The Life Cycle of a Soccer Ball

Soccer—the most popular sport in the world—is played by people young and old in countries near and far. Whether you play on a school team or with friends on the weekends, you know that what makes the sport so great is that you can play anywhere; all you really need is open space, teammates, and a ball. And while that may appear simple enough, the making of a soccer ball isn't quite as simple. Have you ever wondered how soccer balls are made and what happens to them when you're finished playing with them?

As with any product, making a soccer ball uses natural resources and energy, which can impact the air, land, and water.

Follow the life cycle of a soccer ball on this poster to learn more about how it is made and how you can help reduce its environmental impacts. Understanding this life cycle can help you make environmental choices about the products you use, and how you dispose of them.

Fast Fact

In most parts of the world, soccer is called football, or fútbol.

1 Gathering the Materials

Soccer balls are made from a variety of raw materials that come from the Earth. For example:

- Crude oil and other materials extracted from the Earth are used to make various kinds of plastic and polymers, including polyurethane (PU), thermoplastic polyurethane (TPU), butyl, and silicone.
- Natural latex rubber is extracted from plants.
- Glue is made from natural substances such as natural rubber, animal bones, fish, starch, milk protein, or casein, or from cyanoacrylate, a clear plastic invented by Dr. Harry Coover.
- Cotton is picked from plants, which grow throughout the United States and other countries.

2 Preparing the Materials

Most raw materials must be processed before manufacturers can use them to make products. For soccer balls, this means converting raw materials into usable plastics and other materials.

The **cover (surface)** of most soccer balls is visible to everyone. It may be patterned with black and white hexagons or a variety of different colors.

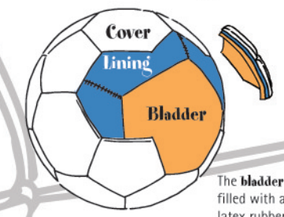
- The surface of soccer balls is made from synthetic leather or rubber, which is typically made from plastics such as types of polyurethane.

Stitching or glue holds the hexagon panels of the surface together.

- Some balls are stitched together using polyester or similar thread, while other balls use glue to hold the panels together.

The **lining** of a ball plays an important role in its strength, structure, and bounce. Layers of lining are placed between the cover and bladder to make sure the thickness of the ball is the same throughout the panels.

- Lining is composed of polyester and/or cotton bonded together.



The **bladder** is the inside part of the ball that is filled with air and is typically made from natural latex rubber or butyl (plastic).

- Bladders made from natural latex rubber provide the softest feel and proper bounce from the ball.
- Bladders made from butyl can hold air longer and retain the ball's shape better than bladders made from latex rubber.

3 Putting the Pieces Together

Although soccer balls can vary in size, weight, and quality, the process to make them is similar:

- Surface material is rolled out—usually several layers of synthetic foam-filled panels are glued (laminated) together to make a strong, yet smooth exterior.
- The lining, made of multiple sheets of fabric, is glued to the cover. The lining goes between the cover and the bladder to provide shape, feel, control, and structure. Balls can have up to four layers of polyester and cotton lining—the more layers, the better the shape and durability of the ball.
- Panels are cut into the exact number needed to make one ball. The number of panels varies for each design.
- Exterior panels are silk-screened with graphics or logos, with each panel printed separately. After printing, the material may have another layer of clear urethane (or other clear plastic substance) applied for protection.
- Holes are pre-punched in each panel and the ball is either hand-stitched or machine-stitched with a polyester thread. A hand-stitched ball takes one person approximately 1.5 hours to sew. A machine-stitched ball takes approximately 10 minutes to be stitched together by many workers.
- The stitched ball is reversed so none of the stitches will show and the bladder is inserted and inflated.
- Soccer balls that are used for professional play or those that include the seal of approval of a soccer organization go through a series of tests performed by an independent laboratory to ensure quality of performance.

4 Getting the Soccer Ball to You

Every material used to make a soccer ball, as well as the finished ball itself, has to get from one place to another—and ultimately to you! Soccer balls are made overseas and are transported by plane, and then truck or train, which requires the use of fossil fuels for energy. Emissions created from the burning of fossil fuels contributes to air pollution and global climate change.

Product packaging helps protect an item from damage, identify the contents, and provide information about the product. But, since it uses valuable natural resources such as paper (from trees), plastic (from crude oil in the Earth), aluminum (from ore), or other materials, excessive or unnecessary packaging can be wasteful. The good news is that the packaging for soccer balls is fairly minimal, usually consisting of a cardboard box or often nothing at all.

Fast Fact

The first international soccer match took place in 1872 between Scotland and England.

5 Using the Ball

Soccer balls come in a variety of different sizes for different age groups, so choosing the right size can impact how you play. In addition, the higher quality soccer balls will likely last longer than cheaper, lower quality balls. One way to ensure quality is to look for a soccer organization's "approval" imprinted on the ball. These designations let you know that the ball has passed tests for proper shape, balance, bounce, and other requirements at an independent laboratory.

Taking good care of your soccer ball will increase its useful life.

Do:

- Check the air pressure frequently to maintain proper pressurization.
- Remove excessive dirt with a damp cloth and mild soap.
- Play on soft, smooth surfaces, such as grass or turf.

Don't:

- Use harsh chemicals for cleaning.
- Play on hard or rough surfaces such as gravel, asphalt, or concrete.
- Play with a wet ball during freezing temperatures.
- Stand or sit on your soccer ball.

Tip

When you buy a ball, try putting a few drops of silicone oil into the valve. The oil will help the ball retain air, and make it easier to insert the needle when refilling it.

6 Reuse

Getting Rid of the Ball

Disposal is a dead-end option. If you can reuse a soccer ball instead of throwing it out, you can save resources, save energy, and prevent pollution.

Recycling a soccer ball is difficult because most of the materials used to make a ball are glued, stitched, or printed and cannot be separated out for recycling. Wondering what to do with your soccer ball when you are done with it? There are two options: reuse it or throw it away. Which one is better for the environment?

Share your love of the sport.

- Donate your used soccer ball to an organization that sends the balls to children who cannot buy their own.
- Donate your soccer gear—shin guards, cleats, or clothes—that you've grown out of or no longer need (see "Global Gear Giveaway" on the back of this poster for more information).
- Organize a "swap" day at your school, camp, or soccer club. Swap your gear for something "new!"

Get Creative.

- Hang your old soccer ball from the ceiling of your garage to mark where the car should stop. The soft ball won't harm the car and may help prevent you from hitting a wall, shelf, or other item in the garage.
- If your ball just won't hold air anymore or is too beat up to be donated, you can give it to your dog or a neighbor's dog as a chew toy. Larger dogs, in particular, love old soccer balls.

EPA

What Is a Life Cycle?

Have you ever considered where the products you use every day come from, or what happens to them when you finish using them? Do you know how each of the products you use impacts the environment?

Just as living things are born, get older, and die, products also complete a life cycle. Each stage of a product's life cycle can affect the environment in different ways. Some products have many different components, each of which has its own life cycle in addition to the life cycle of the composite product. The stages of a product's life cycle usually include:

✓ **Design.** A product's design can influence each stage of its life cycle and, in turn, the environment. Design affects which materials will be used to manufacture a product. For example, cheaper materials are often less durable, which means the product will have a short useful life. Product design can prevent waste in many ways. Products can be designed with modular components that can be easily replaced so that the entire product does not have to be thrown away if only one piece breaks. Items meant to last a long time can avoid trendy designs so they are not thrown away when they go out of style.

✓ **Materials Extraction.** All products are made from materials found in or on the Earth. "Virgin" or "raw" materials, such as trees or ore, are directly mined or harvested from the Earth, a process that can create pollution, use large amounts of energy, and deplete limited natural resources. Making new products from materials that have already been used (recycled materials) can reduce the amount of raw materials we need to take from the Earth.

✓ **Material Processing.** Once materials are extracted, they must be converted into a form that can be used to make products. For example, paper is made from trees, but the wood has to undergo several different processes before we can use it.

✓ **Manufacturing.** Products are made in factories and require a great deal of energy to create. The manufacturing process can also produce pollution. Many products require the use of packaging as well, to prevent spoilage, damage, contamination, and tampering.

✓ **Packaging and Transportation.** The use of packaging can protect products from damage and provide product information. However, packaging consumes valuable natural resources and when used excessively can be wasteful. Some packaging can be made from recycled materials. Finished products are transported in trucks, planes, and trains to different locations where they are sold. All of these forms of transportation burn fossil fuels, which can contribute to global climate change.

✓ **Use.** The way products are used can impact the environment. For example, products that are only used once create more waste than products that are used again and again.

✓ **Reuse/Recycling/Disposal.** Using a product over and over again prevents the need to create the product from scratch, which saves resources and energy while also preventing pollution. Recycling or re-manufacturing products also reduces the amount of new materials that have to be extracted from the Earth. Throwing a product away means that it will end up in a landfill or incinerator and will not be useful again.

What's in That Ball?

The materials used to make soccer balls have evolved over the years. Early balls were made of stitched-up cloth, pig or cow bladders, and even animal and human skulls. Today's soccer balls are made from synthetic leather and other raw materials so that they maintain their shape, and are fast in flight, waterproof, soft to the touch, and safe to head. The timeline at the bottom of this poster shows how the content and design of the soccer ball has changed over the years.

From the list below, match the raw material found in the Earth to the product that is created and used to make soccer balls.

Product	Source
Plastic	Plants
Natural latex rubber	Animal bones, fish, starch, milk protein
Glue	Plant extract
Silicone	Crude oil
Cotton	Earth's crust

Answers:
Plastic = crude oil; Natural latex rubber = plant extract; Glue = animal bones, fish, starch, milk protein; Silicone = earth's crust; Cotton = plants.

South American Soccer Smarts

Soccer is played all over the world and is especially popular in South America, where reducing waste is as important as it is in the United States. In many of these countries environmental laws are not strict enough to enforce wise use of natural resources, so common activities like logging and pollution can cause environmental concern.

Use the following clues to determine which South American country is being described.

To learn more about these countries, you can conduct your own research on the Internet or at your school library. What kind of language, culture, and climate do these countries have? Do they face any particular kind of environmental problems, such as air pollution? Why? What can be done to improve the state of the environment of these countries?

Answer Key:
1. B; 2. F; 3. I; 4. C; 5. J; 6. D; 7. E; 8. A; 9. H; 10. G

1. This country has more than 1,920 recorded species of birds and is home to Carlos Valderrama, who led the country to three World Cups.
2. This country, which boasts both deserts and glaciers, suffers from extensive logging outside of protected areas. It also hosted the World Cup in 1962.
3. Due to the dense human population in the eastern part of this country, mammals such as the giant anteater, maned wolf, Brazilian tapir, and jaguar are quickly disappearing. In 1998, it also had the first Golden Goal scored in a World Cup match by Laurent Blanc.
4. No bigger than the state of Nevada, this country suffered an oil spill off the coast of the Galapagos Islands in 2001. It also participated in the World Cup for the first time in 2002.
5. This country has won three World Cups with the help of Pelé, who scored more than 1,000 goals in his career. The Amazon, the world's longest river, is also found here.
6. Well-known striker Teofilio Cubillas, who scored 10 World Cup goals, is from this South American country, which claims paper-making as a primary industry.
7. This country is the fifth-largest in South America, measuring roughly the size of France and Spain combined. The country lost to Spain 3-1 in the 1994 World Cup.
8. More than 30 percent of this country is taken up by the grassland plain of the central Llanos, which is drained by the continent's third-largest river, the Rio Orinoco. It is also the only South American country where baseball is more popular than soccer.
9. Five rivers flow westward across this country and drain into the Rio Uruguay. It's been more than half a century since this country won the World Cup.
10. This country's national parks preserve unique thorn forests, virgin rainforests, flowering cacti, and extensive forests of monkey-puzzle trees. It is also home to Diego Maradona, one of the best dribblers in soccer history.

Shipping Out

Transportation is a major part of the environmental impacts of soccer balls. Soccer balls are not manufactured in the United States, which means they must be transported to your local sports store by plane, boat, train, and/or truck. The fuel used during this transport releases carbon dioxide (CO_2), a greenhouse gas that contributes to global climate change. Kick your math skills into gear by answering the questions below.

1. Out of all the forms of transportation, air travel creates the most CO_2 emissions. Therefore, many soccer ball and equipment manufacturers are attempting to reduce the number of shipments of products by air.
   - **a.** For example, one major soccer apparel manufacturer reduced its air freight shipments by 5 percent from 2000 to 2001 through improved planning and production. If the company had 20,000 shipments in 2000, what was its number of shipments in 2001?
   - **b.** How many total shipments would the company have if it decreased its number of shipments by another 3 percent in 2002?
2. A one-way flight from Hong Kong, China (where many soccer balls are made), to Los Angeles, California, in the United States is 7,233 miles. To make this trip an average airplane uses 1,500 gallons of fuel, which produces approximately 36,000 pounds of CO_2 emissions.
   - **a.** How much fuel (in gallons) is required for a round-trip flight between these two cities?
   - **b.** If a manufacturer requires 500 air shipments a year from Hong Kong to Los Angeles, how much CO_2 will be emitted (in pounds)?
   - **c.** What if the number of trips was reduced by 5 percent? How much less CO_2 (in pounds) would be emitted?
   - **d.** To put these numbers in perspective, the CO_2 emissions for a one-way trip from Hong Kong to Los Angeles is equivalent to the CO_2 emitted by 772 cars in one day! Let's say 10 one-way flights were made in one day. That's the equivalent in CO_2 emissions of how many cars?

Answer Key:
1a) 19,000 **1b)** 18,430
2a) 3,000 gallons **2b)** 18 million pounds **2c)** 900,000 pounds **2d)** 7,720

Global Gear Giveaway

One great way to extend the life of your soccer ball is to give it to someone else when you're finished with it. In many parts of the world, balls and other sporting equipment are very expensive and difficult to find. You can help others and be environmentally friendly by sending your used sporting equipment (either individually or by organizing a collection drive) to kids and teams who would otherwise not have them.

Here are some tips for organizing a successful equipment drive in your school or community. You can collect lots of used gear to donate, and prevent useful items from ending up in the trash.

1. Check in with the organization you will be working with on what kind of equipment they accept, and only collect those items. (See the list of organizations below).
2. Set up bins, cardboard boxes, or trash cans in a central location so people can drop off their gear. These can be set up at your school, church, local businesses, sports and recreation fields, etc.
3. Determine a time frame for your collection. For your first drive, a shorter time frame might be more manageable, so as to control the amount of gear you receive. Pick a specific date to end the drive.
4. Try to get as many people as possible involved. Inform people through your school, local sports leagues and teams, local newspapers or other media outlets, or simply word-of-mouth. Most people will be more than willing to help out and happy to know that their old gear will be of use.
5. Make sure you record the amount you send off so you can report back to the families that participated, as well as to local papers.

Organizations That Collect Used Sporting Equipment

Make sure to check with the individual organizations to confirm their donation policies.

- The Passback program collects playable soccer gear and sends it to teams and organizations that cannot afford even the most basic equipment. **<www.passback.com>**
- One World Running collects, washes, and sends new and "near-new" athletic shoes, T-shirts, and shorts, along with medicine and school supplies, to athletes and children in developing countries. **<www.oneworldrunning.com>**
- Goodwill sorts and prices your sporting equipment (as well as other items) and then sells it in one of their 1,900 well-known retail stores across North America. The revenue from the stores helps fund programs that give people job training and other career services. **<www.goodwill.org>**
- The Nike Reuse-A-Shoe program takes old, worn-out, unusable footwear and converts them into basketball and tennis courts, running tracks, and athletic fields. **<http://nikereuseashoe.com>**

Crafts for Kicks

Do you have an old soccer ball that you can't use anymore but can't bear to part with? Perhaps it was the game ball from the first time you scored, or the first soccer ball you ever received. Whatever its sentimental value, an old ball sitting on the shelf isn't very useful, so why not try to extend its life by turning it into something else?

Ball Handler

Make a decorative flower pot out of your soccer ball.

You will need:

- An old soccer ball
- Scissors
- Two small potted plants
- A pencil

Directions:

1. With your pencil, draw a line around the center of the soccer ball. This will be the line you follow to cut your soccer ball in half.
2. Begin cutting the cover of the soccer ball. You may find that it is easier to cut along the panel stitching rather than trying to cut a straight line.
3. When the soccer ball has been cut, begin removing the lining and the bladder so that all that is left is the two halves of the soccer ball cover.
4. Take your potted plant and place it, with its pot, inside one half of the soccer ball. Do the same thing with the second potted plant and the other half of the soccer ball.
5. Place your plant and new holder in a spot that is appropriate for the plant to grow. You might want to put the holder on a plate to catch excess water.

For a more fitted pot holder, transfer the plant from it's existing pot directly into the half soccer ball. Before doing this, line the soccer ball with plastic wrap or aluminum foil to keep water from leaking. Add extra soil as necessary to fill the soccer ball.

Bank the Shot

To make a bank out of your ball, you will need:

- An old soccer ball
- Scissors
- A pencil
- A thick sewing needle
- Thread

Directions:

1. Deflate your old soccer ball.
2. Cut a slit in the ball. Pull out all of the lining and the bladder. As you begin pulling out the insides of the ball, you may find that you need to widen the slit you cut, do so with scissors instead of allowing the ball cover to rip.
3. When all of the insides are out, begin sewing your ball back together. Leave about 1½ inches open on the ball so that you can add coins to it.
4. Begin filling your ball with coins. Watch your ball firm up as you add more and more money. When the ball is full, cut the thread and take out all of the coins. Use your coins to buy tickets to a soccer match, donate the money to a charity, or put the money away in savings.
5. When you are ready to start collecting money again, sew the slit back together, again leaving an open slot for coins and start the process all over again! You are giving your soccer ball a second life as a bank, and using it over and over again.

Sun Safety

Most soccer games around the world are played outside. However, spending too much time in the sun can lead to skin damage, including sunburn, blisters, leathery skin, and skin cancer. Wearing sun protective items can protect your skin from the effects of the sun.

Today's sun rays are so strong because of the loss of ozone. Ozone is a naturally occurring gas found in Earth's upper atmosphere that absorbs the sun's harmful ultraviolet (UV) rays. Until recently, a variety of chemicals, including chlorofluorocarbons, released into the atmosphere reduced the amount of ozone. Realizing the danger they posed, these chemicals were banned from use in manufacturing processes and products. With the depletion of the protective layer of ozone, we receive more UV radiation on Earth, which makes the sun more harmful to our skin.

Using a stopwatch, spend 60 seconds memorizing the sun protection items below. When the 60 seconds are up, pull out a blank sheet of paper and write down as many as you can remember. How many of these items can you remember to use when you spend time in the sun? How does each item help protect you from harmful UV rays?

For more information about sun safety, visit **<www.epa.gov/sunwise>**.

For more information, check out what these organizations are doing to protect the environment:

Adidas
http://www.adidas-salomon.com/en/sustainability/environment/default.asp

Nike
http://www.nike.com/nikebiz/nikebiz.jhtml?page=27

Soccer Balls Through the Ages

1855
Charles Goodyear designed and built the first treated rubber soccer balls.

1862
H.J. Lindon developed one of the first inflatable rubber bladders for balls.

1863
The newly formed English Football Association, or EFA (named so because soccer is known as football in every nation except the United States), met to decide on the laws of the game. No description of the ball was offered in the first set of rules.

1872
The EFA revised the rules of soccer, including that the ball "must be spherical with a circumference of 27 to 28 inches." That rule remains in today's Fédération Internationale de Football Association (FIFA) laws. EFA and FIFA are both members of the International Football Association Board.

Late 1880s
Top-grade ball covers were made with leather from the rump of a cow while lower quality balls were made from the shoulder.

1937
The official size and weight of the soccer ball was changed slightly when the official weight range was increased from 13 to 15 ounces to 14 to 16 ounces.

1960s
The first totally synthetic ball was produced.

1980s
Synthetic leather totally replaced the leather ball.

2002
A new ball made entirely of synthetic materials was introduced as the official soccer ball of the 2002 World Cup. Controversy ensued as some players felt that the materials used made the ball too light and bouncy to control.

1850 1860 1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000

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