

Celebrating Chemistry



Health and Wellness!

National Chemistry Week • October 17–23, 2004
American Chemical Society



Each year the American Chemical Society celebrates National Chemistry Week during October. This year the celebration will take place October 17–23 with the theme “Health and Wellness!”

Staying healthy and well is all about feeling good and being physically able to do the things you want to do. It sounds easy, but it is not always possible. Someone with the sniffles may cough in our direction, or we may fall accidentally and skin our knee. Some things simply cannot be prevented, but there are some simple steps that we can take.

1. Keep Clean—Most common illnesses like colds and the flu are spread by person-to-person contact. To get the flu, you must be in close contact with someone that has the flu. The virus that has invaded their body to make them sick must get into your body before it can make you ill. You can't prevent them from coughing on you, but you can wash your hands and avoid touching your mouth, your nose, or your eyes.

You should wash your hands for at least 20 seconds with soap and water each time that you play outside,

cough or sneeze, play with pets, or go to the bathroom. You should also wash your hands before you eat.

Keeping clean also means brushing your teeth for two minutes at least two times a day. Brushing your teeth will keep your teeth white and your smile bright.

2. Eat Right—Eating the right things will ensure that your body will have all the nutrients it needs to grow healthy and strong. It also helps you to fight off any illnesses or infections. Eating the right things can make a big difference in the way that you look and in the way that you feel.

3. Exercise—Whether you choose to play baseball, go swimming, run around the block, or fly a kite, it is important that you do some exercise every day. Exercising helps you to build a healthy body with strong bones and muscles that will be able to get you where you want to go.

4. Protect Your Skin—Sunscreens help protect our skin from the harmful ultraviolet light from the sun. Using a sunscreen with a rating of SPF 15 or greater is

recommended for any outside activity to guard against sunburn and help prevent skin cancer.

Staying healthy and well is a full-time job, but you are up to the task. Just remember to keep clean, eat right, exercise and use sunscreen to help you stay healthy and well for a lifetime.



“This year’s National Chemistry Week focus on making healthy choices and being active will allow lots of people to live longer, healthier lives. But sometimes, the miracles of science have to step in and help out. By combining the benefits of prevention (eating well, exercising, and of course, not smoking) with the promise of scientific discovery we can ensure a healthier tomorrow for all of us.”

—Vice Admiral Richard H. Carmona, M.D., M.P.H., F.A.C.S.,
Surgeon General, United States of America

Healthy Eating

You may have heard someone say, “You are what you eat.” This does not mean that if you only eat french fries, you will become a french fry. It does mean that if you always eat foods of one sort, it can become a problem. When you were little, you probably did not have too many choices of what foods to eat. As you are growing up, you get to choose more often, especially in places like the school cafeteria or when you are out with your family or friends.

If you look at a nutrition label on a package of any of the foods you eat, you will see the words “carbohydrate”, “fat”, and “protein”. A carbohydrate is a sugar. There are two kinds of carbohydrates: simple sugars (glucose, fructose) and complex sugars, known as polysaccharides (starch and fiber). Your body needs carbohydrates for energy, but many people eat far too

much simple sugar. Soft drinks and candy are loaded with simple sugars that we could do without. Eating an apple or a peach is a better choice for our bodies.

Fats also come in two types: saturated and unsaturated. Saturated fats are solid at room temperature (butter, shortening, coconut oil) and you should not eat much of this kind of fat. Unsaturated fats are liquid at room temperature (olive oil, corn oil, vegetable oil) and are considered better for you. Your body needs a little fat each day, but too much can clog your arteries and cause you to gain weight. As a general rule, you should choose foods that are low in saturated fats.

Proteins are made of amino acids and are important for growth. Hair, skin, muscles, and fingernails are all made of protein. There are many amino acids, but just twenty of them are used to make your body’s proteins.

Nine of the amino acids must come from the foods you eat. Your body can make the other eleven amino acids itself. Chicken, eggs, fish, and dairy products are complete proteins—foods that have all nine amino acids the body needs.

In addition to carbohydrates, fats, and proteins, vitamins and minerals are also essential for a healthy lifestyle. One place you can find them: brightly colored fruits and vegetables. Examples of a few sources of vitamins and minerals are shown in the table “Colorful Fruits and Vegetables—Good for You”.

It is a good idea to eat a variety of foods, especially fruits and vegetables. By eating a varied diet, you are more likely to get the nutrients that you need to stay healthy and well.

Colorful Fruits and Vegetables – Good for You



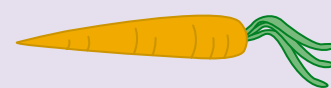
Vitamin

Vitamin	Found in	What it does	If you don't get enough
A	Green and yellow vegetables	Helps you see, helps skin cells grow	Problems seeing at night, flaky skin
K	Cabbage, spinach, leafy green vegetables	Protects blood cells, important for muscles	Weak blood cells and muscles
C	Citrus fruits, tomatoes	Helps fight infection and heal wounds; needed to make collagen found in muscle and bone	Weakness (anemia), cuts that do not heal well



Mineral

Mineral	Found in	What it does	If you don't get enough
Calcium	Spinach	Helps grow strong bones and teeth, important for muscles	Poor bones and teeth
Potassium	Bananas, vegetables	Assists in muscle-building, muscle movement and sending messages through nerves	Muscle and nerve weakness, dry skin



Milli's Safety Tips!

Safety First!



Always:

- Perform the activities with adult supervision.
- Read and follow all directions for the activity.
- Read all warning labels on all materials being used.
- Wear eye protection, specifically splash and impact-resistant goggles.
- Follow safety warnings or precautions, such as wearing aprons and gloves, or tying back long hair.
- Use all materials carefully, following the directions given.
- Be sure to clean up and dispose of materials properly when you are finished with an activity.
- Wash your hands well after every activity.
- **Never** eat or drink while conducting an experiment, and be careful to keep all of the materials used away from your mouth, nose, and eyes!
- **Never** experiment on your own!

For more information on safety go to chemistry.org/ncw and click on "Safety Guidelines".

What on Earth is Diabetes?

Diabetes is a disease that is becoming more and more common. People who have diabetes are not able to use the energy from the foods they eat. Currently, over 18 million people in the United States have diabetes, and that number is growing.

During digestion, the sugars in the food you eat are changed into glucose and other simple sugars. Glucose is the fuel that your body uses to make your muscles and other body parts do work. Once your food is changed into glucose, it passes through the lining of your stomach and small intestine into your bloodstream, but your body won't use it right away. First, your body must be told to use the glucose by a hormone called insulin.

Your pancreas, a small organ located just above your belly button, makes and controls insulin. After you eat and glucose goes into your bloodstream, your pancreas

releases insulin. The insulin causes your body to use the glucose in your blood for energy, and you are able to do all the things that you would like to do. If a person's pancreas doesn't make enough insulin, that person's body cannot properly use the glucose from the food they eat. These people have diabetes.

People with diabetes must watch what they eat very carefully, to make sure that the amount of glucose in their blood does not get too high. From time to time they use a small machine to measure the amount of glucose in their blood. If there is too much glucose, they may have to give themselves a shot of insulin. Others may use an insulin pump, which is a small device that automatically injects insulin into their bloodstream.

There are two types of diabetes: **type 1**, and **type 2**. Type 1 diabetes is rare. It is caused by damage to the

part of the pancreas that makes insulin. Because people with type 1 diabetes do not make any insulin, they must take a shot of it after each meal. Guessing the right amount of insulin can be very tricky. In type 2 diabetes, a person's pancreas still makes insulin, but either it does not make enough, or their body does not respond to the insulin the way that it should. Some people with type 2 diabetes can control their disease by watching what they eat, exercising, and losing weight. Others take one or more daily medications, sometimes including insulin.

There is no cure for diabetes, but many people are trying to find one. Chemists, biologists, molecular engineers, and physicians are all working together to put an end to the disease. But until a cure can be found, the best ways to prevent diabetes are to eat a proper diet and to exercise.

Coloring with Foods

Fruits and vegetables come in many different and beautiful colors. Their colors are caused by pigments. For example, the red color of tomatoes and watermelon is from the pigment lycopene.

For centuries, people have used plants or parts of plants (like berries or bark) to paint their faces, dye their clothes, and color their homes. In this activity, you will rub parts of fruits and vegetables on paper to create a colorful picture.

Materials

- * Colorful fruits and vegetables
- * Sheet of white paper

Procedure

1. Ask your adult partner to help you collect samples of colored fruits and vegetables. Try to find ones that will give different colors: red, orange, yellow, green, and purple. Some examples of vegetables and fruits that contain colorful plant pigments can be found in the table entitled "Common Sources of Colors".
2. Draw a picture on a piece of white paper by rubbing or squishing pieces of the fruits and vegetables onto the paper.
3. Describe what you saw in the "What Did You Observe?" section.
4. Throw the materials used in this activity in the trash. Thoroughly clean the work area and wash your hands.

What Did You Observe?

Fruit or Vegetable Used in Activity	Color
1.	
2.	
3.	
4.	
5.	
6.	
7.	



Be sure to follow Milli's Safety Tips and do this activity with an adult! Do not eat any of the materials used in this activity.

Common Sources of Colors

Color	Fruit/Vegetable
Red	Radish
Orange	Carrot
Yellow	Orange Peel
Green	Spinach
Purple	Purple Cabbage



Where's the Chemistry?

Plants contain many different pigments for a variety of reasons. For instance, the green pigment chlorophyll harvests the sun's energy. Other pigments may be used to attract the insects or animals that pollinate flowers or help spread seeds.

Plant pigments can also have health benefits for us. Beta-carotene is the orange pigment in carrots. Like lycopene from tomatoes, it is an antioxidant that helps to prevent certain kinds of cancer. Beta-carotene is also changed by our livers into vitamin A, which prevents night blindness and fights infection. Keeping a variety of colored fruits and vegetables in our diets is a very good way of making sure that we get the vitamins and nutrients that we need to stay healthy.

Sweet Measurements

Many of the foods that we eat today are filled with sugars like fructose, sucrose or glucose. Sugars taste very sweet, but we eat far too much of them. Sugar added to candies and sodas provides calories without many essential nutrients. In this activity, you will get a chance to see just how much sugar is in a soda. You may be surprised.

Materials

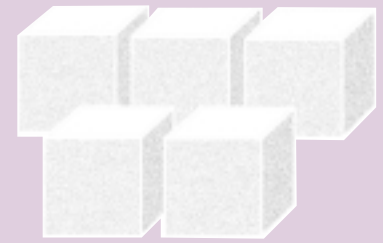
- * Empty soda bottle or can with a "Nutrition Facts" label (8 or 12 oz., not diet soda)
- * Kitchen or postal balance with a gram scale
- * Box of sugar cubes
- * Tongs
- * Calculator (optional)

ADAPTATION You may substitute packets of sugar for sugar cubes. The measurement will be slightly off, but the lesson will remain intact.

SAFETY! Be sure to follow Milli's Safety Tips and do this activity with an adult! Do not eat any of the materials in this activity.

Procedure

1. Guess how many sugar cubes would be equal to the sugar in a bottle of soda. Write your guess in the space provided in the "What Did You Observe?" section.
2. Read the "Nutrition Facts" label on the soda bottle to see the number of servings in the bottle. Write the number in the "What Did You Observe?" section.
3. Read the "Nutrition Facts" label on the soda bottle to see how many grams (g) of sugar are in 1 serving of soda. Write the number in the "What Did You Observe?" section.
4. Multiply the number of grams of sugar in one serving by the number of servings to find the number of grams of sugar in the bottle. Write your answer in the "What Did You Observe?" section.
5. Place the balance on a sturdy table or desk.
6. Use the tongs to add sugar cubes to the weighing pan of the balance one by one. Watch the scale on the balance, and keep adding sugar cubes until the reading on the balance is equal to the number of grams of sugar in the bottle of soda.
7. Count the number of sugar cubes in the weighing pan and write your answer in the "What Did You Observe?" section. Compare this number to the guess you made at the beginning of the activity.
8. Thoroughly clean the work area and wash your hands.



Try this...

Repeat this experiment to find the amount of sugar in other beverages, or in foods like ice cream or a candy bar.

Where's the Chemistry?

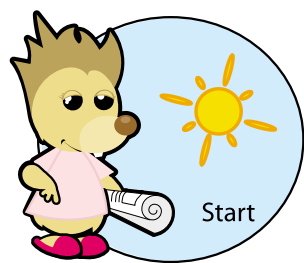
We have many food choices today, and most of them contain sugars. Naturally occurring sugars, like those in fruits, are better for you than the processed sugars and syrups found in candy and soda. You can find out how much sugar a product contains by reading the "Nutrition Facts" label on the item. You may also recognize the names of many different sugars by looking at the list of ingredients. The names of most sugars end in -ose. Commonly added sugars are sucrose, fructose and glucose. The name of the sugar found in milk is lactose. Look at the nutrition labels on some of your favorite foods. Can you find the names of any sugars? Can you find any sugars other than those named above?

What Did You Observe?

Before you begin:	Count:
How many sugar cubes do you think are in a bottle of soda? _____	Number of sugar cubes in the weighing pan: _____
From the label:	Report:
Number of servings in bottle: _____	Which was greater, the number of sugar cubes that you thought would be in the bottle of soda, or the number of sugar cubes that you weighed on the balance?
Grams of sugar in one serving of soda: _____ g	
Calculate:	
Number of grams of sugar in the bottle: _____ g	
(Hint: number of servings in bottle x grams of sugar in a serving = grams of sugar in the bottle)	

Healthy Choices Maze

Help Milli make healthy choices as she makes it through her day.





The Adventures of Meg A. Mole, Future Chemist

In honor of National Chemistry Week, and celebrating health and wellness, I got to travel all the way to Indiana to meet Dr. Helen Free! Dr. Free works for Bayer HealthCare, Diagnostics Division, Self-Testing Segment. I had no idea what self-testing meant, but I was really looking forward to finding out!

Dr. Free is an inventor! She has been a chemist for over 60 years. In those years she has invented many products used by doctors' offices and hospitals to test urine and blood for diseases. Self-testing, or testing yourself, is very important for people who have diseases. People with diabetes or kidney problems depend on these tests to let them know how their organs are working.

Two of the self-tests at Bayer are Clinistix and Multistix. Clinistix let you know how much glucose (sugar) is in your urine! The Multistix strips test for ten different things in your urine including glucose, protein, blood, and other physical characteristics. The scientific name for the chemical compounds you are testing for is "analytes."

One other test she showed me was called "Breeze." It was a small tear-drop shaped instrument that takes a drop of blood and tests it for glucose. It times the test by itself and tells you the amount of glucose in the blood when the test is done!

Dr. Free used to work in a laboratory, but now has an office and computer. She spends a lot of her time talking

to children in schools. She wants to let them know what the signs of diabetes are: being hungry all the time but losing weight, being thirsty all of the time and going to the bathroom often. She tells children about what we can do to prevent diabetes and other bad medical conditions. We must eat healthy foods to keep us from getting overweight, or "obese" as doctors say. We must also exercise by playing active games instead of watching too much TV. Type 2 diabetes used to be found mostly in adults, but is becoming more common in children and young adults because of the increase in obesity in our age group. Dr. Free told me a story about when she gave a talk on the "signs of diabetes" to a girls' science camp. A little girl from the camp told her

mother that she had the signs of diabetes. She had remembered the signs from the talk and because of this, her mother took her to the doctor. The doctor tested her blood sugar and found out that it was indeed very high. The little girl helped to diagnose her diabetes just from listening to Dr. Free's talk!

Before I left, I asked Dr. Free what made her want to go into science. She said she originally wanted to be an English teacher but changed to chemistry while in college because it was "fun and exciting." She has made such significant contributions to our field and has even been inducted into the National Inventors Hall of Fame. Her decision to become a chemist has helped millions of people and I'm proud that she's an outstanding member and volunteer of the American Chemical Society.



Personal Profile: Dr. Helen Free

What is your favorite food? Japanese food

What is your favorite color? Red

What is your birthday? February 20

What is your favorite pastime? Traveling to other countries. I have been to more than 31 different countries.

About your family: I have a wonderful large family and we often have family reunions. I have 6 children, 3 stepchildren, 15 grandchildren and 3 great-grandchildren!

Were you interested in science when you were growing up? Yes, I was interested in all school subjects when I was growing up. I always asked WHY did this happen, WHAT causes this, or HOW else could you do that?

What do you like about your job? All the different things I get to do. The joy of figuring out how to solve problems in the lab and how to design experiments to answer specific questions that would help people who had different diseases.

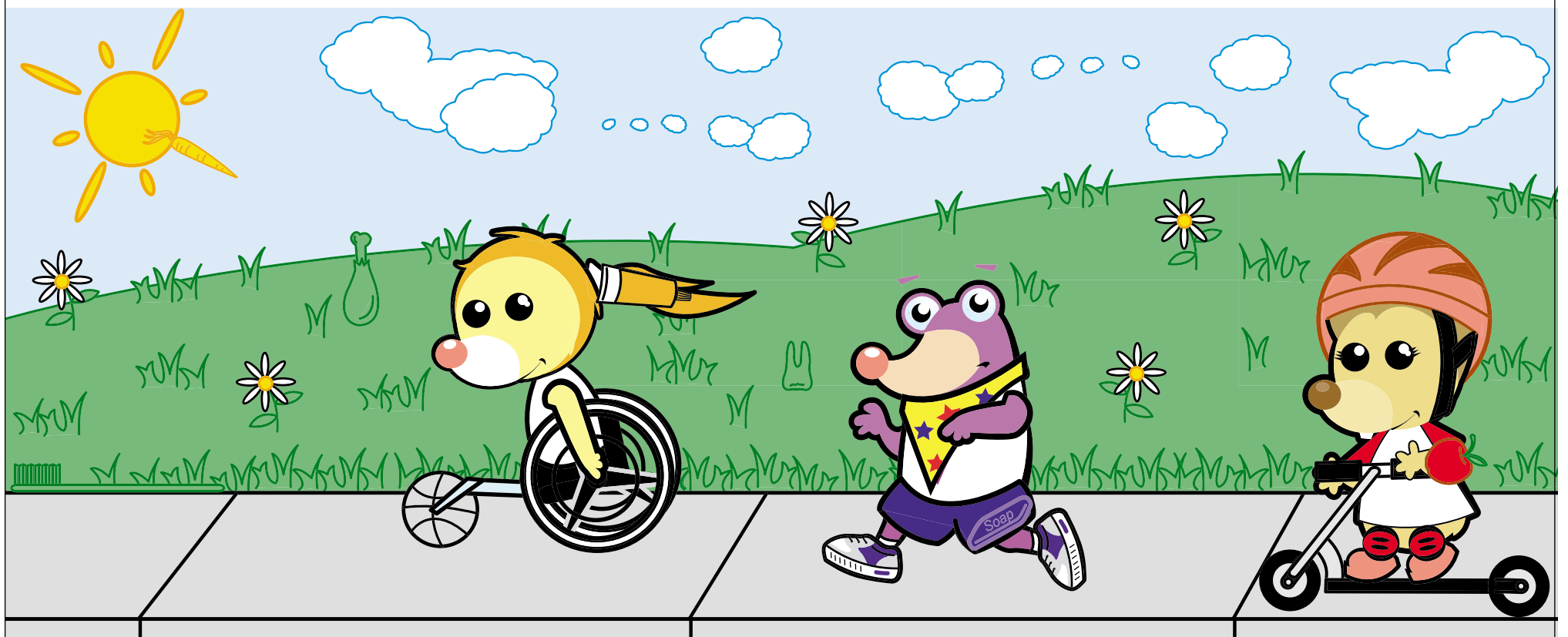
Hidden Objects Check off each object as you find it!

- Apple
- Carrot

- Chicken drumstick
- Toothbrush

- Toothpaste
- Tooth

- Basketball
- Bar of Soap



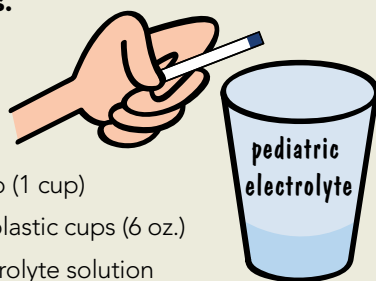
Answers on page 12.

Urine the Know

Urine can tell you a lot about a person's health. If a person's urine contains too much glucose, it could mean that they have diabetes. If it contains protein, it could mean that something is wrong with their kidneys. Urine testing, or urinalysis, is a quick way to see if certain chemicals are present in urine. In this activity, you will compare water with artificial urine to see how urinalysis works.

Materials

- * Marking pen
- * Distilled water
- * Measuring cup (1 cup)
- * 4 disposable plastic cups (6 oz.)
- * Pediatric electrolyte solution
- * Powdered milk
- * Measuring spoon (1/4 teaspoon)
- * 2 disposable plastic spoons
- * 4 glucose test urinalysis strips (available at your local pharmacy) *
- * Paper towel
- * 4 multiple test urinalysis strips (available at your local pharmacy) †



NOTE: Powdered egg whites can be substituted for powdered milk. Tall, narrow cups are better than short, wide cups for this activity. If only glucose test strips are available, just the top row of the data table is relevant.

ADAPTATION A magnifying glass may make the test pads and comparison charts easier to see. Wooden craft sticks can be taped to the test strips to make them easier to hold.

SAFETY! Be sure to follow Milli's Safety Tips and do this activity with an adult! Do not test your own urine, or that of someone else. Do not eat or drink any of the materials in this activity.

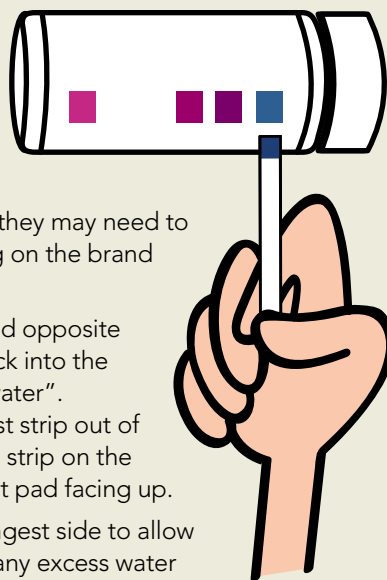
Procedure

Test Sample Preparation

1. Label one cup "distilled water", the second cup "pediatric electrolyte", the third cup "water + milk" and the last cup "pediatric electrolyte + milk".
2. Pour 1/2 cup distilled water in the cups labeled "distilled water" and "water + milk".
3. Pour 1/2 cup pediatric electrolyte solution in the cups labeled "pediatric electrolyte" and "pediatric electrolyte + milk".
4. Add 1/4 teaspoon powdered milk to the cups labeled "water + milk", and "pediatric electrolyte + milk". Using a different spoon for each, stir the mixtures until the powdered milk dissolves.

Glucose testing

5. Read the instructions for the glucose test urinalysis strips that you are using in this activity. General instructions are given in the next few steps, but they may need to be modified depending on the brand of strips you use. *
6. Hold the strip by the end opposite the felt pad. Dip the stick into the cup labeled "distilled water". Immediately pull the test strip out of the water and place the strip on the paper towel with the felt pad facing up.
7. Tilt the strip onto its longest side to allow the paper towel to dry any excess water remaining on the strip.
8. Watch the color of the felt pad to see if it changes. Compare the color on the pad with the chart on the side of the bottle for the glucose test urinalysis strips. If the color stays pink, then there is no glucose in the solution. If the felt pad turned purple, then glucose is present.
9. Record whether glucose is present in the solution by circling "Yes" or "No" in the "Glucose Test Urinalysis Strip Results" table in the "What Did You Observe?" section.
10. Repeat steps 6–9 with new test strips for the other three solutions, and record your results in the "Glucose Test Urinalysis Strip Results" table in the "What Did You Observe?" section.



Protein testing

11. Read the instructions for the multiple test urinalysis strips that you are using in this activity. General instructions are given in the next few steps, but they may need to be modified depending on the brand of strips you use. †
12. Hold the strip by the end opposite the felt pads. Dip the stick into the cup labeled "distilled water". Make sure that all the pads on the strip are wet, and immediately pull the test strip out of the water and place the strip on the paper towel with the felt pads facing up.
13. Tilt the strip onto its longest side to allow the paper towel to dry any excess water remaining on the strip.
14. Watch the colors of the felt pads to see if they change. Compare the color on the pad for the protein test with the chart on the side of the bottle for the multiple test urinalysis strips. Because the multiple test urinalysis strips have many different pads for many different tests, you will need to check the chart on the side of the bottle to see which pad shows the results for protein.
15. Record whether protein was present in the solution by circling "Yes" or "No" in the "Multiple Test Urinalysis Strip Results" table in the "What Did You Observe?" section.
16. Repeat steps 12–15 with new test strips for the other three solutions, and record your results in the "Multiple Test Urinalysis Strip Results" table in the "What Did You Observe?" section.
17. Pour all the liquids down the drain and throw away the rest of the materials. Thoroughly clean the work area and wash your hands.

Where's the Chemistry?

The urinalysis test strips that you used in this activity use a mixture of several different chemicals that react with each other to change the color of the felt pad when glucose or protein is present. Because the test looks at how much the color changes, it is called a "colorimetric" test. Colorimetric is a compound word, with the first part being "color", and the root of second part being "meter". Together, the word means color meter. Can you think of any other colorimetric tests around your home?

* Many brands of glucose test strips are available through your pharmacy, and all should work well in this experiment. Clinistix from Bayer HealthCare, Diagnostics Division were used in the preparation of this activity. The use of the Clinistix brand in this activity does not imply an endorsement of the product by the American Chemical Society.

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What Did You Observe?

Circle "Yes" or "No" for each of the following.

Glucose Test Urinalysis Strip Results:
Is Glucose Present?

Distilled Water	Pediatric Electrolyte	Water + Milk	Pediatric Electrolyte + Milk
Yes / No	Yes / No	Yes / No	Yes / No

Multiple Test Urinalysis Strip Results:
Is Protein Present?

Distilled Water	Pediatric Electrolyte	Water + Milk	Pediatric Electrolyte + Milk
Yes / No	Yes / No	Yes / No	Yes / No

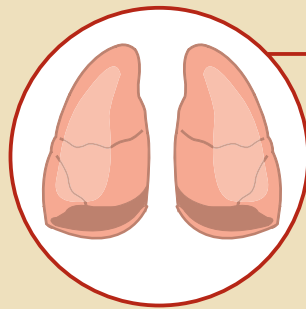
Body Works

Nose—Your nose plays a key role in your sense of taste. You may remember that the last time you had a cold, nothing tasted quite right. That was because your nose was all stopped up. When you eat, vapors from your food float up through the back of your throat and into your nose. Then your nose reports what it smells to your brain. Your brain must have information from both the taste buds on your tongue and the sensors in your nose to tell how something really tastes.



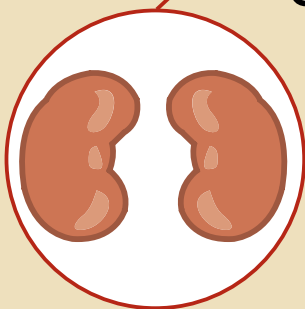
Lungs—Your lungs inhale (breathe in) and exhale (breathe out) about 12 to 20 times a minute when you are at rest. Each time you inhale fresh air into your lungs, the blood in your circulatory system picks up oxygen and drops off carbon dioxide. The carbon dioxide is pushed out of your lungs when you exhale.

Blood that is loaded with oxygen is bright red. The iron in your blood holds onto the oxygen until it can be delivered to your muscles or another part of your body that needs it. After delivering oxygen and picking up carbon dioxide to take back to your lungs, your blood turns blue. When you skin your knee or bleed for some other reason, the blood that comes out is red because it comes into contact with the oxygen in air outside of your body.

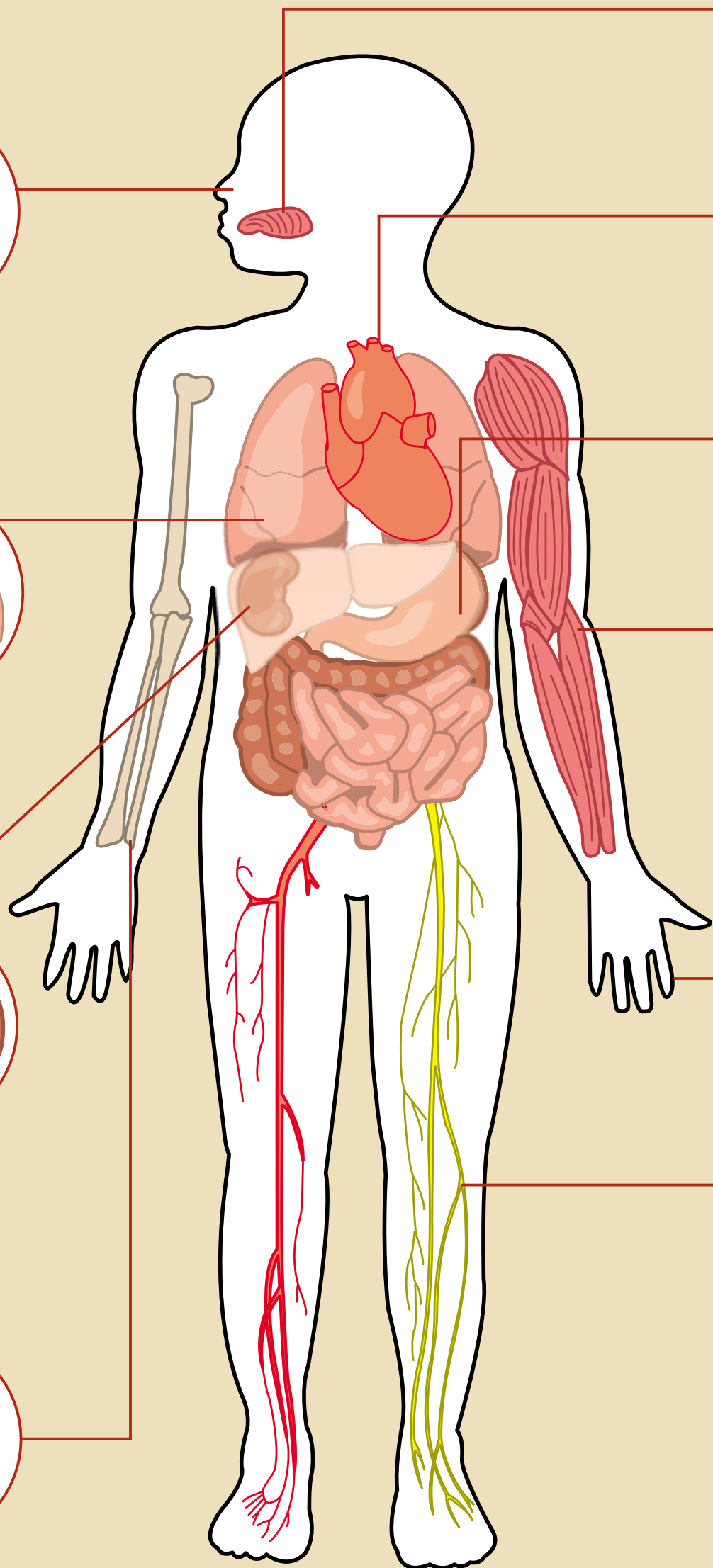
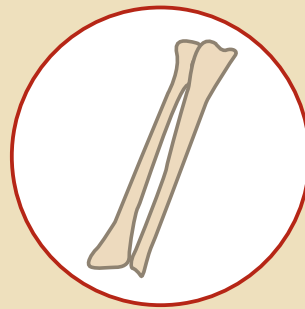


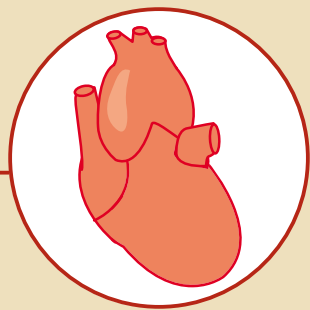
Kidneys—Most of us have two kidneys that help to clean waste products from our blood. The wastes that they pick up combine with any extra water in your body to make urine. On a typical day, your kidneys will clean over 160 liters (42 gallons) of blood, and produce about one liter (2 pints) of urine.

If your kidneys stop working, you can get sick very quickly because wastes get trapped in your bloodstream. The only sure way to make you well would be to get your kidneys working again, or to transplant a kidney from someone else. If it were to take a while for your kidneys to heal, or if a donor kidney was not available, you might be connected to an artificial kidney machine for a short time.



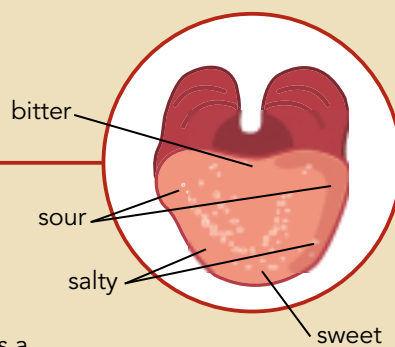
Bones—Your bones are the framework within your skin. They hold you up and provide protection for your inner parts. When you are born you have about 300 bones, but by the time you become an adult you will only have 206. Don't worry! They won't go away—they'll just fuse (join) together to make bigger bones.



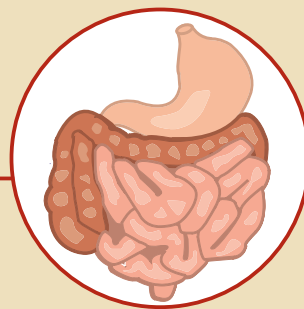


Heart—Your heart is the centerpiece of your circulatory system. It pumps about 100,000 times a day to keep your blood flowing through the tips of your fingers, your toes and your nose. It is connected to the parts of your body through nearly 97,000 km (60,000 miles) of blood vessels.

Foods that are high in fats, especially saturated fats, tend to clog your blood vessels. At your age, you probably don't notice the difference, but by the time that you're an adult it could lead to serious problems. So next time, pass on fat and eat more fruits and vegetables instead.

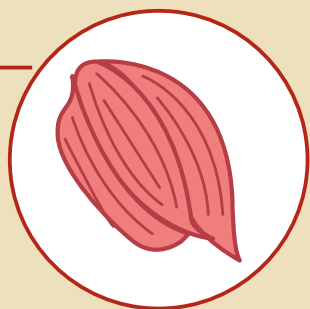


Tongue—Your tongue is lined with taste buds that are connected to nerves that attach to your brain. When you eat an orange, the juice covers your tongue and your taste buds go to work. Taste buds can tell the difference between four different types of tastes: bitter, sour, salty, and sweet. The taste buds that sense bitter things are located on the back part of your tongue, while the ones that taste sour things are on its sides. The taste buds for salty and sweet things are at the front of your tongue. All in all, you have about 9,000 bumpy little taste buds on your tongue.

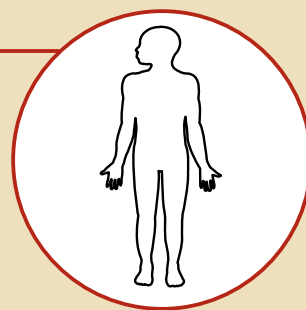


Stomach and Intestines—Although digestion starts in your mouth with enzymes in your saliva, most of the work gets done in your stomach and intestines. On average, people eat a little less than one and a half kilograms (3 pounds) of food a day. After you swallow, food enters your stomach, where it is bathed in acids so strong that they could burn a hole in your carpet. But no need to worry: the lining of your stomach is protected by a thick layer of gooey mucus. After about six hours of churning and turning, some sugars, salt, and water soak through the walls of your stomach and into your bloodstream. The rest is squirted into your small intestine where the remaining nutrients are removed. Anything left over is dumped into the large intestine, where thousands of good bacteria break it down even further so that it can exit safely from your body.

A lot of chemistry goes on in your digestive system. Your food is broken down into proteins, carbohydrates, and fats, which are then broken down further into even smaller and simpler chemicals that can be absorbed into your bloodstream for delivery to all the parts of your body.

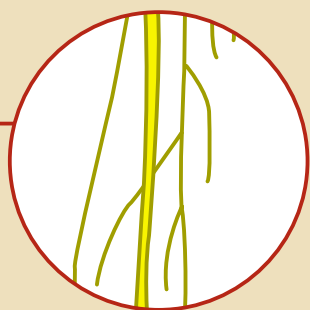


Muscles—Your muscles get you where you want to go. They are the meat on your bones and account for much of your outward appearance. They also heat you up. Most of the heat that your body makes comes from the contractions of muscles.



Skin—Your skin is your largest and one of your most important organs. It covers your body, keeping your insides in and keeping everything else out. It is loaded with nerve endings that sense heat, cold, and pain allowing you to keep in touch with the world around you. It also has sweat glands that cool you when you're hot, and a layer of fat that insulates you when you're not.

Your skin takes a beating when you're in the sun, so use sunscreen to keep it healthy. You should remember to always put on some sunscreen, slip on a long-sleeved shirt, and wear a hat to prevent damage to your skin.



Nerves—Your body is wired with thousands of nerves that let your brain know all the things your body parts are doing. Nerves also let your brain send messages to different areas of your body, so that you can walk, talk, and wiggle your fingers. When nerves are damaged, messages from the brain get lost, and some parts of the body may stop working the way they should.

Signals travel through your nerves at about 250 miles per hour. That's faster than the speediest car in the Indianapolis 500. Many things can slow down or stop signals from your brain to the parts of your body, but one of the most common causes is illegal drug use. Drugs like crystal, crack, and ice can block messages traveling through your nerves and cause permanent damage to your brain.

Chemical Elements in the Human Body

aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, bromine, cadmium, calcium, carbon, cesium, chlorine, chromium, cobalt, copper, fluorine, gold, hydrogen, iodine, iron, lithium, magnesium, manganese, mercury, molybdenum, nickel, niobium, nitrogen, oxygen, phosphorus, potassium, radium, rubidium, selenium, silver, sodium, strontium, sulfur, tellurium, tin, titanium, uranium, vanadium, zinc, and zirconium

Glitter Slime

Our bodies defend themselves in many different ways to prevent us from getting sick. One way our noses keep allergens like pollen, spores, and dust out of our lungs is with a sticky, slimy substance called mucus. When you breathe air in through your nose, allergens like pollen and dust get stuck in the mucus and become trapped. In this activity, you will make a slimy substance very similar to mucus, and sprinkle it with glitter to imitate the way that allergens are trapped.

Materials

- ★ Measuring spoons (1/2 teaspoon and teaspoon)
- ★ Zip-closing bag (snack size)
- ★ Water
- ★ Clear gel glue
- ★ Food coloring
- ★ Measuring cup (1/4 cup)
- ★ Marking pen
- ★ Disposable plastic cup (3 oz.)
- ★ Disposable plastic spoon
- ★ Borax
- ★ Glitter
- ★ Metric ruler

NOTE: It is possible to eliminate the potential for a glitter spill by purchasing clear gel glue with glitter already in it. Using squeeze bottles of food coloring reduces the potential for a mess.

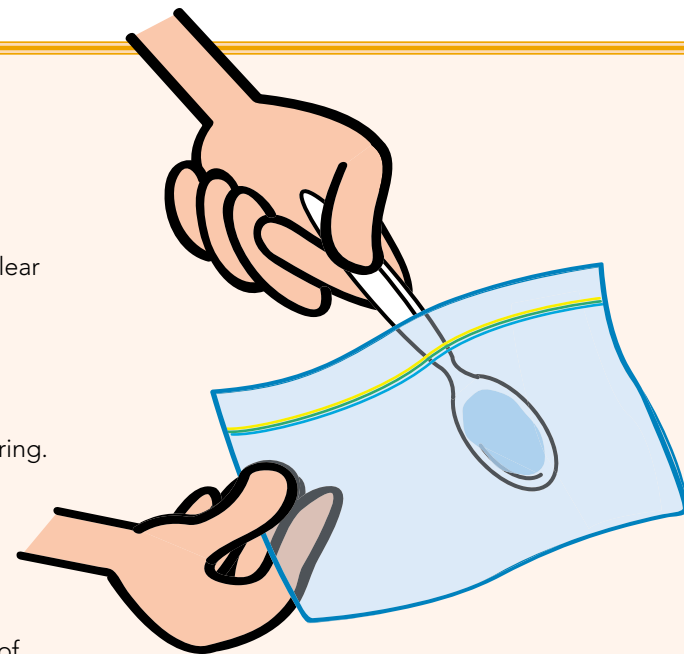
ADAPTATION Substitute 1 tablespoon Styrofoam beads or craft beads for the glitter to create a greater tactile difference between the slime and what has been added.

SAFETY! Be sure to follow Milli's Safety Tips and do this activity with an adult! Do not eat or drink any of the materials in this activity.

Procedure

Making Slime

1. Pour 2 teaspoons of water and 1 teaspoon of clear gel glue into a zip-closing bag.
2. Seal the bag completely. Squeeze the bag between your fingers until the contents are thoroughly mixed.
3. Open the bag and add two drops of food coloring.
4. Repeat step 2.
5. Use the marking pen to label the cup "borax solution".
6. Pour 1/4 cup of water into the plastic cup.
7. Make a borax solution by adding 1/2 teaspoon of borax to the water in the cup and stirring with the plastic spoon until most of the borax dissolves.
8. Open the zip-closing bag and add 1 teaspoon of the borax solution to the glue mixture.
9. Repeat step 2.
10. Open the bag and remove the slime. How does it feel? Roll the slime into a ball and measure the distance in centimeters (or inches) from one side of the ball to the other (width). Write your answers in the "What Did You Observe?" section.
11. Stretch your ball of slime as far as you can and measure its length in centimeters (or inches). Write your answer in the "What Did You Observe?" section.

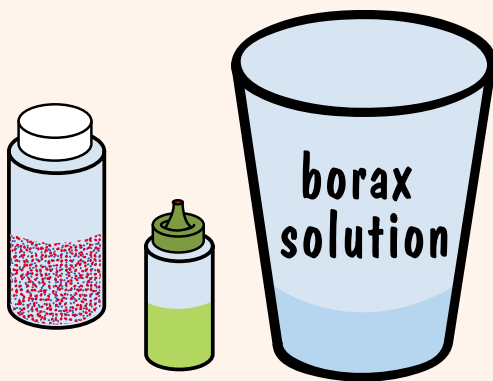


Trapping "Allergens"

(NOTE: First two steps are not necessary if glitter glue was used.)

1. Put all of the slime back in the zip-closing bag and add 1/4 teaspoon of glitter.
2. Repeat step 2 from the section above.
3. Open the bag. Remove and examine the contents. Does the glitter stick to the slime? Write your answer in the "What Did You Observe?" section.
4. Pour any extra borax solution down the drain, and throw away the rest of the materials. Do not try to pour the slime down the drain. Throw it in the trash instead. Thoroughly clean the work area and wash your hands.

NOTE: Glitter slime should be stored in an airtight container to prevent it from hardening. Hardened glitter slime can be washed out of clothing or carpet with warm soapy water.



What Did You Observe?

Describe how the slime feels:

Width of ball of slime _____ cm

Length of stretched slime _____ cm

Does the glitter stick to the slime? _____

Where's the Chemistry?

The glue and water mixture contains long chains of a polymer called polyvinyl acetate. When you add the borax solution, it links the long polymer chains together, changing the liquid into a slimy glob. When you add the glitter to the slime, it stays there and does not easily come back out.

The slime is like mucus that we find in our bodies. Our natural mucus contains sugars and proteins, which are also polymers. Mucus protects many other parts of your body. The inside of your stomach is completely coated with it. If there were no mucus to protect your stomach, the powerful acids used to digest your food would digest your stomach too.

Playing it Safe

Playing sports and exercising are important ways to burn calories, work on coordination, and make friends. Exercise keeps us healthy and makes our bones and muscles strong.

Some sports like football, baseball, and soccer require special equipment to keep safe. The helmets and pads used in these sports are made of plastic. The plastic is tough, but probably not as hard as you think. Instead of cracking, splitting, or breaking like your bones might, these pads bend slightly, taking some of the punch out of a defensive block.

The protective gear used in rollerblading and bicycling is a lot like the equipment used in football and soccer, except that the helmets are lined with Styrofoam. Styrofoam is even softer than plastic, so it can do a better job of protecting your head in a crash. When Styrofoam is being made, chemists bubble carbon dioxide through the foam so that it will be filled with thousands of tiny little pockets of gas. These pockets can be squished flat, but they bounce right back to give you a soft landing.

Sports like jogging, running, and hiking can be very hot, and your body can overheat. New materials like CoolMax help keep you dry and cool on a hot summer day by wicking away moisture from your skin where it can evaporate. Gore-Tex is used to keep you dry as you stomp through mountain creeks and weather through rainstorms: it keeps water out while letting your skin breathe, so you won't get soaked by either the rain or your sweat.

Chemists are always working on new materials. Each year, track shoes get lighter, protective gear gets stronger, and we get safer because someone invented a better way to protect you and me.

The Nose Knows!

Your heart pumps blood throughout your body. As your blood flows through your lungs, it picks up oxygen, and as it flows past your stomach and intestines, it picks up nutrients. Blood travels through a system of tubes called blood vessels. There are two main types of blood vessels: arteries and veins. The smallest ones, called capillaries, are very thin like a layer of plastic wrap, or the walls of a rubber balloon. In this activity, you will test how flavoring extracts move through the walls of a balloon similar to the way that oxygen and nutrients move through the walls of your capillaries to feed your body.

Materials

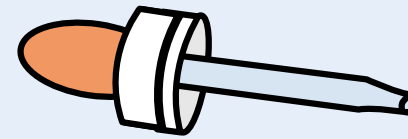
- * 3 small rubber balloons (same size)
- * Permanent marking pen
- * 3 disposable plastic cups (3 oz.)
- * 3 droppers
- * 3 different flavoring extracts (vanilla, peppermint, and orange extracts work well)
- * Balloon pump (optional)
- * Blunt-end scissors for adult partner (optional)

ADAPTATION A balloon pump can be used to inflate the balloons. Visually impaired people may use balloons of various shapes or small pieces of masking tape to mark the balloons.

SAFETY! Be sure to follow Milli's Safety Tips and do this activity with an adult! Do not eat or drink any of the materials used in this activity.

Procedure

1. Look closely at the three balloons that you will use in this activity to make sure that they do not have any visible holes in them.
2. Use the marking pen to write "1" on one of your balloons.
3. Repeat steps 1 and 2, labeling the second balloon "2", and the third balloon "3".
4. Label three plastic cups "1", "2" and "3" as you did for the balloons, and place a dropper in each one.
5. Have your adult partner pour a small amount of a different flavoring extract into each of the cups that you just labeled. Your adult partner should make a note of which extract is which, but should not share the list with you.
6. Use the dropper to place 10 drops of the extract in cup "1" into balloon "1". Be sure to place the tip of the dropper as far into the balloon as possible before you squeeze the dropper bulb so the extract does not get into the neck of the balloon. Be careful not to get the extract on your hands. If you do, wash your hands before going on to the next step.
7. After making sure that there is no extract solution on the lip or neck of the balloon, blow it up, tie a knot in the neck, and shake it a few times.
8. Repeat steps 6 and 7 for extracts "2" and "3". Blow each balloon up to about the same size.
9. Try to smell the extract inside balloon 1 by holding the balloon about 30 cm (1 foot) in front of your face in one hand, and using your other hand to fan the air around the balloon towards you. Slowly move the balloon towards your nose until you begin to smell the extract. Record the odor you smell in the column labeled "Odor Detected" in the "What Did You Observe?" section.
10. Repeat step 9 for balloons 2 and 3.
11. When you have finished recording the scents in the column labeled "Odor Detected", ask your adult partner to tell you the names of the extracts used in each numbered balloon and write them in the "Extract" column of the table in the "What Did You Observe?" section. Were your observations correct?
12. One-by-one hold each balloon over a sink, and ask your adult partner to cut the knot off of the balloon to drain its contents. Pour any excess extracts down the drain, and throw away the deflated balloons and any trash. Thoroughly clean the work area and wash your hands.



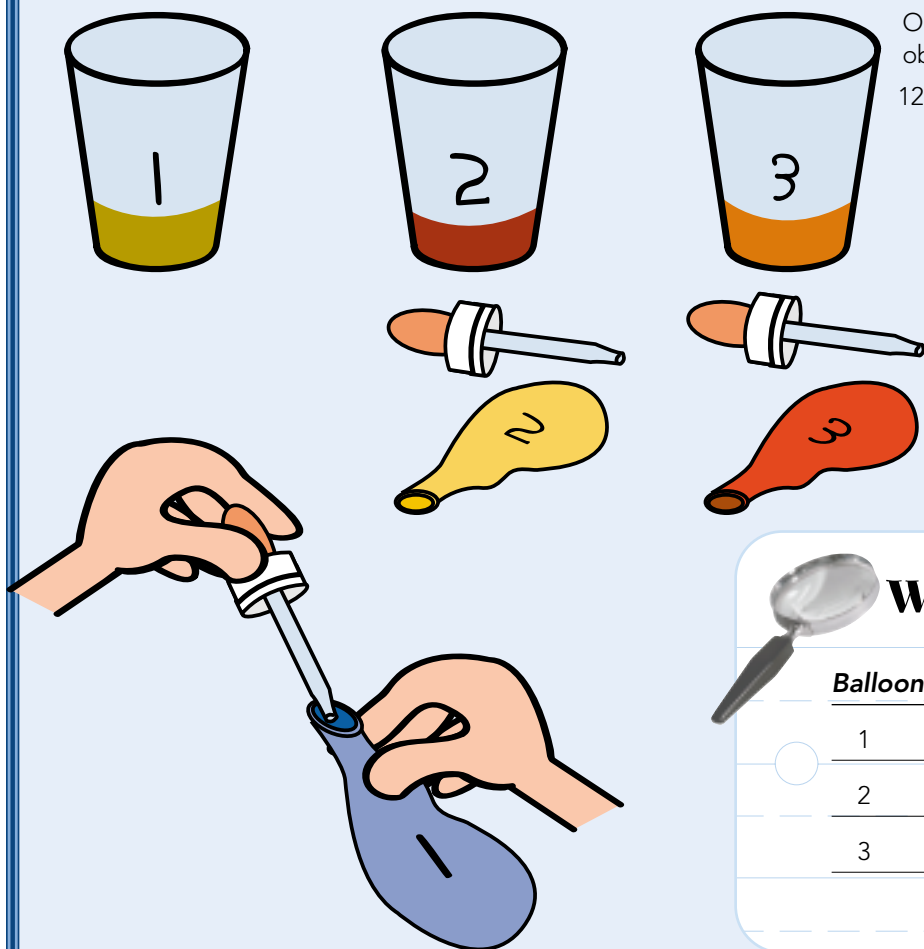
Try this...

Compare natural and artificial vanilla flavorings to see if you can tell a difference. Try inserting cloves or pieces of garlic, nutmeg or onion inside balloons to see if their scents will pass through the rubber membrane of the balloon. Try substituting snack-size zip-closing plastic bags for the balloons.

Where's the Chemistry?

At the beginning of this activity, you checked each of the balloons for any holes, and found none. But somehow, the extracts made it out of the balloons and to your nose. To us, the rubber wall of the balloon looked solid and without any holes, but it actually had many. They were just too small for us to see. The scents of the flavoring extracts passed through these very small holes to make it to the outside of the balloon.

The walls of our capillaries also have holes that are too small for us to see. The holes allow oxygen and nutrients to pass through the capillary wall to feed our muscles and other body parts. They also let wastes, like carbon dioxide back in, so that they can be carried away.



What Did You Observe?

Balloon	Odor Detected	Name of Flavoring Extract
1		
2		
3		

Safe in the Sun

In addition to the rays of light that we can see, sunlight also has ultraviolet or UV rays. These UV rays harm our skin. If we stay in the sun too long without sunscreen or protective clothing, the UV rays will cause sunburn, or even worse, may lead to skin cancer. In this activity, you will use a special plastic card that has been painted with a chemical that changes color when it is in UV light. The more UV rays there are, the darker the painted portion on the card will turn.

Materials

- * PULS card (or other UV indicator card)
- * Letter-size envelope
- * Zip-closing bag (snack size)
- * Watch with second hand
- * Clear spray-on sunscreen (SPF 30 or greater)
- * Paper towel



NOTE: This activity should be done outside. Windows often have special coatings that filter out UV rays.



A magnifying glass may be helpful to read small print.



Be sure to follow Milli's Safety Tips and do this activity with an adult! **DO NOT LOOK AT THE SUN!**

PERMANENT EYE DAMAGE WILL RESULT!

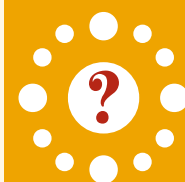
Procedure

1. Before going outside, place the PULS card inside an envelope to keep it out of the sunlight.
2. Find a sunny spot where the card can be placed in the sunlight. Be careful to avoid shadows from buildings or trees.
3. Using terms like "partly cloudy", "raining", or "sunny" describe the weather in the "What Did You Observe?" section.
4. Remove the PULS card from the envelope and place it in a zip-closing bag.
5. Hold the bag with the card (face up) in the sun for 20 seconds.
6. Look closely at the color-changing portion of the card and compare it with the "Level of Sun Exposure" section. Pick the block color from the scale that most closely matches the color-changing portion of the card. Read the word below the color block (minimum, low, moderate, high or critical), and record it in the "What Did You Observe?" section.
7. Take the card out of the plastic and place it back into the envelope so that it is out of the sunlight for at least 3 minutes.
8. While you are waiting, spray the outside of the zip-closing bag with sunscreen. Be careful to make an even coating. If the sunscreen does not spray on clear, you will need to spray it on and wipe away the excess with a paper towel.
9. Write the SPF rating for the sunscreen in the "What Did You Observe?" section.
10. After three minutes have passed, open the zip-closing bag, and place the PULS card inside.
11. Repeat steps 5 and 6 recording your results in the "What Did You Observe?" section.
12. Throw the plastic bag in the trash, but keep the card and the sunscreen for future use. Thoroughly clean your work area and wash your hands.



Try this...

Try the activity again on a different day when the weather is different, or try a sunscreen with a different SPF number.



Where's the Chemistry?

Sunscreens protect our skin from harmful UV rays. We can have some idea of how well they will work based on the SPF number indicated on the bottle. The higher the SPF, or Sun Protection Factor, the stronger the sunscreen. The American Academy of Dermatology recommends that everyone use sunscreen with SPF 15 or higher whenever working or playing outside.



What Did You Observe?

Describe the weather. (partly cloudy, sunny, raining?)

SPF of sunscreen _____

	Reading on PULS Card
PULS Card in bag	
PULS Card in bag with sunscreen	

Word Find

Find each of the following words. They can be forward, backward, up, down, diagonal, or straight. (Answers on page 12.)

- | | |
|-----------|------------|
| CALCIUM | NUTRITION |
| DENTIST | PANCREAS |
| DIABETES | PIGMENTS |
| DIFFUSION | POLYMER |
| EXERCISE | PROTEIN |
| FRUITS | SUGAR |
| HEALTH | SUNSCREEN |
| KIDNEY | URINALYSIS |
| MEG | VEGETABLES |
| MILLI | WELLNESS |

N G N O I S U F F I D D V F F C V N T I
 V O J W U H A V Q N M R E M Y L O P S M
 E L I G E N E P G Y I E G O C T P E I W
 W G A T K L I A T E O E E G F R U I T S
 U R N K I G L M L C M O T N H Q Y O N S
 V R N Z M R U N S T K R A O L L F A E P
 W L I E L I T U E T H D B U R Z M T D A
 Z I N N C S N U J S J A L H R P E K B N
 X T F L A S R D N O S G E S Z B A I Y C
 S M A B C L F N W W U O S O A L H D M R
 Y C E R O M Y V H I Y V N I S M Z N S E
 U B E G I C Z S C D R A D H F U C E J A
 J E M E X E R C I S E I L L I M V Y R S
 N X R C X Q N L F S T D D Z C L L M R Y
 I X N H F Y N C H D X M W S P E V X A K



Dental Damage

Each day, your teeth are attacked by millions of bacteria. They form a clear coating on your teeth called plaque. When you eat, they eat too, gobbling up sugar and making acids that burn holes in your teeth. You can taste the acid that bacteria make about an hour after you have eaten something sweet. The acid tastes sour. The best way to prevent plaque is to brush for two minutes at least two times a day using toothpaste and a toothbrush.

Your teeth have three main layers. Enamel covers the outside, dentin is in the middle, and pulp is on the inside. Enamel only covers the part of your tooth that sticks out of your gums, called the "crown". The part below your gumline is the "root".

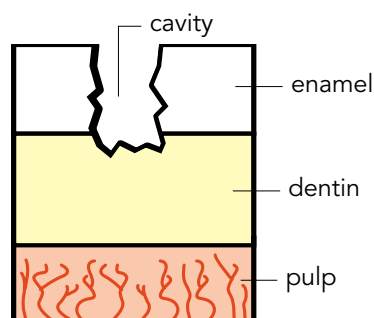
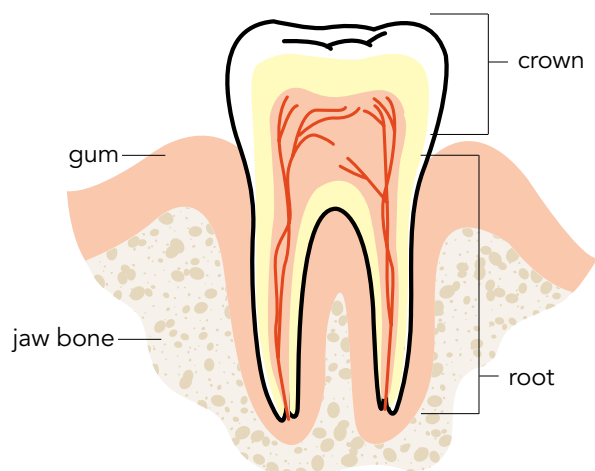
Enamel is the hardest material in your body, and that's a good thing considering what you eat. Chewing food is a tough job, so your teeth must have enamel to protect them. Dentin makes up most of your tooth. It is also hard and bony, but not as hard as enamel. It protects the nerves and blood vessels in your tooth's pulp.

When bacteria eat through the enamel on your teeth, they form cavities. Cavities are bad, because they give bacteria a place to hide. Inside of the cavity, bacteria will continue to eat and to make acid that burns its way even deeper into your teeth. If a cavity gets deep enough into your tooth, it will begin to hurt because the nerves in your tooth pulp will be exposed.

Dentists can fix most cavities, but it is not an easy process. First, they drill away the rotten part of your tooth. Then they can fill the hole left behind. The ceramic material used to fill the hole in your tooth is like glass: it is hard like your enamel, but it can break easily. So, it is best to avoid cavities when you can.

Most toothpaste has fluoride, a chemical that hardens your tooth enamel. Your drinking water may also have fluoride in it. Using fluoride helps to prevent cavities by making it harder for acids to burn through your teeth.

Preventing cavities by brushing for two minutes at least twice a day with toothpaste and a toothbrush is a good way to make sure that you will still have your teeth when you are older. It will also give you something to smile about.



Paper Cover Up

Wax can be used to keep things clean by protecting them. Apples at the market are often coated with a thin layer of wax to protect them. The coating helps them last longer, and makes them look shiny and fresh. In this activity, you will use candle wax to make an "invisible" design that you will reveal with watercolor paints.

Materials

- * Paper towels
- * White candle (birthday candle or small taper)
- * Sheet of white paper
- * Paintbrush
- * Cup of water
- * Watercolor paints (dark colors work best)

NOTE: Paper towels should be available as mats for the activity and for cleaning up accidental spills while conducting this activity.

ADAPTATION A white crayon may be used instead of the candle, and water-based markers may be used instead of watercolor paints. A wide foam brush may be easier for some people to use than a traditional paintbrush.

SAFETY! Be sure to follow Milli's Safety Tips and do this activity with an adult! Do not drink any of the water used in this activity.

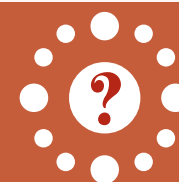
Procedure

1. Use the bottom of the candle to write a secret message or draw a picture on the paper. It will not be easy to see what you are drawing, so look carefully.
2. Dip the paintbrush into the water, and then mix it with a dark color of paint.
3. Paint across the surface of the paper making sure to paint over the areas that you marked with the candle.
4. Take a look at your finished picture. What happened when you painted across a place where there was wax on the paper? Write your observations in the "What Did You Observe?" section.
5. Put your paper aside to dry.
6. Rinse the paintbrushes with plenty of water. Thoroughly clean the work area, and wash your hands.



What Did You Observe?

Describe what happened when you painted across the paper.



Where's the Chemistry?

The wax protected the white surface of the paper from being colored by the watercolor paint. Because wax does not mix with water, it blocked the watercolor paint from reaching the paper underneath.

In the same way that you coated the paper with wax, dentists can coat the tops of your back teeth with a special type of plastic sealant. The sealant prevents tooth decay by keeping food and bacteria away from the surfaces of these teeth. The sealant does not easily rub or wash off of your teeth, so it can protect them from decay for several years. You will still need to brush for two minutes twice a day to keep your other teeth and your gums healthy!

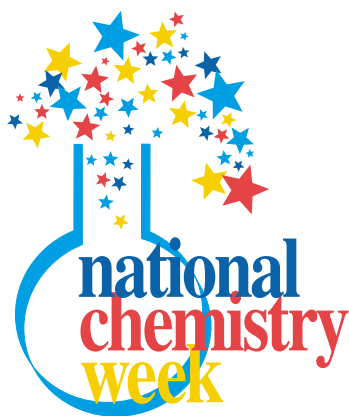


chemistry.org/kids



Visit chemistry.org/kids for more hands-on activities.

Additional materials for National Chemistry Week are available at chemistry.org/ncw.



Celebrating Chemistry is a publication of the American Chemical Society's (ACS) Office of Community Activities in conjunction with the Committee on Community Activities. The Office of Community Activities is part of the ACS Membership Division. *Celebrating Chemistry* is published annually and is available free of charge through your local National Chemistry Week Coordinator. You can go to chemistry.org/ncw to locate your National Chemistry Week Coordinator or to find out more about National Chemistry Week.

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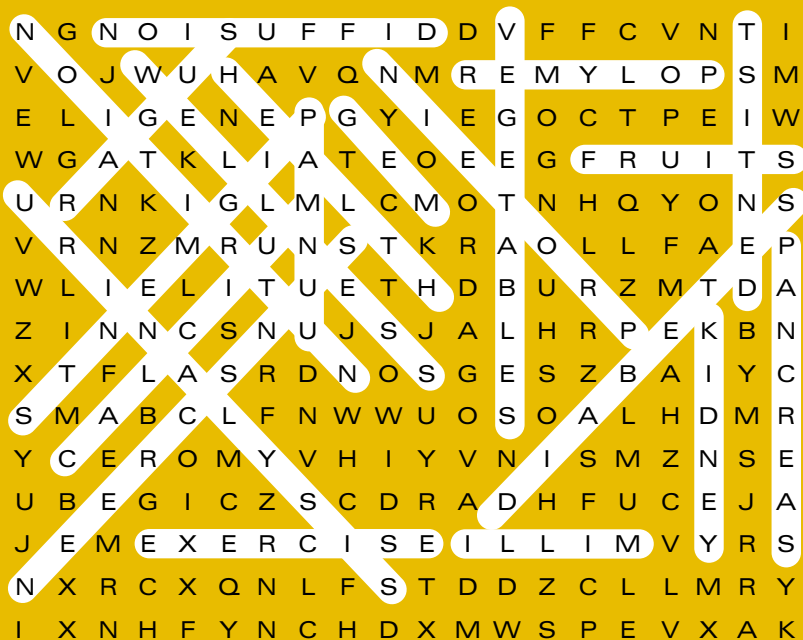
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Acknowledgments

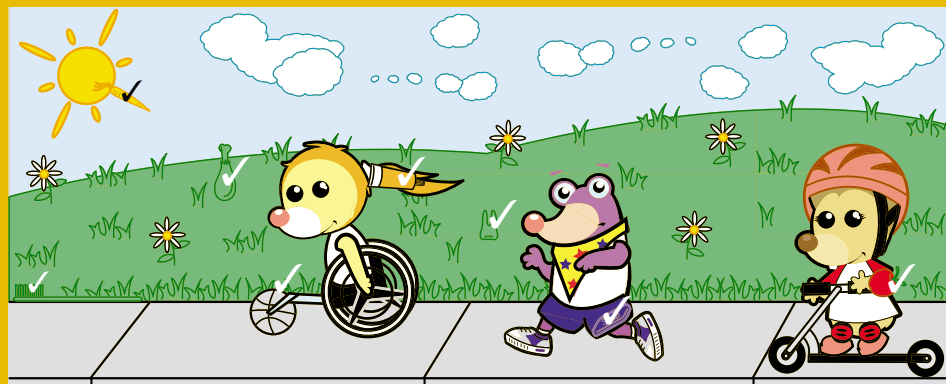
Many of the activities described in this publication were modified from *WonderNet* (chemistry.org/wondernet), a publication of the ACS Education Division. The diabetes article and Helen Free interview were written by Kara Jackson. "The Nose Knows" was based on an activity in *Teaching Chemistry with Toys* by Sarquis, Sarquis and Williams. "Glitter Slime" is based on work done by David Katz and Sylvia Branzei.

The activities described in this newspaper are intended for elementary school children under the direct supervision of adults. The American Chemical Society cannot be responsible for any accidents or injuries that may result from conducting the activities without proper supervision, from not specifically following directions, or from ignoring the cautions contained in the text.

Word Find from page 10



Hidden Objects from page 4



What is the American Chemical Society?

The American Chemical Society (ACS) is the largest scientific organization in the world. ACS members are mostly chemists, chemical engineers, and other professionals who work in chemistry or chemistry-related jobs. The ACS has more than 159,000 members. The majority of ACS members live in the United States, but others live in different countries around the world. Members of the ACS share ideas with each other and learn about important discoveries in chemistry during meetings that the ACS holds around the United States several times a year, through the use of the ACS website, and through the journals the ACS publishes.

The members of the ACS carry out many programs that help the public learn about chemistry. The largest of these outreach programs is National Chemistry Week (NCW). NCW is held every year in October. ACS members celebrate NCW by holding events in schools, shopping malls, libraries, science museums, and even train stations!

Activities at these events include, among other things, carrying out chemistry investigations and participating in contests and games. If you would like to know more about how you can participate in National Chemistry Week, please contact us!



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