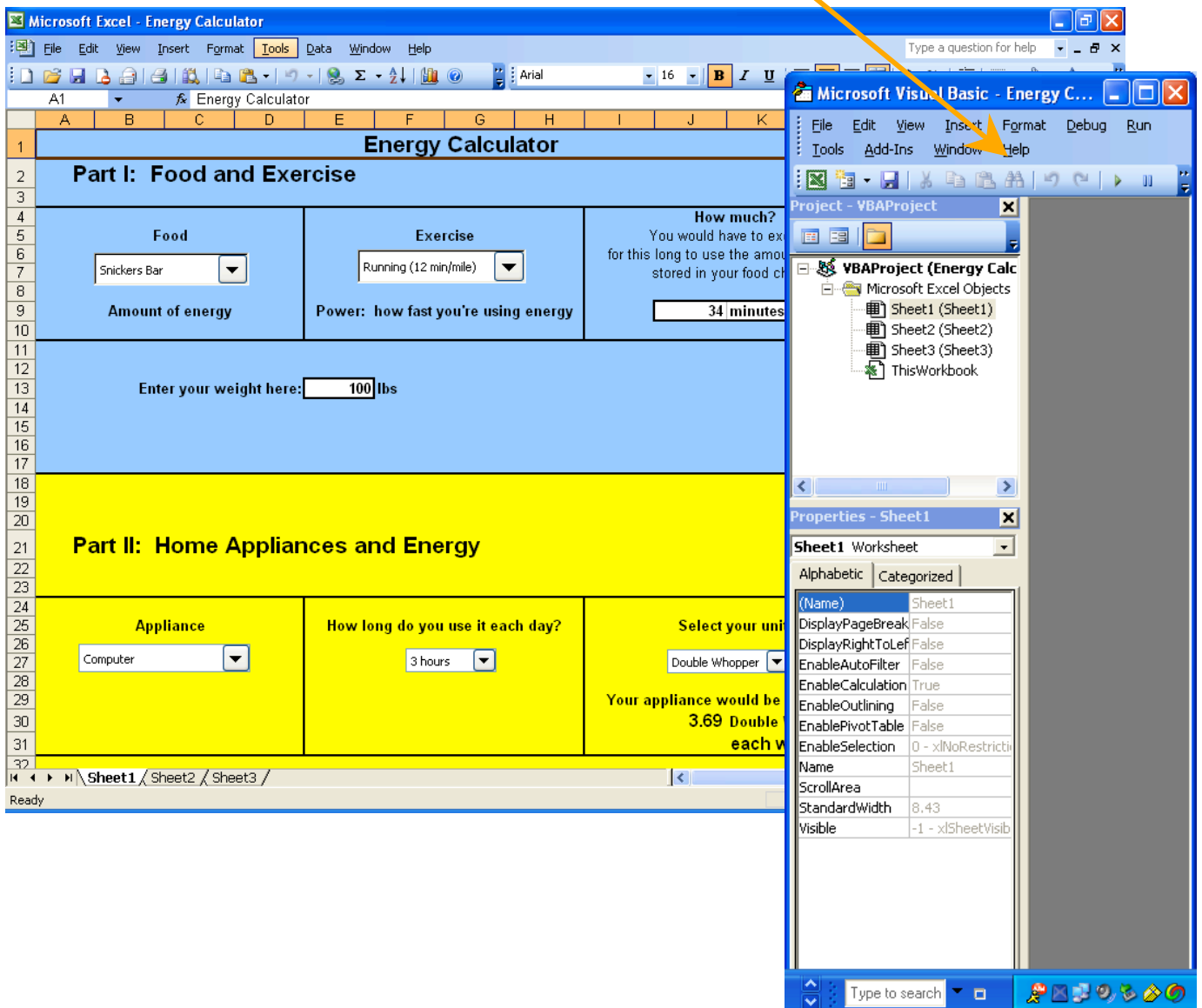
Journal Articles:

- Farenga, Stephen J & Ness, Daniel (2006) Calories, energy, and the food you eat, *Science Scope*, 29, 5, p 50.

Modifying the Energy Calculator:

- The Energy Calculator was created using macros that run using Visual Basic Editor within a Microsoft Excel spreadsheet. You will notice that columns M through S are hidden on the Excel sheet the data and drop-down menu choices are currently stored there. You can view and edit the choices after “unhiding” the columns.
- The calculator can be modified to suit the food preferences and needs of your students by adjusting the data and macros to suit your needs. Please see the following website for a basic explanation of a macro: <http://office.microsoft.com/en->

<http://office.microsoft.com/en-us/assistance/HP052012011033.aspx>. For information on macro editing, please see: <http://office.microsoft.com/en-us/assistance/HP051999451033.aspx> and follow the instructions for accessing the “Microsoft Visual Basic Editor” Help menu.



Name: _____

Eating your Energy's Worth

(Exploring energy consumption through food)

Overview

In this activity, you will learn that energy comes in many forms (electrical and chemical, for example) and that some physical activities and electrical appliances use energy very quickly and others use energy very slowly.

Part 1 Food and Exercise

1) Think about the following food items. Talk with your group members and rank the foods based on the amount of energy you think the food contains (with 1 being the food with the most energy and 7 being the food with the least energy). Hint: The number of calories in a piece of food tells us how much energy it contains.

Food item	Predicted Energy rank
Snickers Bar	
Big Mac	
Double Whopper	
Orange	
Mountain Dew	
Banana	
Personal Pan Pizza from Pizza Hut	

2) Let's say you had a Mountain Dew with lunch one day and you decided to go for a walk. How long do you think you would need to walk to use all of the energy contained in the Mountain Dew?

My predicted walking time is: _____ minutes

3) Use the Energy Calculator to find out. From the food selections, choose Mountain Dew. From the exercise selections, choose walking. Be sure to enter your weight in the space provided. Have the other members in your group use their weights, too.

a) How long would you have to walk to burn off all of the energy in a Mountain Dew?

b) Did this value surprise you? Why or why not?

4) What if you chose a different physical activity, like running or playing basketball? Do you think the length of time would be different for those activities? Why or why not?

5) Let's try it and see. Use the Energy Calculator to calculate the amount of time you would have to spend for each of the following activities to burn off a Mountain Dew.

Exercise	Length of time (minutes)
Walking	
Swimming laps	
Running fast	
Running slowly	
Playing basketball	
Sleeping	
Watching television	

6) In the table below, rank the exercises based on how fast they used the energy in the Mountain Dew.

Exercise	Rank
Walking	
Swimming laps	
Running fast	
Running slowly	
Playing basketball	
Sleeping	
Watching television	

7) Why do you think the different types of exercise use energy more slowly or more quickly?

8) At the beginning of this activity, you were asked to rank types of food based on the amount of energy they contained. How could you use the Energy Calculator to figure out whether you were right? Talk with your group members and write your idea here.

9) Try it and see. Copy your group's predicted ranks and then use your idea from part 8 to determine the ranks of the different types of food.

Food item	Predicted Energy rank	Real Energy rank
Snickers Bar		
Big Mac		
Double Whopper		
Orange		
Mountain Dew		
Banana		
Personal Pan Pizza from Pizza Hut		

- 10) a) Does the real rank seem correct? Don't forget to explain why or why not.
b) Were your results a lot different from your original predictions?

a)

b)

11) Why do you think the Energy Calculator uses a person's weight? Do you think how fast a person uses energy depends on their weight? Explain.

Part 2 (Home Appliances and Energy)

In Part 1, we looked at the amount of energy in different types of food and how fast different activities used energy. In this part, we look at different electrical appliances and how fast they use energy.

12) Look at the list of electrical appliances below. Remembering what you learned about different types of exercise, talk with your group members and rank the appliances based on how fast they use energy. Use 1 to indicate the most energy and 8 to indicate the least energy.

Appliance	Rank
Toaster	
Computer	
Lamp	
Stereo	
Television	
Microwave	
Vacuum cleaner	
Hair dryer	

13) What factors did your group consider as you were ranking the appliances?

14) a) Just like exercising, the appliances need to run for a while to use energy. For each of the appliances, talk with your group members to figure out how long each of the appliances is used daily. The Energy Calculator will let you choose the following lengths of time: **2 minutes, 5 minutes, 10 minutes, 30 minutes, 1 hour, 2 hours, or 3 hours**. Use these values when you fill out the chart.

b) For each of the appliances, use the Energy Calculator to determine how much energy that appliance uses each week. The Energy Calculator reports energy amounts in the food items used in part 1. You can choose any type of food, but use the same for all the calculations. Be sure to fill out the shaded box with your food type.

Appliance	Amount of time	Number of _____
Toaster		
Computer		
Lamp		
Stereo		
Television		
Microwave		
Vacuum cleaner		
Hair dryer		

15) How much total energy was used by all of the appliances in a week? Were you surprised by the amount?

16) Earlier in this section, you were asked to rank the appliances based on how fast they used energy. How could you use the Energy Calculator to figure out whether you were right? Talk with your group members and write your idea here.

17) Try it and see. Copy your group's predicted ranks and then use your idea from part 16 to determine the ranks of the different appliances.

Appliance	Predicted Rank	Real Rank
Toaster		
Computer		
Lamp		
Stereo		
Television		
Microwave		
Vacuum cleaner		
Hair dryer		

18) a) Does the real rank seem correct?
b) Were your results a lot different from your original predictions?

a)

b)

19) How could we decrease the amount of electrical energy we use each week? Hint: Look at your energy tally from section 14 to see what areas used the most energy and which areas could be easy to change.
