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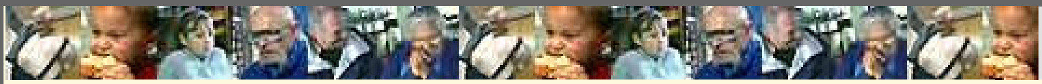
SCIENTIFIC AMERICAN FRONTIERS

# Fat and Happy?





## Teaching Guide

*Activity 1: Grades 5-8*

### Counting Calories

ACTIVITIES

- Counting Calories
- The Anti-oxidant effects of Vitamin C
- Testing for Simple Sugars
- Quiz

As you learned in "Doctor Empathy", monitoring the caloric content of the foods you eat can greatly impact weight gain or weight loss. Calories that are counted in our everyday diet are based upon the same units of heat that measure the potential energy stored within chemical bonds. As substances react, chemical bonds are broken and reformed. During this process, energy is released. The amount of released energy is measured in calories and is dependent upon the original energy content of the reactant bonds. Foods that are high in calories have chemical bonds that when rearranged give off large amounts of energy. When a high-energy bond is broken, a large amount of energy is released. If the body can't use all of this energy, it stores the access within the chemical bonds of fat.

Nutritionists usually refer to food in terms of kilocalories (1000 calories). When pamphlets and books refer to food energy in kilocalories they use the word Calorie with an uppercase "C". So one Calorie is equal to 1 kilocalorie which is equal to 1000 calories (lowercase "c").

**TEACHER CAUTION**: Before performing this activity, be sure that no student who will enter the room or be exposed to the smoke has a peanut allergy.

**THE PEANUT TEST**
To determine the calorie content of a particular food, its stored bond energy must be liberated and measured. This energy is released as heat and is transferred to water. As the water absorbs the heat, its temperature rises. By knowing the mass of burnt food, the volume of water, and the change in the water's temperature, you can determine the calories/gram of the burned food.

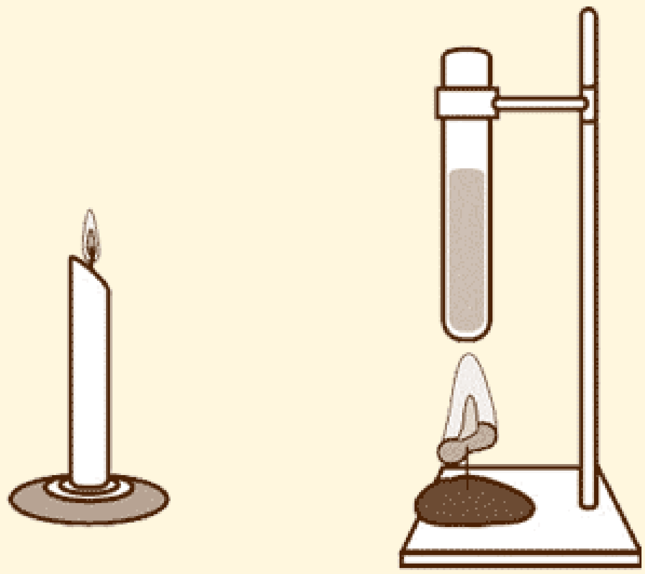
**NOTE** Physical scientists define one calorie as the amount of heat needed to raise the temperature of one gram of water by one Celsius degree.

**OBJECTIVE**
This activity page will offer

- an activity to determine relative amounts of calories in a peanut
- an opportunity to integrate mathematics and science
- an arena for critical thought on experimental design

## MATERIALS

- Large test tube
- Test tube holder
- Ring stand
- Peanut
- Graduated cylinder
- Clay
- Needle
- Matches
- Candle
- Thermometer
- Laboratory balance
- Water (maintained at room temperature)
- Safety goggles



## PROCEDURE

1. Review all safety precautions associated with the use of an open flame with your instructor.
2. Put on your safety goggles. Use a graduated cylinder to pure 10 mLs of water into a test tube.
3. Secure the tube in a fixed test tube holder.
4. Obtain the mass of an unshelled peanut. Record this value.
5. Carefully pierce the peanut with a needle.
6. Anchor the free end of the needle into a lump of clay, as seen in the DIAGRAM.
7. Measure the temperature of the test tube water in degrees Celcius. Record this value as the initial temperature.
8. With your instructor's approval, light a nearby candle. Once the candle is burning, use it to set the peanut on fire.
9. Once the peanut has started burning, position it directly beneath the water filled test tube.
   **NOTE:** when re-igniting the peanut, slide it away from the test tube in order to prevent the candle's heat from warming the water.
10. When the peanut has stopped burning, retake the temperature of the water. Record this value.
11. Pour out the test tube water into a graduated cylinder. Record this volume.

12. Place the burnt peanut on the balance and determine its end mass.

**QUESTIONS**

1. What was the volume of water that was heated by the burning peanut?
2. What was the initial temperature of the water? What was the final temperature of the water? How many °C did it rise?
3. Use the following equation to determine the heat gained by the water:

   Calories = (mass of water) (change in temperature of water)

   For our approximation, we'll equate mLs and grams, therefore: calories = (volume of water) (change in temperature of water)

   We'll also simplify our calculations by assuming that minimal heat was lost to the surroundings. Therefore, we'll set the heat gained by the water equal to the heat lost by the peanut.

4. What was the initial mass of the peanut? What was the final mass of the peanut? What was the mass of the peanut that was burned?
5. To calculate the calories per gram of the peanut, use the following equation:

   calories per gram = (heat gained by water)/(mass lost when peanut burned)

6. To calculate the number of nutritional Calories per gram simply divide the heat calories from question 5 by 1000.

**EXTENSIONS**

**WATER'S MASS**
To simplify our calculations, we set the mass of 1 mL equal to 1 gram. How accurate is such an approximation? To find out, use a laboratory balance to obtain the mass of a beaker. Record this value. Use a graduated cylinder to introduce 100 mL of water to this beaker. Determine its new mass. Subtract the initial mass from the final mass to obtain the mass of 100 mL of water. Divide this value by 100 to obtain the mass of 1 mL. Was the approximation you used in the previous experiment acceptable? Explain.

**LOSING HEAT**
The experimental design was flawed. All of the energy released by the burning peanut was not absorbed by the water. Where did it go?Can you design a better set-up in which less heat energy is lost? Think about it. Then create a set of blueprints for a laboratory tool that would more efficiently transfer heat from a burning material to a quantity of water.

**CHECK IT OUT**
Survey the labels of a dozen different types of foods. Find out which foods have the most calories per gram. Pool the class results. From this information, can you uncover any similarities in food content that may account for increased Calories?

**WEB CONNECTION**

The New Food Label

http://www.fda.gov/opacom/backgrounders/foodlabel/newlabel.html#panel
A useful, interactive

**FDA Nutrition Label Nutrition on the Web**

A teen-created site on nutrition - includes a chat room
http://library.thinkquest.org/10991/

**A rich resource on the FDA's food guide pyramid**
http://www.pueblo.gsa.gov/cic_text/food/food-pyramid/main.htm

The activities in this guide were contributed by Michael DiSpzio, a Massachusetts-based science writer and author of "Critical Thinking Puzzles" and "Awesome Experiments in Light & Sound" (Sterling Publishing Co., NY).

**Academic Advisors for this Guide:**
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SCIENTIFIC AMERICAN FRONTIERS

# Fat and Happy?

## Teaching Guide

Educator Notes

*Activity 1: Grades 5-8*

## Counting Calories



**TEACHER CAUTION**: Before performing this activity, be sure that no student who will enter the room or be exposed to the smoke has a peanut allergy.

### PART 1- QUESTIONS

#### QUESTIONS

1. What was the volume of water that was heated by the burning peanut? (accept all reasonable answers)
2. What was the initial temperature of the water? What was the final temperature of the water? How many °C did it rise? (this value is obtained by subtracting the initial water temperature from the final water temperature)
3. Use the following equation to determine the heat gained by the water:

   Calories = (mass of water) (change in temperature of water)

   For our approximation, we'll equate mLs and grams, therefore: calories = (volume of water) (change in temperature of water)

   We'll also simplify our calculations by assuming that minimal heat was lost to the surroundings. Therefore, we'll set the heat gained by the water equal to the heat lost by the peanut.

4. What was the initial mass of the peanut? What was the final mass of the peanut? What was the mass of the peanut that was burned? (the mass of the peanut burned is obtained by subtracting the final mass of the peanut from its initial mass)
5. To calculate the calories per gram of the peanut, use the following equation:

   calories per gram = (heat gained by water)/(mass lost when peanut burned)

6. To calculate the number of nutritional Calories per gram

simply divide the heat calories from question 5 by 1000.

## EXTENSIONS

### WATER'S MASS

To simplify our calculations, we set the mass of 1 mL equal to 1 gram. How accurate is such an approximation? To find out, use a laboratory balance to obtain the mass of a beaker. Record this value. Use a graduated cylinder to introduce 100 mL of water to this beaker. Determine its new mass. Subtract the initial mass from the final mass to obtain the mass of 100 mL of water. Divide this value by 100 to obtain the mass of 1 mL. Was the approximation you used in the previous experiment acceptable? Explain. (accept all reasonable answers)

### LOSING HEAT

The experimental design was flawed. All of the energy released by the burning peanut was not absorbed by the water. Where did it go? (changed into light, absorbed by the test tube glass, lost as heat to the surrounding air) Can you design a better set-up in which less heat energy is lost? Think about it. Then create a set of blueprints for a laboratory tool that would more efficiently transfer heat from a burning material to a quantity of water.

## CURRICULUM LINKS

| |
|---|
| **Chemistry:** |
| Chemical Reactions, Heat of Reaction |
| **Biology:** |
| Health, Nutrition |

## NATIONAL SCIENCE STANDARDS (Grades 5-8)

| |
|---|
| **Science As Inquiry-Content Standard A** |
| Students should develop abilities necessary to do scientific inquiry, |
| Students should develop an understanding about scientific inquiry |
| **Physical Science -Content Standard B** |
| Students should develop and understanding of the properties and changes of properties in matter |
| Students should develop and understanding transformations of energy |
| **Science and Personal and Social Perspectives -Content Standard F** |
| Student should develop an understanding about personal health |

SCIENTIFIC AMERICAN FRONTIERS

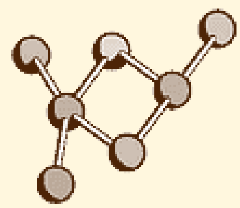
# Fat and Happy?

## Teaching Guide

*Activity 2: Grades 5-8*

### The Antioxidant Effects of Vitamin C





In "Eat Less - Live Longer," you heard how important diet is to good health and longevity. Not only does a well-balanced diet supply you with the nutrients you need to grow, but it also protects you against the destructive action of oxygen and a group of particles called free radicals. Free radicals are atoms (or groups of atoms) that are highly reactive due to the presence of at least one unpaired electron. When molecules of atmospheric oxygen (O2) get struck by sunlight they can split into two oxygen radicals. . Combining with cell compounds, these free radicals can injure cells and lead to a variety of disorders. Substances such as vitamin C can reduce the damage caused by free radicals. By "sacrificing" their own electrons, they can quench the reactive needs of the free radical species.

Have you ever taken a bite of an apple and then left the fruit exposed to air? If so, within minutes you may have observed a "browning" of the fruit surface. The discoloration is produced by the action of atmospheric oxygen upon the exposed apple tissue. Sunlight decomposes the diatomic oxygen molecule into its free radial form. Reacting with the apple compounds, the free radical steals away electrons and sets in motion other reactions that produce additional free radicals. During these events, the apple surface is quickly oxidized as evidenced in the rapid change in its appearance.

**OBJECTIVE**

This activity page will offer

- an understanding of oxygen free radical formation
- an introduction to oxidation and free radicals
- the opportunity to observe the effect of oxidants and free radicals
- an activity using vitamin C to retard the actions of oxidants and free radicals

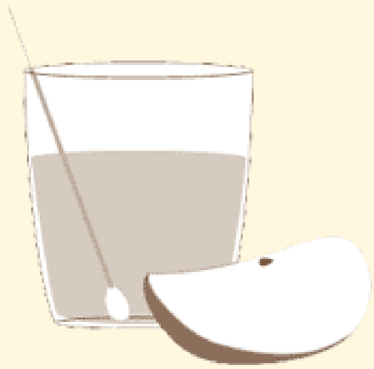
**MATERIALS**

- Vitamin C (1000 mg capsule)*
- Water-filled beaker
- Cotton-tipped applicator
- Apple

- Knife
- Stopwatch or clock

***TEACHER NOTE**
Vitamin C capsules are available at most markets and drug stores.

**PROCEDURE**



1. 1. Work in pairs. With your instructor's permission, carefully slice off a section of apple so that the inner "meat" is exposed to the surrounding air. Begin timing.
2. Determine how long it takes for the apple to show signs of browning. Record your results.
3. Repeat steps one and two using different sections of the same apple and record. Add the results you've obtained for each of the two trials. Divide this number by 2 to obtain an average time for discoloration.
4. Add about 100 mL of water to a beaker. Hold a vitamin C capsule over the beaker. Carefully twist open the capsule allowing its contents to fall into the beaker. Use a cotton-tipped applicator to mix the solution. This applicator will also be used to "paint" the exposed apple tissue.
5. Expose another slice of apple to the air.
6. As soon as the apple is cut, use the applicator to "paint" the exposed surface with the solution of vitamin C.
7. Determine how long it takes for this apple slice to show signs of browning. Record your results.
8. Repeat steps 5, 6 and 7. Add the results you've obtained for each of the two trials. Divide this number by two to obtain an average time for the discoloration with vitamin C.

**QUESTIONS**

1. What happened to the appearance of the exposed apple surface without Vitamin C?
2. What caused this change?
3. From where did this oxygen come from?
4. Identify the substance that was "painted" onto the exposed apple surface.
5. Did the vitamin C covering affect oxidation? How could you tell?

**POOLING RESULTS**
Pool the class results. Then, find the average time for a slice of apple to brown. Did your apple brown before or after the class average time? What might account for differences in the rate?

**ON YOUR OWN**
The speed of a reaction is dependent upon the temperature of its reactants: the lower the temperature, the slower the molecules. At slow speeds, collisions are less frequent as evidenced by a slower reaction rate. At high speeds, collisions increase in frequency and reactions speed up. Design an experiment that would illustrate the effect of temperature on the oxidation of exposed apple.

**EXTENSIONS**

## FREE RADICALS

The existence of free radicals was first proposed as a way of explaining collisions that are unlikely to occur. Consider the formation of ozone ($O_3$ ) from oxygen gas ($O_2$). This reaction is represented by the following equation:

$$3O_2 \rightarrow 2O_3$$

In this reaction, three particles of oxygen must collide at the same time to produce the ozone. As you might imagine, a 3-way collision is highly unlikely. If we reexamine the reaction in terms of free radicals, we can separate the reaction into two distinct steps. During the first reaction, sunlight splits oxygen gas into two free radicals of oxygen. No collision between molecules is required for this first step.

$$O_2 \rightarrow O + O$$

In the second step, a collision between only two particles needs to occur. As you might imagine, a 2-way collision is much more likely event. Here, the oxygen radical formed in the first step collides with an oxygen molecule . The product of this 2-way collision is a molecule of ozone.

$$O + O_2 \rightarrow O_3$$

Work in a team of three. Each team member gets a tennis ball. Position yourselves about two meters apart from each other (at the corners of an equilateral triangle). At a given signal roll the three balls towards the center of the triangle. Your objective is to have the collision of all three balls occur at the same time. Then, try to collide only two balls at the same time. Use this experience to explain the more plausible mechanics of free radical reactions.

## WEB CONNECTION

**The Anti-Oxidant Vitamin**
http://www.garynull.com/Documents/vitaminc.htm
A summary of vitamin C's benefits, including its role as an anti-oxidant.

**Anti-Oxidants Cut Free Radical Risk**
http://www.veg.on.ca/newsletr/mayjun97/antioxidant.html
An informative study on the connection between anti-oxidants and free radicals.

**What Are Free Radicals and What do Antioxidants Do?**
www.thebetter.com/synergy/v0000014.htm
Discusses the relationship between free radicals, antioxidants, and cell disorders.

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SCIENTIFIC AMERICAN FRONTIERS

# Fat and Happy?

## Teaching Guide

### Educator Notes

*Activity 2: Grades 5-8*

The Antioxidant Effects of Vitamin C

ACTIVITIES

- Counting Calories
- The Anti-oxidant effects of Vitamin C
- Testing for Simple Sugars
- Quiz

**QUESTIONS**

1. What happened to the appearance of the exposed apple surface without Vitamin C? (it turned brown)
2. What caused this change? (oxidation)
3. From where did this oxygen come from? (the atmosphere)
4. Identify the substance that was "painted" onto the exposed apple surface. (aqueous solution of vitamin C)
5. Did the vitamin C covering affect oxidation? (yes) How could you tell? (the exposed surface did not brown)

**POOLING RESULTS**

Pool the class results. Then, find the average time for a slice of apple to brown. Did your apple brown before or after the class average time? What might account for differences in the rate? (accept all reasonable answers such as different cut depths, different amounts of exposed surface)

**CURRICULUM LINKS**

| **Chemistry:** |
|---|
| Chemical Reactions, Chemical Kinetics |

**NATIONAL SCIENCE STANDARDS (Grades 5-8)**

| **Science As Inquiry-Content Standard A** |
|---|
| Students should develop abilities necessary to do scientific inquiry, |
| Students should develop an understanding about scientific inquiry |
| **Physical Science -Content Standard B** |
| Students should develop and understanding of the properties and changes of properties in matter |
| Students should develop and understanding transformations of energy |

SCIENTIFIC AMERICAN FRONTIERS

# Fat and Happy?

## Teaching Guide

*Activity 3: Grades 5-8*

## Testing for Simple Sugars

ACTIVITIES

- Counting Calories
- The Anti-oxidant effects of Vitamin C
- Testing for Simple Sugars
- Quiz


As you learned in "The Desert's Perfect Foods," the Pima Indians have a genetic predisposition to gaining weight when adhering to a contemporary Western diet. This weight gain sets the stage for a variety of health disorders including diabetes. Diabetics have difficulty in regulating their body's store of sugar. To help manage this health risk, diabetics must limit the amount of sugar they ingest. By keeping records of their meals and maintaining a low-sugar diet, they can gain some control over the ill effects of this disorder.

There are several different methods to test the sugar content of food. One laboratory technique uses Benedict's solution (a mixture of mostly copper sulfate and sodium hydroxide). When this reagent is mixed with a sample of food and heated, a color change identifies the relative concentration of sugar in the test solution. The sugars that Benedict's reagent tests for are simple sugars such as glucose and fructose. More complex sugars such as sucrose and lactose (formed by two simple sugars hooked together) cannot be identified with this test.

### OBJECTIVE

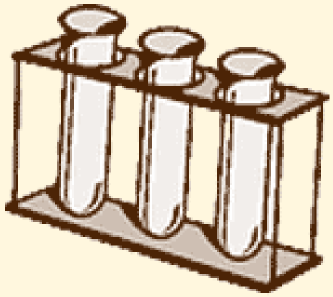
This activity page will offer

- an overview of diabetes
- a hands-on activity using a sugar indicator solution
- an activity to determine relative amounts of sugar in several juices esign

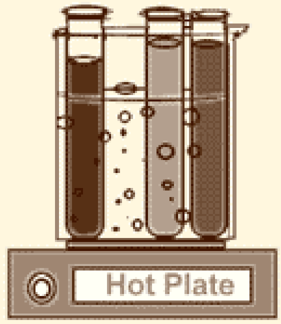
### MATERIALS

- Benedicts reagent (available through school catalogs or at local pharmacies)
- Scale illustrating colors and associated sugar concentrations
- Beaker, size 1000 ml
- Test tubes
- Test tube holder
- Graduated cylinder, size 10 ml or 100 ml
- Lime juice
- White grape juice
- Grapefruit juice
- Apple juice
- Protective goggles
- Boiling water bath

## PROCEDURE



1. Put on your safety goggles and adhere to all laboratory precautions addressing the use of a boiling water bath.
2. Add 4 mL of white grape juice to your test tube.
3. Add 1 mL of Benedict's solution to the juice. Swirl the tube to ensure that it
4. mixes well.
5. With your instructor's approval, place your test tube in the boiling water bath.




6. Wait several minutes or until the color change is complete (blue color may turn to green, yellow. orange, red, brown). Examine and compare the color of the solution to reference color sheet. Record the relative concentration of sugar.
7. Test the other juice samples in the same manner. Record all results in a data table.

## QUESTIONS

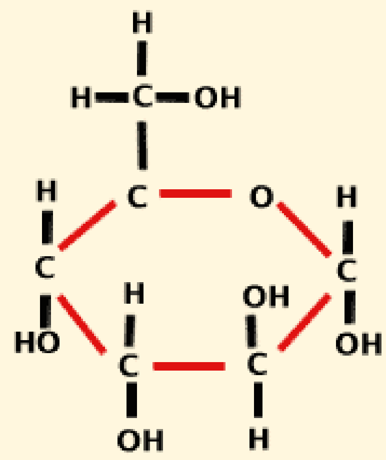
1. What did the Benedict's solution test for?
2. How did the presence of a reducing sugar affect the Benedict's solution?
3. What color would the Benedict's display if there was no sugar in the solution?
4. What color would the Benedict's display if it tested a sugar (sucrose) solution?
5. Did these juices contain reducing sugars? How could you tell?
6. Which juice underwent the most dramatic color shift? Why?
7. Which juice underwent the least change in color? Why?

## EXTENSIONS

### MODEL MAKING

The molecular formula for glucose is $C_6H_{12}O_6$.

Five of the carbons and one oxygen atom are joined together in a ring structure. The other carbon is attached to one of the ring carbons that is located next to the ring oxygen. The remaining five oxygen atoms are joined to hydrogen atoms to form OH groups. From this information and a supply of gumdrops and toothpicks, construct the glucose molecule.



GLUCOSE MOLECULE

**A SWEET MATH CONNECTION**

This scale illustrates the relative sweetness of several sugars based upon sucrose = 100
Lactose (complex sugar) = 16
Galactos (simple sugar) =32
Sucrose (complex sugar) =100
Fructose (simple sugar) =173

Using this scale, answer the following questions:

**QUESTIONS**

1. Which is the sweetest of these four sugars?
2. How many times sweeter is sucrose than lactose?
3. How many grams of fructose would be needed to replace 10 grams of sucrose in order to produce the same sweetness?
4. Suppose a recipe calls for 5 grams of sucrose to sweeten a dish. How much lactose would be needed if you substituted sugars?

**Primer on Diabetes**
Diabetes is a chronic disorder that results in an increased level of sugar (glucose) in the bloodstream. It is caused by the inadequate production or use of insulin, a hormone produced within the pancreas that allows the body to use and store glucose. With an insufficient level of this hormone, high levels of sugar remain in the blood resulting in symptoms including increased urine production and excessive thirst. The body responds to the low insulin levels by breaking down fat and producing damaging metabolic bi-products called ketones. Diabetes may be regulated by regular doses of insulin, which quickly lowers the blood sugar level. If, however, the level of insulin is too high, excessive sugar is removed from the blood. In order to regain this delicate sugar balance, an individual may require a quick "fix" of sugar that is available in orange juice and other sweet liquids.

**QUESTION**

If a diabetic has a low blood sugar level, that person may drink orange juice. Orange juice contains a high concentration of sugar that is readily used by the body. In contrast, some foods contain sugars that must be broken down before they can be used. These slow-release sugars may offer a diabetic a window in which a compromised insulin response has sufficient time to deal with the slowly rising sugar level. Think about it. Should a diabetic who is suffering from low sugar levels be given a food containing a slow-release sugar? Explain.

## WEB CONNECTION

**What the Hunter/Gatherers Ate**
http://www.panix.com/~paleodiet/
A review of Paleolithic nutrition

**Diabetes Knowledge Test**
http://www.endocrinologist.com/diabtest.htm
An interactive, multiple-choice diabetes test

**Nutrient Data Laboratory**
http://www.nal.usda.gov/fnic/cgi-bin/nut_search.pl
Nutrient database for all foods maintained by the USDA

**AIDA**
http://www.2aida.org/
A sophisticated diabetes software simulator program

The activities in this guide were contributed by Michael DiSpezio, a Massachusetts-based science writer and author of "Critical Thinking Puzzles" and "Awesome Experiments in Light & Sound" (Sterling Publishing Co., NY).

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# Teaching Guide

## Educator Notes

*Activity 3: Grades 5-8*

# Testing for Simple Sugars

ACTIVITIES

- Counting Calories
- The Anti-oxidant effects of Vitamin C
- Testing for Simple Sugars
- Quiz

### QUESTIONS

1. What did the Benedict's solution test for? (the presence of simple reducing sugars)
2. How did the presence of a reducing sugar affect the Benedict's solution? (the Benedict's solution underwent a color change)
3. What color would the Benedict's display if there was no sugar in the solution? (It would remain blue)
4. What color would the Benedict's display if it tested a sugar (sucrose) solution? (the blue color wouldn't change since sucrose isn't a simple reducing sugar)
5. Did these juices contain reducing sugars? How could you tell? (yes - the indicator solution underwent a color change when heated)
6. Which juice underwent the most dramatic color shift? Why? (apple juice - it had the highest concentration of sugar)
7. Which juice underwent the least change in color? Why? (lime juice - it had the lowest concentration of sugar)

### A SWEET MATH CONNECTION

This scale illustrates the relative sweetness of several sugars based upon
sucrose = 100
Lactose (complex sugar) = 16
Galactos (simple sugar) =32
Sucrose (complex sugar) =100
Fructose (simple sugar) =173

Using this scale, answer the following questions:

### QUESTIONS

1. Which is the sweetest of these four sugars? (fructose)
2. How many times sweeter is sucrose than lactose? (6.25 times sweeter)
3. How many grams of fructose would be needed to replace 10 grams of sucrose in order to produce the same sweetness?

(1000/173 = 5.8 grams)

4. Suppose a recipe calls for 5 grams of sucrose to sweeten a dish. How much lactose would be needed if you substituted sugars? (31.25 grams)
5. If a diabetic has a low blood sugar level, that person may drink orange juice. Orange juice contains a high concentration of sugar that is readily used by the body. In contrast, some foods contain sugars that must be broken down before they can be used. These slow-release sugars may offer a diabetic a window in which a compromised insulin response has sufficient time to deal with the slowly rising sugar level. Think about it. Should a diabetic who is suffering from low sugar levels be given a food containing a slow-release sugar? (no) Explain. (The slow release will not offer an immediate source of sugar to patient)

## CURRICULUM LINKS

| |
|---|
| **Chemistry:** |
| Chemical Reactions, Biochemistry, Indicators |
| **Mathematics:** |
| Ratios, Data Analysis |
| **Biology:** |
| Health, Nutrition |

## NATIONAL SCIENCE STANDARDS (Grades 5-8)

| |
|---|
| **Science As Inquiry-Content Standard A** |
| Students should develop abilities necessary to do scientific inquiry, |
| Students should develop an understanding about scientific inquiry |
| **Physical Science -Content Standard B** |
| Students should develop and understanding of the properties and changes of properties in matter |
| Student should develop an understanding about transfer of energy |
| **Life Science -Content Standard C** |
| Student should develop an understanding about structure and function in living systems |
| **Science in Personal and Social Perspectives -Content Standard F** |
| Student should develop an understanding about personal health |

SCIENTIFIC AMERICAN FRONTIERS

# Fat and Happy?

## Teaching Guide

*Activity 4*

## Frontiers Pop Quiz

ACTIVITIES

- Counting Calories
- The Anti-oxidant effects of Vitamin C
- Testing for Simple Sugars
- Quiz

**Dr. Empathy**

1. Name two ways exercise helps people lose weight.

2. According to Dr. Blackburn, dieters should aim to lose a maximum of how much weight per month?

a) 1 Pound
b) 4 Pounds
c) 7 Pounds
d) 10 Pounds

**Obesity Begins at Home**

3. Why do five-year-olds eat more than three-year-olds, according to Leann Birch?

a) They are hungrier
b) They are bigger and need more food
c) They have learned to clean their plates
d) They are greedier

4) Why does Leann Birch think Elizabeth ignores the tray of junk food while Morgan digs in?

**Couch Potato Kids**

5) According to Len Epstein's study, how can TV watching cause weight gain?

a) by increasing eating
b) by decreasing physical activity

c) both (a) and (b)
d) none of the above

6) What happened when kids decreased the amount of time they spent in front of the TV or the computer?

**Eat Less-- Live Longer**

7) What happens to lab mice fed half the calories of normal mice?

a) they lived up to twice as long
b) their blood pressure dropped
c) their cholesterol level dropped
d) all of the above

8) Where did Dr. Walford first study restricted-calorie diets in humans?

**The Desert's Perfect Foods**

9) How are the Arizona Pima and Tohono O'Odham different from their Mexican relatives?

10) Which of the following foods was NOT part of the Tohono O'Odham's traditional diet?

a) tepary beans
b) potatos
c) prickly pear
d) cholla cactus buds

SCIENTIFIC AMERICAN FRONTIERS

# Fat and Happy?

## Teaching Guide

Educator Notes

*Activity 4*

## Frontiers Pop Quiz



### Answers

1) Exercise burns calories. It also builds muscle, which in turn burn more calories than other kinds of body tissues.

2) b

3) c

4) Elizabeth's parents do not restrict her foods, while Morgan's parents are strict about snack foods.

5) c

6) They increased their physical activity by several hours per week

7) d

8) In Bioshpere II

9) The Airzona populations have much higher rates of obesity and diabetes

10) b