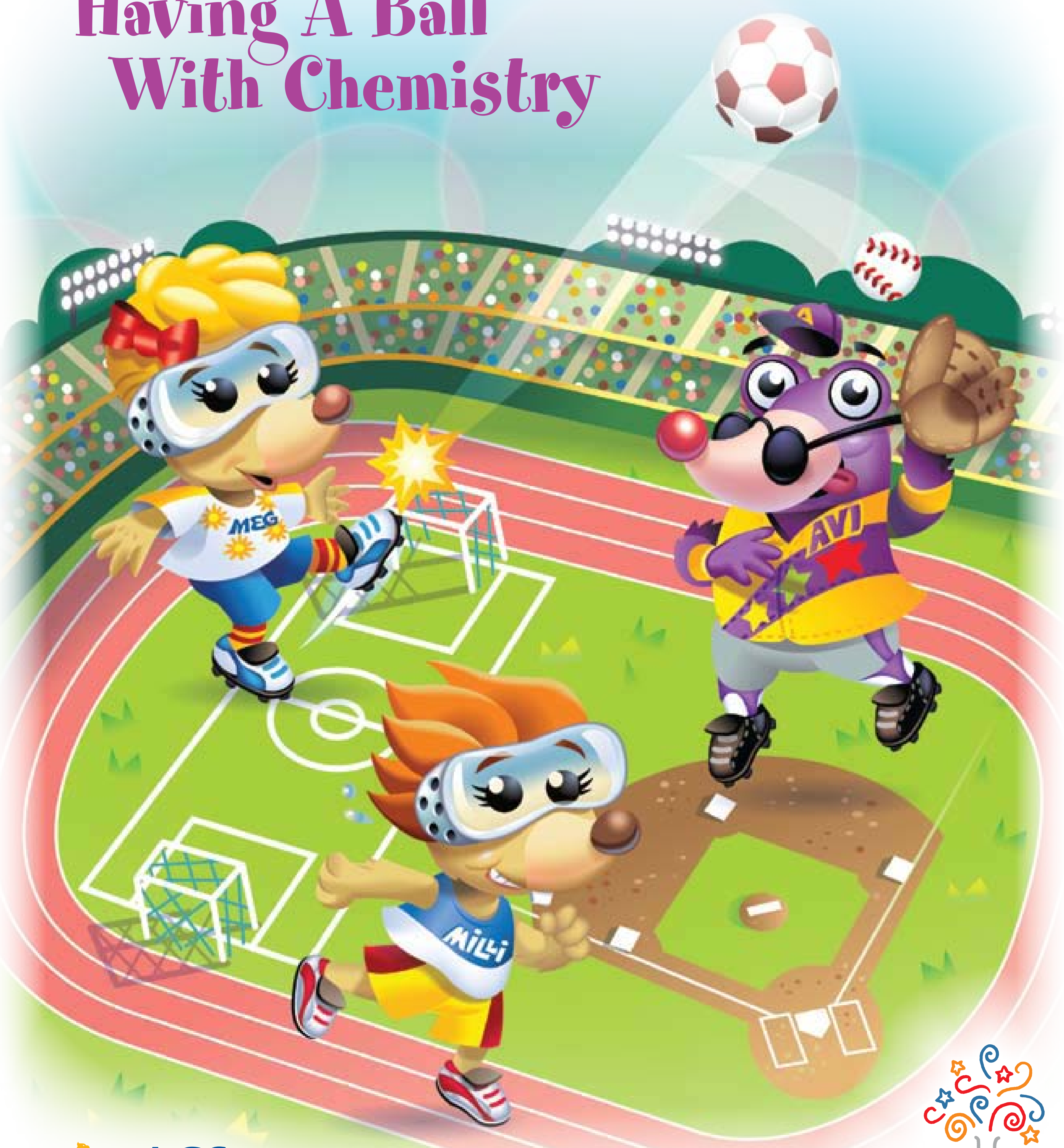
Celebrating Chemistry

National Chemistry Week · American Chemical Society

Having A Ball With Chemistry



ACS Chemistry for Life™

National Chemistry Week

The Chemistry

WHAT'S INSIDE

Did you know that the first Olympics ever recorded took place in 776 B.C.? Since then, a lot has changed. The study of chemistry has improved the way that athletes train, the sports they play, and the equipment they use.

For example, we now know much more about how our bodies break down foods to provide "power" for our cells. Scientists are able to measure the energy and nutrients that foods contain so that we can make better decisions about what to eat. We also realize that it is essential to stay hydrated—our bodies need water to carry nutrients, to regulate temperature, and to help muscles work properly.

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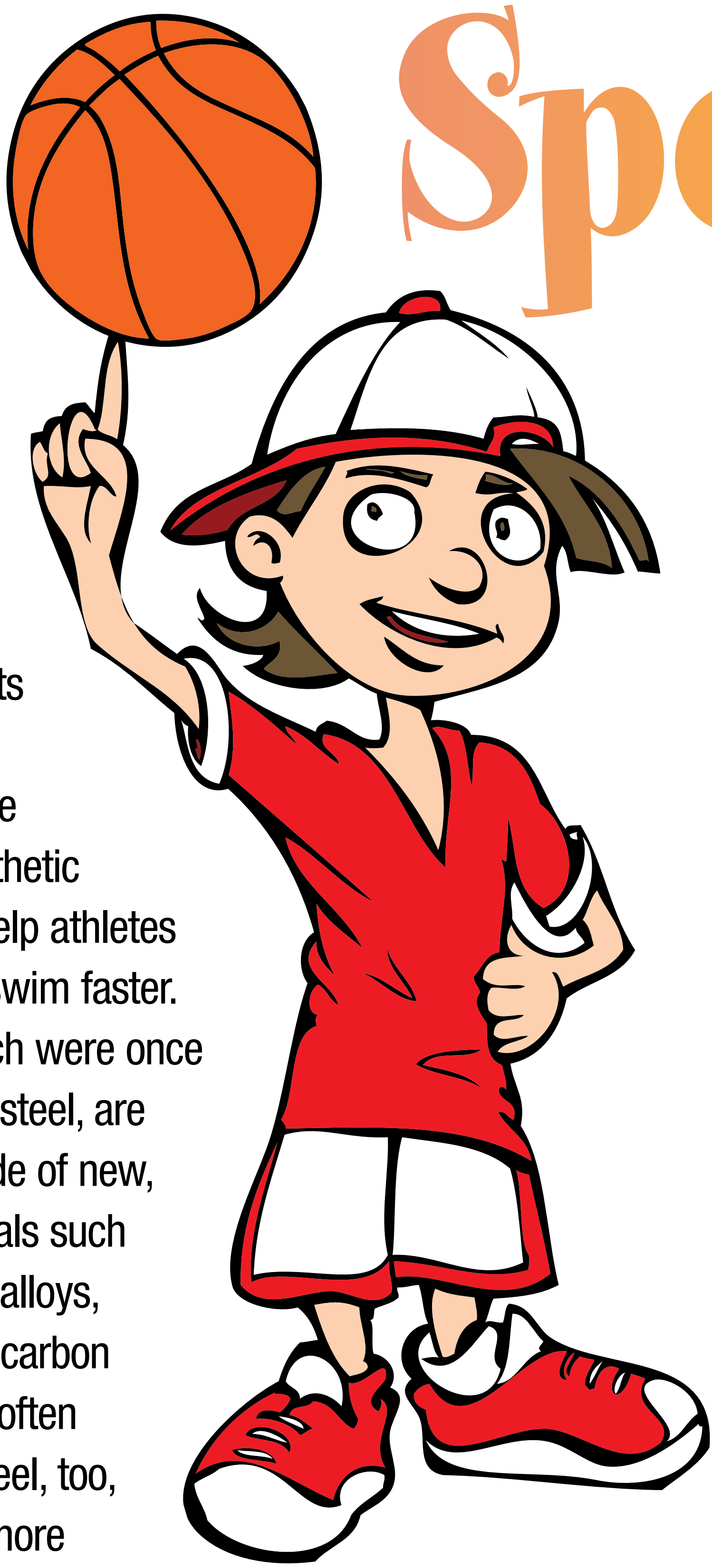
# of Sports



Advances in chemistry have also led to the development of better sports equipment. Chemists have designed synthetic fabrics that help athletes stay drier or swim faster. Bicycles, which were once only made of steel, are now also made of new, lighter materials such as aluminum alloys, titanium, and carbon fiber. They're often stiffer than steel, too, so they turn more peddling energy into rolling energy. Lighter and stiffer frames mean faster bicycles—and perhaps more wins for racers.

Thanks to discoveries by chemists, engineers, and other scientists, today's athletes have a definite advantage over those ancient Olympians. After reading and doing the activities in this issue of *Celebrating Chemistry*, you will realize chemistry's role in the sports you play and watch. Share your knowledge with family members and your teachers!

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 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 detailed information on safety go to www.acs.org/education and scroll to "Standards & Guidelines." Click on Safety Guidelines.

Shoe Anatomy

When you jump, run, or play, your legs and feet can take on the pressure of up to seven times your normal weight. Modern shoes contain various types of polymers that absorb shock at the same time as they provide support, flexibility, and traction. Look at the picture below to find out what materials can be found in your athletic shoe. Also remember that when you wear out or outgrow your shoes, it is a good idea to find a place to recycle them. Who knows? They might turn up in a playground, basketball court, or running track.

Midsole

Most of a shoe's shock absorption takes place in the midsole. The most common material used today is a springy foam polymer called ethylene vinyl acetate. Some sports shoes use a denser foam polymer that chemists developed from polyurethane—the same material as skateboard wheels, just with air bubbles in it! You can also find gel or high-tech plastic materials.

Upper

The upper portion contains the laces, color, and design. It is usually made from leather or a synthetic material—depending on the sport or activity the shoe will be used. For instance, most running shoes are made from a synthetic polymer called polyester, also known as "mesh". It is lightweight and helps with support and breathability.

Insole

The insoles also absorb shock to keep your muscles from working too hard even during normal activities. Insoles come in a variety of different types, including plastic foam and silicone gel.

Laces

Most shoelaces are made of leather, cotton, or a mix of natural and synthetic polymer materials.

Toe Box

By controlling how rubber is made, chemists can change how it feels. For example, a harder type of rubber may be used to protect your toes in your soccer or baseball cleats, and a softer type may be used in jazz shoes for dancing on your tiptoes.

Outer Sole

The soles need to be long-lasting and provide good grip to a playground or gym floor. Various forms of rubber are most often used here.

Synthetics in Athletics

About 50 years ago, bathing suits were made of cotton, and tennis racquets were built with wood. Not anymore. The work of chemists and other scientists have led to the use of new materials in sports equipment and clothing that have changed many sports. The materials are usually lighter and longer-lasting and help athletes move faster and feel more comfortable.

Many of the materials used in today's sports are made in laboratories by chemists. These materials are known as "synthetic". For example, the 2008 Olympic swimmers wore swimsuits made from nylon and spandex. Both of these materials are synthetic polymers; long fibers that chemists have designed to have special properties—nylon to be smooth and durable, and spandex to be stretchy. Compared with a cotton swimsuit, a nylon and spandex one is light, slippery, and fits tightly. It allows the swimmer to move and glide quickly through the water.

Today's tennis racquets are made of carbon fiber and fiberglass, a combination of synthetic materials. The racquets weigh about half as much as early wooden racquets. Because they are lighter, the risk of injury decreases and a more powerful swing is produced.

Another common material used in sports equipment is found in nature: rubber. It is a natural polymer that comes from a tree. For example, rubber is the main ingredient in bicycle tires and basketballs. It is often mixed with other chemicals to make it stronger. In bicycle tires, carbon black is added to improve the traction of the tire's treads and to give it its traditional black color. The insides of most balls are made of rubber that is wrapped with layers of fibers. Other natural materials that are used are cotton and leather. Think about where you can find them in today's sports equipment.

As you explore the chemistry in sports equipment, look at the materials in your own activities. How do these materials compare to what your teachers or family members used when they were younger?

Now and Then

SPORT	SPORT ITEM	NOW	THEN
Soccer	Shin Guards	Injection-molded plastic	Extra socks or none
	Balls	Polyurethane	Leather
Football	Helmets	Polycarbonate with soft foam or air-filled cushioning	Leather
Gymnastics	Floor Mats	Several layers of protective plastics	Horsehair and straw
Volleyball	Knee Pads	Plastic foams	Nothing
Track & Field	Tracks	Plastic rubbers	Cinder and clay
	Pole-Vault	Plastic and fiberglass	Bamboo
	Hurdles	Plastic	Wood
Basketball	Backboards	Fiberglass	Wire mesh or wood
	Nets	Nylon	Metal chains
Baseball	Bats	Titanium, aluminum, and wood	Wood
Ice Hockey	Pucks	Rubber	Wood
Golf	Clubs	Titanium or other metals	Hickory
	Balls	Rubber-core, Titanium-core	Wood, Feather-stuffed leather

Meg A. Mole's Bouncing Ball

Balls have been around for thousands of years. The earliest balls were made out of stone and wood. They were used to play games that involved kicking and carrying. The discovery of natural rubber changed what people could do with a ball. They could bounce it! These days, not all bouncing balls are made out of rubber. They can also be made out of leather or plastic and be hollow or solid. Think about the last ball that you bounced. What materials were used to make it? In this activity, you will make a bouncy ball from glue, borax, and cornstarch.

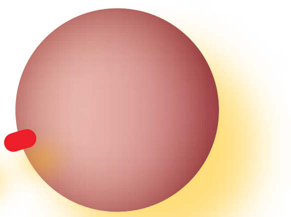
SAFETY! *Be sure to follow Milli's Safety Tips and do this activity with an adult! Do not eat or drink any of the materials used in this activity.*

Materials

- Marking pen
- 2 small plastic cups (4 oz.)
- Measuring spoons
- Warm water
- Borax
- Wooden craft stick
- White craft glue
- Cornstarch
- Watch with second hand
- Metric ruler
- Zip-closing bag

Procedure

1. Using a marking pen, label one of the cups "Borax Solution". Ask your adult partner to help you pour 2 tablespoons of warm water into the plastic cup. Measure 1⁄2 teaspoon of borax powder and place it in the same cup. Gently stir with a wooden craft stick until the powder is completely dissolved in the water.
2. Use a marking pen to label the second cup, "Ball Mix". Pour one tablespoon of glue into this plastic cup.
3. Add 1⁄2 teaspoon of the borax solution to the cup labeled, "Ball Mix". Do not stir the mix yet!
4. Add 1 tablespoon of cornstarch and wait about 10–15 seconds before you mix it all together with a wooden craft stick.
5. Stir everything together until you can no longer stir the mix with the wooden stick.
6. Take the mixture out of the cup and place it in your hands. The mixture will be sticky and messy!
7. Knead the mix to form a ball. (The more you knead, the less sticky it will become.)
8. Once the mix has been shaped into a ball, bounce it and play with it!
9. Measure the width of your ball and write it down in the "What Did You Observe?" section. Describe what the mix felt like before and after you shaped it.
10. Store your bouncy ball in a zip-closing plastic bag once you are finished playing with it.
11. Thoroughly clean the work area and wash your hands.



Try this...

See what happens if you add more cornstarch. Are you still able to make a ball that bounces?

Try making different colored balls by adding food coloring to the glue. Combine one drop of two different colors to see what you get.

What Did You Observe?

How did the mix feel as you started to shape it?

____

How did it feel after you shaped it?

____

Width of your ball: ________cm

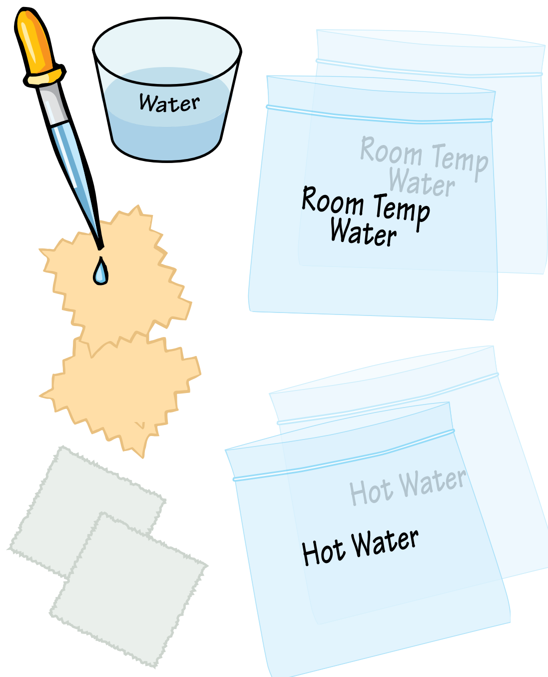
How high did it bounce? ________cm

Where's the Chemistry?

Glue contains a polymer called polyvinyl acetate (PVA). When you add borax solution to polymers like PVA, it cross-links or connects the two polymers together like a net or a spider's web. Depending on how much of each ingredient that you mix together, you can make something that is "goopy", slimy, or stretchy. For instance if you add more cornstarch, you will be able to bend and stretch the mix. Add less borax and you will get a "goopy" mixture. To make a slimy substance, add more glue.

Evaporation Exploration

You're geared up and ready to play. Wait! What are you wearing? Fabrics like cotton can soak up sweat and water, and they dry slowly. So as you sweat, cotton clothes can become wet and sticky, even heavy—they hold on to the water they soak up. The new high-tech fabrics in modern sports clothing are different. They have the ability to pull moisture away from the skin and carry it to the outer surface of the clothing, where it can evaporate more easily and cool you off. In the following activity, you will compare the rate of evaporation of water from cotton and a paper towel, which will act like a high-tech fabric.



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.*

Materials

- Permanent marking pen
- Small cup
- Hot tap water
- Room temperature water
- 4 zip-closing plastic bags, quart size
- 2 droppers
- 2 brown paper towels
- 2 pieces of 3" x 3" cotton fabric swatches

Procedure

1. Use a marking pen to label the cup "Water".
2. Use the marking pen to label 2 zip-closing bags with "Room Temp". Label the other 2 bags with "Hot Water".
3. Add about 1 cup of room-temperature water to each of the 2 zip-closing plastic bags labeled "Room Temp". Get as much air out as possible, and seal the bags securely. Lay the bags down flat.
4. Have your adult partner add about 1 cup of hot tap water to each of the 2 zip-closing plastic bags labeled "Hot Water". Get as much air out as possible, and seal the bag securely. Lay the bag down flat. This bag will serve as a heat source.
5. At the same time, use a dropper to place 1 drop of room temperature water in the center of 2 separate pieces of brown paper towel.
6. Repeat step 3 with the cotton fabric swatches.
7. Allow the drops to spread for about 10-20 seconds until they don't seem to spread any more.
8. Place one paper towel on the bag labeled "Room Temp". Place the other paper towel on the bag labeled "Hot Water".
9. Repeat step 8 with the cotton swatches.
10. Observe every few minutes. Compare the amount of water on each paper towel in the "What Did You Observe?" section.
11. Thoroughly clean the work area and wash your hands.

What Did You Observe

Does adding heat to water increase the rate of evaporation?

____

____

Which sample of water evaporated faster, the cotton swatch or the paper towel?

____

____

Where's the Chemistry?

The fabrics used in modern sports clothes have pores to move water away from the skin and to the outer surface of the fabric so that it will not soak up. The pores provide a way for sweat to evaporate faster, keeping you dry and comfortable. Evaporation happens when water is heated and goes into the air. It takes energy to evaporate water. Heat is a form of energy, so water evaporates more quickly at warmer temperatures. The material that soaked up the water will have a slower rate of evaporation versus the material that contains pores for the water to easily evaporate, just like what is used in high-tech clothing.

Sports Word Scramble

Each of the scrambled words below is a sport. Un-scramble these words and place each letter in the underlined spaces to the right. The highlighted letters will reveal a hidden message!! *Answers are on page 16.*

olblfato _ _ _ _ _ _ _ _

nbwogli _ _ _ _ _ _ _

yllvoellab _ _ _ _ _ _ _ _ _ _

matssygnic _ _ _ _ _ _ _ _ _ _

wlitsgern _ _ _ _

ixbngo _ _ _ _ _ _

djou _ _ _ _

netisn _ _ _ _ _ _ _ _

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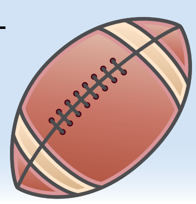


Chemistry is _ _ _   _ _ _ _ _ _ _   _ _ **!!!**

Chemistry Is All

In the city scene below, do you see a sport that you play or that you like to watch? Go through these streets and read about the materials used in the sports gear that you or athletes may use. If your favorite is not mentioned, ask your teacher or family member to help you investigate the chemistry behind the sport. Discover that chemistry is all around you!

Swimming Chlorine is the chemical most often used to keep swimming pools free of bacteria. Chlorine kills bacteria, can be used as a cleansing agent, and also works to rid pools of algae.

Bowling Bowling balls today are covered with polyester, urethane, or resin, also called reactive urethane. Inside is either a dense plastic or ceramic core for weight.

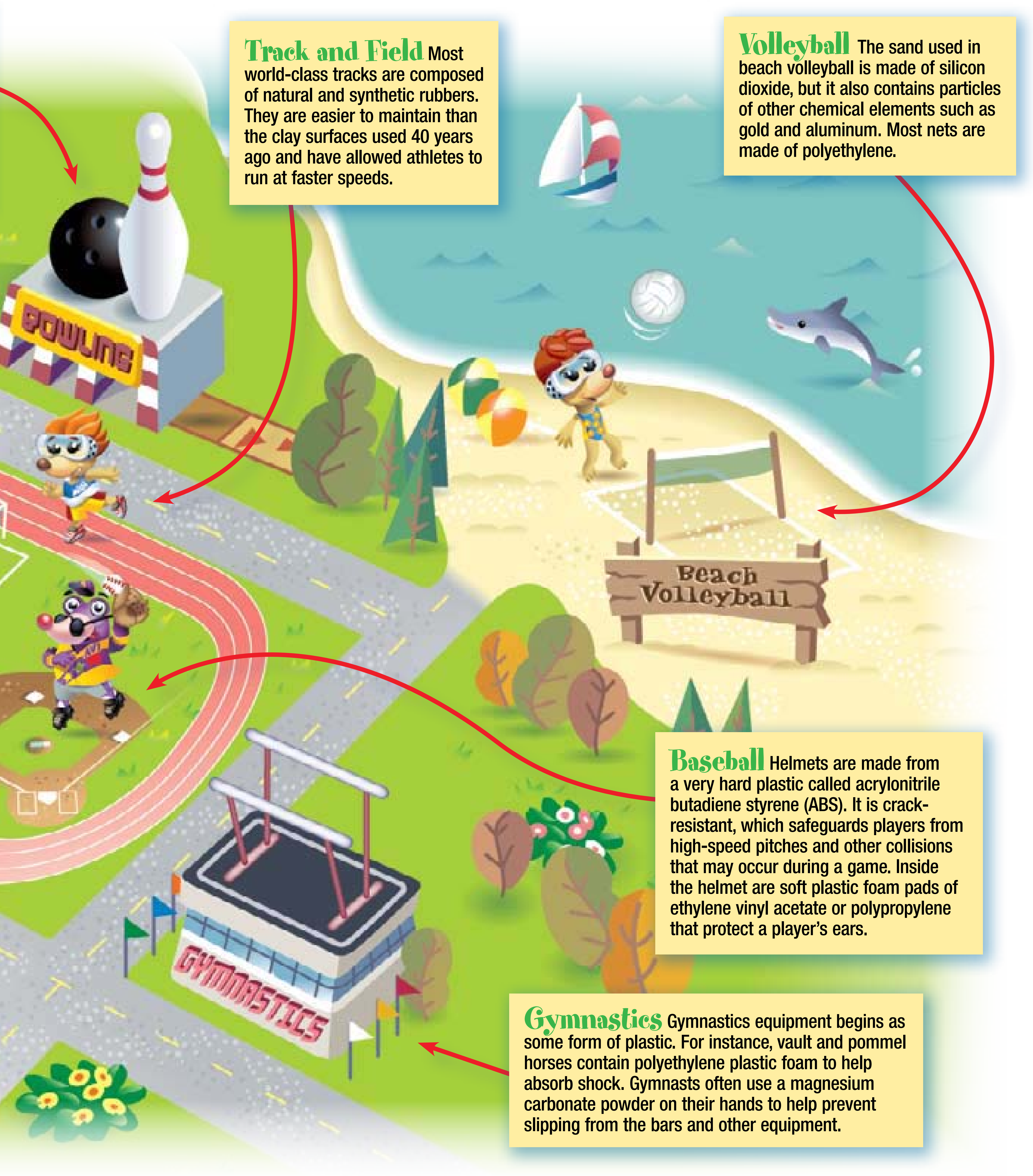
Tennis The primary material used in today's tennis racquets is graphite, a combination of carbon fiber and plastic resin that makes a light, stiff, powerful racquet. Most players use strings made of nylon or polyester.

Soccer Soccer balls are made from synthetic leather, usually either polyurethane or polyvinyl chloride (PVC). Even after many kicks and hits, the synthetic material allows the ball to keep its shape.

Boxing Fighters generally use an instrument called an enswell (or "end-swell") to help reduce swelling from hits to the eye area. It is usually made of aluminum or other metal alloy, and can be easily cooled on ice.

Cycling Bicycle tires are either natural or synthetic rubber mixed with carbon black. Rims and frames can be made from traditional steel to aluminum, titanium, and carbon fiber.

Around Us!!!



Track and Field Most world-class tracks are composed of natural and synthetic rubbers. They are easier to maintain than the clay surfaces used 40 years ago and have allowed athletes to run at faster speeds.

Volleyball The sand used in beach volleyball is made of silicon dioxide, but it also contains particles of other chemical elements such as gold and aluminum. Most nets are made of polyethylene.

Baseball Helmets are made from a very hard plastic called acrylonitrile butadiene styrene (ABS). It is crack-resistant, which safeguards players from high-speed pitches and other collisions that may occur during a game. Inside the helmet are soft plastic foam pads of ethylene vinyl acetate or polypropylene that protect a player's ears.

Gymnastics Gymnastics equipment begins as some form of plastic. For instance, vault and pommel horses contain polyethylene plastic foam to help absorb shock. Gymnasts often use a magnesium carbonate powder on their hands to help prevent slipping from the bars and other equipment.

Don't Sweat It: You're Covered

Think about when you sweat. After running around at recess? Playing sports? Just standing in the sun on a hot summer day? In each of these cases, your body is trying to get cooler.

When you are hot, you sweat. Your body makes sweat

inside tiny coiled tubes buried in your skin, called sweat glands. The average person has over 2 million of them! Sweat is released onto the surface of your skin through small openings called pores. It may not feel like it when you're sweating a lot, but the water in your sweat is always drying on your skin. As it dries, it carries away some of the extra heat from your body. This process is known as evaporation.

What are Electrolytes

Besides water, you release minerals called electrolytes. Your body needs electrolytes so your nerves can talk to each other, your muscles can contract and move as they're supposed to, and you maintain the right balance of water in your cells. The most abundant electrolytes found in your body are sodium, potassium, and chloride. When you sweat, these electrolytes come together to form salts that give sweat a salty taste.

Keeping the right amounts of water and electrolytes in your body is important. Without enough of either, your muscles can become weak or can cramp up. You may also get a headache or feel dizzy.

Water is Best

For exercise or play that lasts 30 minutes or less, just drinking plenty of water is best. Our bodies usually get enough electrolytes from what we eat and drink during the day. For example, bananas and potatoes are full of potassium. Do you have any ideas of foods you may eat that contain electrolytes? You can check nutritional labels on food packages or ask a family member or teacher.

Athletes who are very active for long periods of time can lose a lot of electrolytes as they sweat. In their cases, they need to replace these electrolytes. That's why you may see athletes gulp sports drinks as well as water as they play.

Remember, to do your best at sports, stay hydrated with plenty of water. Luckily, you do not have worry about staying cool; your body has it covered—with sweat!

The Buzz on Electrolytes

When you sweat you lose important electrolytes like sodium, chloride, and potassium. One major function of electrolytes is that they help to conduct electrical currents in your body and allow muscles to contract and relax. We usually get enough electrolytes from our regular diet. For example, both bananas and raisins are rich in potassium. We also get plenty of sodium and chloride from the table salt that is used to flavor foods and even some drinks! In this activity, you will make a sensor to test for the presence of electrolytes in everyday liquids. Listen for the buzz. It will let you know if they are there.

Materials

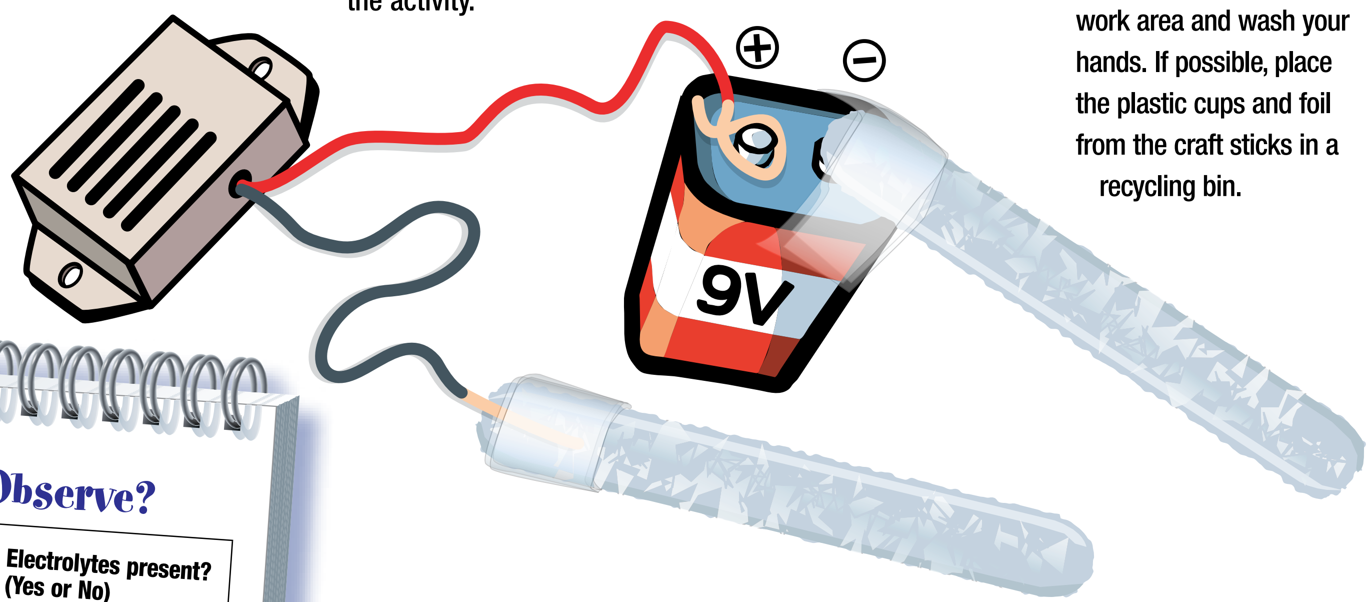
- 2 mini craft sticks
- Aluminum foil
- Buzzer *(available at electronics store, like Radio Shack, model #273-55)*
- 9V battery
- Transparent tape
- Permanent marking pen
- 4 disposable plastic cups (4 oz.)
- 1 paper towel sheet
- Distilled water
- Sports drink
- Juice
- Vegetable Oil

SAFETY!

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

Procedure

1. Use the marking pen to label each of the four cups. Label one cup "Distilled Water", another, "Sports Drink", the third with "Juice", and the last "Vegetable Oil".
2. Fill each of the cups with the four different liquids until it is about ¾ full.
3. Completely cover each of the craft sticks with aluminum foil.
4. Grab your buzzer. It should have one red and one black wire. If necessary, untwine the wires so that your adult partner can easily set up the activity.
5. Have your adult partner use the transparent tape to tape the red wire to the positive end of the battery. It will have a "+" sign.
6. Next grab the other craft stick. Have your adult partner tape the black wire of the buzzer to the craft stick.
7. Then tape your other craft stick to the negative end of the battery. It will have a "–" sign. Your electrolyte tester should now be ready.
8. Take the craft sticks and gently place them about an inch apart from each other in the cup labeled "Distilled Water". Did the buzzer make a sound? Record your results and note whether electrolytes were present in the "What Did You Observe?" section.
9. Rinse the craft sticks with the distilled water and wipe them dry with a paper towel, making sure there is no liquid left on the sticks.
10. Repeat steps 8 and 9 with the "Juice", the "Sports Drink" and the "Vegetable Oil".
11. Thoroughly clean the work area and wash your hands. If possible, place the plastic cups and foil from the craft sticks in a recycling bin.



What Did You Observe?

Cup	Buzzed	Electrolytes present? (Yes or No)
Distilled water		
Sport Drink		
Juice		
Vegetable Oil		

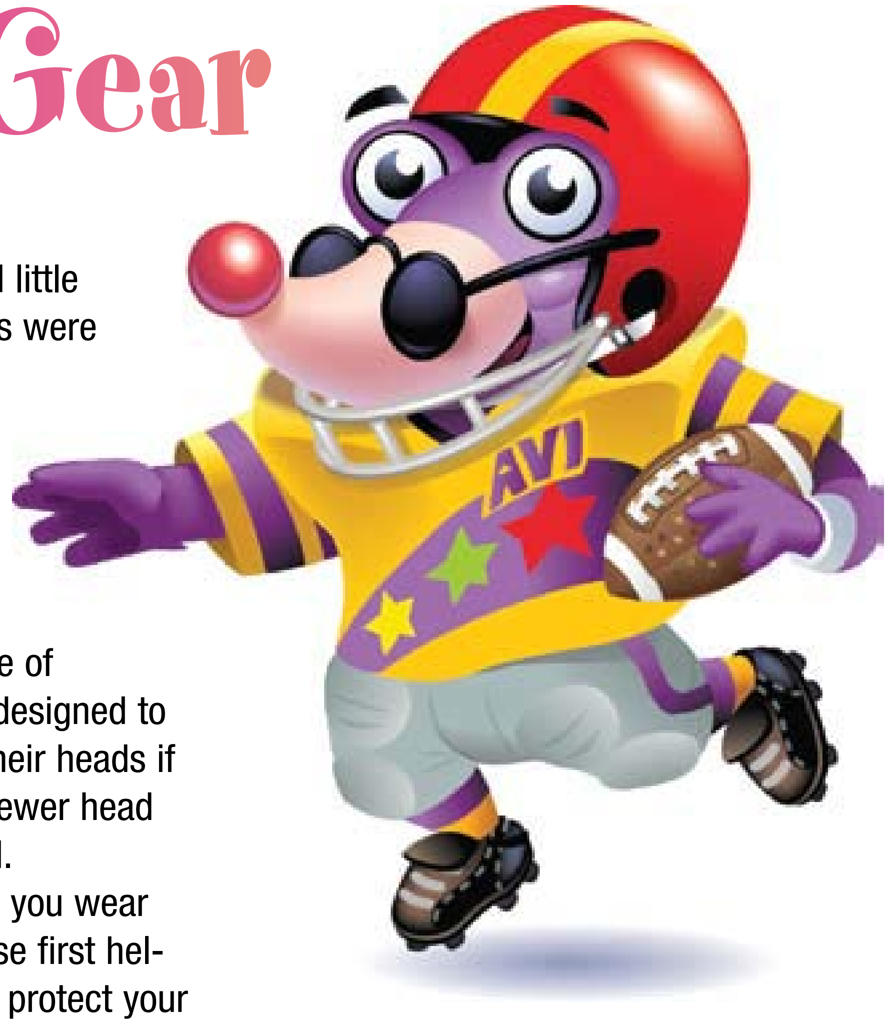
Try this...

Test whether other drinks, such as milk, soda or lemonade, have electrolytes present.

Where's the Chemistry?

Although electrolytes are invisible to our eyes, you detected their presence when you heard the sensor buzz. In this experiment, the electricity from the battery was passed through the aluminum foil on the first craft stick. The solutions that contained electrolytes acted like a wire by letting the electricity pass from the first craft stick to the second craft stick, and eventually to the buzzer.

Play It Safe: Go for the Gear



When you're playing sports, the last thing you want to think about is getting hurt. Luckily, chemists have thought about it for you. Developments by chemists and other scientists have helped sports become safer from when your parents were children. Today's safety gear is lighter, sturdier and—best of all—it protects you better.

Helmets— Layer of Protection

Helmets are the kind of safety gear that people often think of first. Back in the early 1900s, football and baseball players wore helmets made from leather. It offered little protection, and players were likely to suffer from a head injury. The same was true in bicycling. Then in the mid-1980s, bicycle racers started wearing helmets made of polymers. They were designed to protect and cushion their heads if they fell. As a result, fewer head injuries have occurred.

The bicycle helmet you wear today is based on those first helmets. Not only does it protect your head from injury, it is much lighter and cooler to wear. That's because chemists, engineers, and other scientists are inventing new materials and ways to put them together to protect you better.

Safer with Polymers

Most kinds of sports gear today are made of polymers. Polymers can be hard, like the plastic shell of a helmet, or soft, like the foam inside of a volleyball knee pad. Each polymer is carefully designed to act a certain way. A stretchy polymer called spandex helps your soccer shin guards cling to your legs even while you run.

The palms of skate gloves may be a tough nylon polymer that shields hands from scrapes. Basketball players may wear polycarbonate eye shields to protect their eyes from balls, elbows, and other kinds of hits.

Even the materials found in your athletic shoes are designed to keep you from being injured. For example, the soles of most sports shoes are made from rubber, a type of polymer. It helps you grip to a surface such as a cement sidewalk or your gym's floor to prevent you from slipping and hurting yourself. Another example may be found in your neighborhood park or school playground—rubber mats. Most are made from recycled tires and, most importantly, they provide good padding in case you fall.

Before your next outing, look at your safety gear and equipment used in the sports you play. How does each piece help protect you?

COOL CHEMIST: Amy Wylie

What is your title and where do you work?

Senior Research and Development Specialist in the Business Development Group at Bayer Material Science

What is your job?

I formulate polyurethane coatings that protect plastic parts from being scratched or damaged. I also invent “soft feel” coatings that can be found on handles of sports equipment. These “coats” protect objects.

What is the coolest part about what you do?

I design a coating in the lab and follow it all the way to where it is actually applied to a product.

How did you become a chemist?

I started working at Bayer Material Science while I was finishing my B. S. in life sciences from Pennsylvania State University. While still working at Bayer, I went back to school at the University of Pittsburgh to earn a second B. S. in chemistry. This degree helped me get a position as a coatings chemist.

What were your favorite subjects in school?

History and chemistry

What made you first interested in science?

When I took a laboratory class for the first time, I enjoyed working hands-on to find a solution.

How would someone come in contact with your work?

You can see polyurethane coatings on plastics every day. They are used for plastic parts that are found in your car, sporting goods, or on toys, to name a few. A good example is the official soccer ball used for the World Cup championship. Bayer supplied polyurethane coatings and adhesives for that ball.

Anything else you would like to share about science?

Science is challenging, yet fun. It can be enjoyed by children of all ages. The wonders of science are all around us, even in our everyday lives.

What Counts in Bounce

Do all balls bounce? Most do, but how high a ball bounces depends on the material from which it is made and the temperature of the ball. In the following activity, you will compare the bounciness of warm and cold racquetballs to see if temperature makes a difference.

Materials

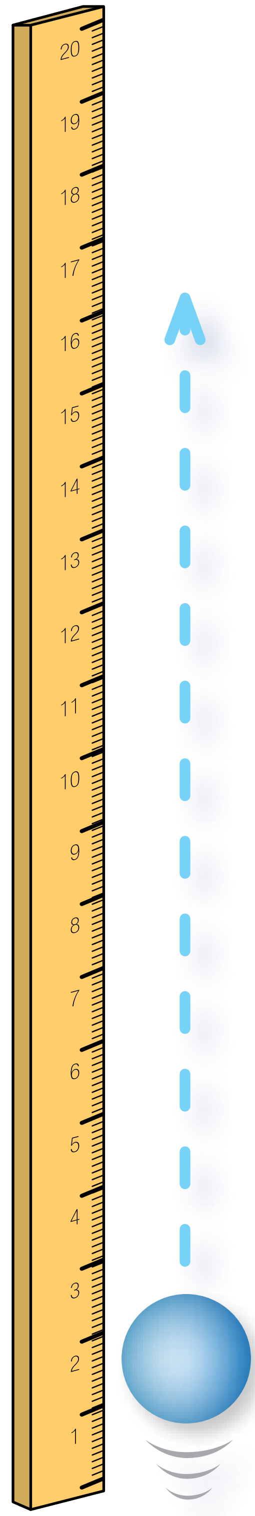
- Masking Tape
- Permanent marking pen
- 3 plastic containers (24 oz.)
- Ice
- Water
- Hot tap water
- 4 racquetballs
- Timer
- Tongs
- Measuring tape or yard stick

ADAPTATION *Students who are visually challenged may press the balls in their hands and feel the difference of how they feel at different temperatures.*

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.*

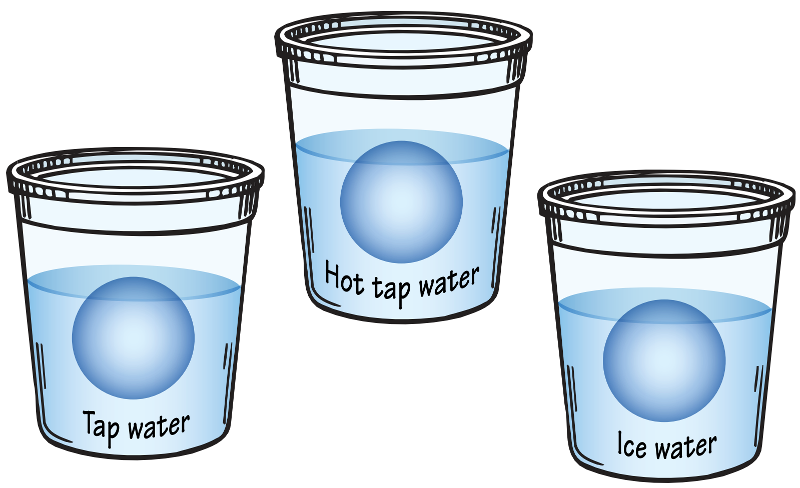
Procedure

1. Using the marking pen and a strip of masking tape, label one of the containers, "Ice water", label the 2nd, "Tap water" and the 3rd, "Hot tap water".
2. To the container labeled "Ice water", fill it halfway with tap water. Next add ice so that the container is ¾ full of ice and water.
3. To the container labeled, "Tap water", fill the container with tap water until it is about ¾ full.
4. To the container labeled, "Hot tap water", have an adult partner fill the container with hot tap water until it is about ¾ full.
5. Place one racquetball in each container and let it sit for at least 2 minutes. Use a timer to keep track of the time.
6. Meanwhile have your adult partner hold a measuring stick or tape with the zero end resting on the floor.
7. Using tongs, remove the ball from the "Tap water" container.
8. Hold the ball at a height of 90 cm above a hard surface and drop the ball next to the measuring stick or tape. Make sure to pay attention to how high the ball bounced.
9. In the table provided, record your result in the "What Did You Observe?" section. Place the ball back into its container.
10. Repeat steps 7-9 for the balls placed in the "Tap" and "Hot tap" water containers, respectively.
11. Thoroughly clean the work area and wash your hands.



What Did You Observe?

Ball temperature	Height (cm)
Ice water	
Tap water	
Hot tap water	



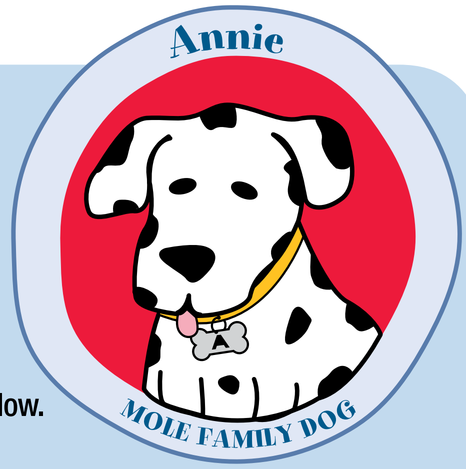
Where's the Chemistry?

Balls bounce because most of them are made from some type of polymer, like rubber. The type of polymer used in a ball will determine how high, or low, a ball will bounce. The rubber polymers found in racquetballs are long, stringy, and closely coiled to each other. It is that coiled shape that gives a ball its ability to spring into the air. When the temperature of a ball is cooled, the polymer loses its coiled shape and becomes straighter and less springy. Warm up a ball and its polymers become even more coiled than at room temperature.

Try this...

Test how temperature affects golf balls.

Annie's Matching Game



Fill in each blank with a letter matching to the correct number below.

1. Many major league baseball pitchers can throw a ball at least ___ miles per hour!

2. You have more than ___ muscles in your body.

3. In the 1800s most bicycle frames were made with steel and wood and weighed an average of ___ pounds.

4. Today's high speed racing bikes can weigh as little as ___ pounds because their frames are made of steel, aluminum, titanium, and carbon-fiber.

5. There are currently ___ sports and over ___ events in the 2008 Olympic games.

6. It's best to eat __ hours before you play a sport.

7. If you are playing a sport for more than ___ minutes, it's a good idea to have a snack to help keep up your energy levels.

8. Children ages 6 to 12 generally need between ___ and ___ calories per day.

- **a.** 2,500
- **b.** 600
- **c.** 3
- **d.** 400
- **e.** 80
- **f.** 1,600
- **g.** 90
- **h.** 95
- **i.** 35
- **j.** 6

Answers for Annie's Matching Game can be found on page 16.

Words to Know

Electrolytes—chemicals that conduct electricity when dissolved in a solution. Our bodies contain many electrolytes, like sodium and potassium salts. We need them to carry electrical signals to nerves and muscles and to maintain proper water balance in our cells. We lose electrolytes in our sweat, which is why eating right and drinking water become especially important when you are active.

Polymer—a very long chemical made up of little repeating units, like beads on a chain.

Synthetic polymers—chemical compounds developed in a laboratory by chemists and engineers. The most widely known synthetic polymer is plastic. Other examples include nylon, polyvinyl chloride, and polyester.

Natural polymers—come from nature. Examples include rubber (from the sap of rubber trees) and silk (from the cocoons of silkworms).

Hydrated—to supply your body with water or liquid so that your organs can work properly.

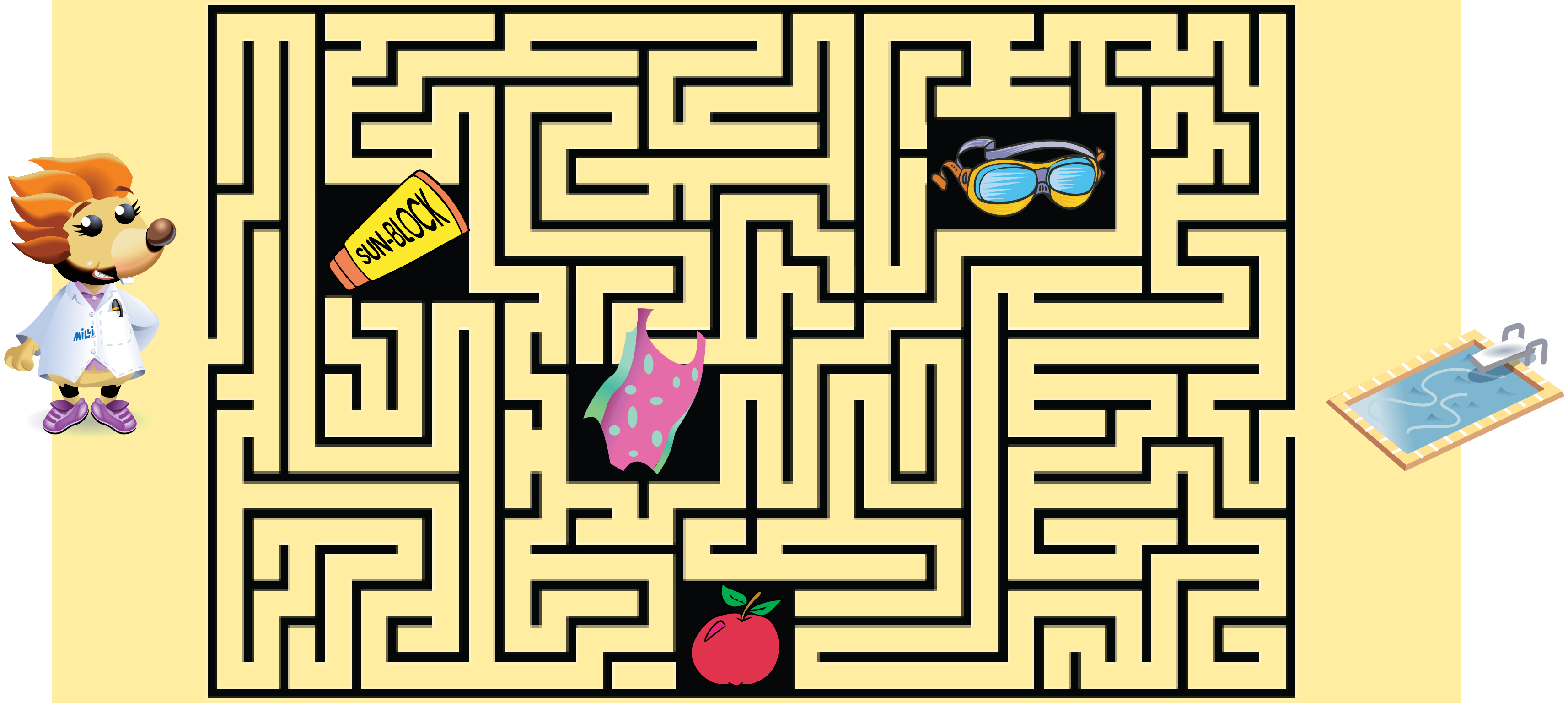
Dehydrated—when your body does not have as much water as it needs. Symptoms include dizziness, extreme thirst, and muscle cramps.

Perspiration—a process, also known as sweating, that our bodies use to cool off. When you run and play, your muscles heat up, and sweat glands in your skin secrete a salty fluid to help bring your body's temperature back down.

Evaporation—When the sweat on your skin disappears, it has evaporated, or changed from a liquid to a gas. We feel cooler when we sweat because our bodies transfer heat to the liquid, which then evaporates and carries away the heat as a gas.

Milli's Maze

Help Milli gather items to go swimming.



For solution, go to www.acs.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 Division of Membership and Scientific Advancement. The National Chemistry Week (NCW) edition of *Celebrating Chemistry* is published annually and is available free of charge through your local NCW Coordinator. NCW is a combined effort among the Office of Community Activities, the Committee on Community Activities, and several ACS Technical Divisions. Please visit www.acs.org/ncw to learn more about National Chemistry Week.

Answers to Annie's Matching Game on page 15

1. h
2. b
3. e
4. j
5. i, d
6. c
7. g
8. f, a

Solution to Sports Word Scramble on page 7

footbAll
bowLing
volleybalL
gymnAstics
wRestiling
bOxing
jUdo
teNnis
hanDball
eqUestrian
softball

CHEMISTRY IS ALL AROUND US !!!

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 160,000 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. One of these programs is National Chemistry Week, held annually the fourth week in October. Another of these programs is Chemists Celebrate Earth Day, held annually April 22nd. ACS members celebrate by holding events in schools, shopping malls, libraries, science museums, and even train stations! Activities at these events include carrying out chemistry investigations and participating in contests and games. If you would like more information about these programs, please contact us at ncw@acs.org!

ACS Chemistry for Life™