
Smithsonian
Safe Cycling
SAMPLE
Nicole Sipe

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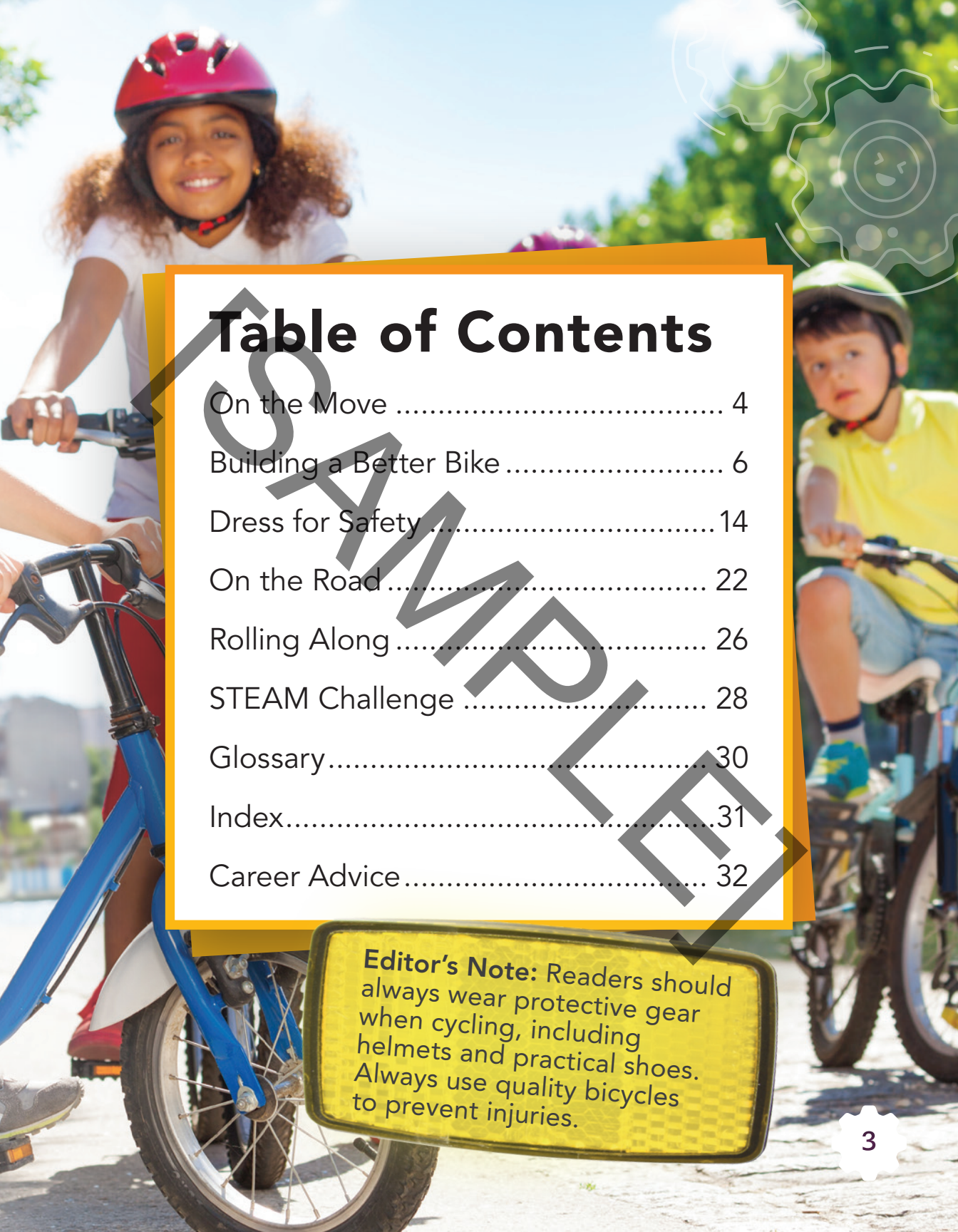

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Editor's Note: Readers should always wear protective gear when cycling, including helmets and practical shoes. Always use quality bicycles to prevent injuries.

On the Move

You feel the cool wind blow through your hair. You hear the swoosh sound your bicycle makes with each turn of the pedal. You ride faster and faster until you feel as though you are flying.

All these things make riding a bike fun. But staying safe makes it even more fun. Riding a bike used to be dangerous. People were badly hurt. Today, **engineers** work hard to keep bike riders safe.

One of the first modern bikes was made by a German man in 1817. He called it a *Laufmaschine*, or "running machine."

Building a Better Bike

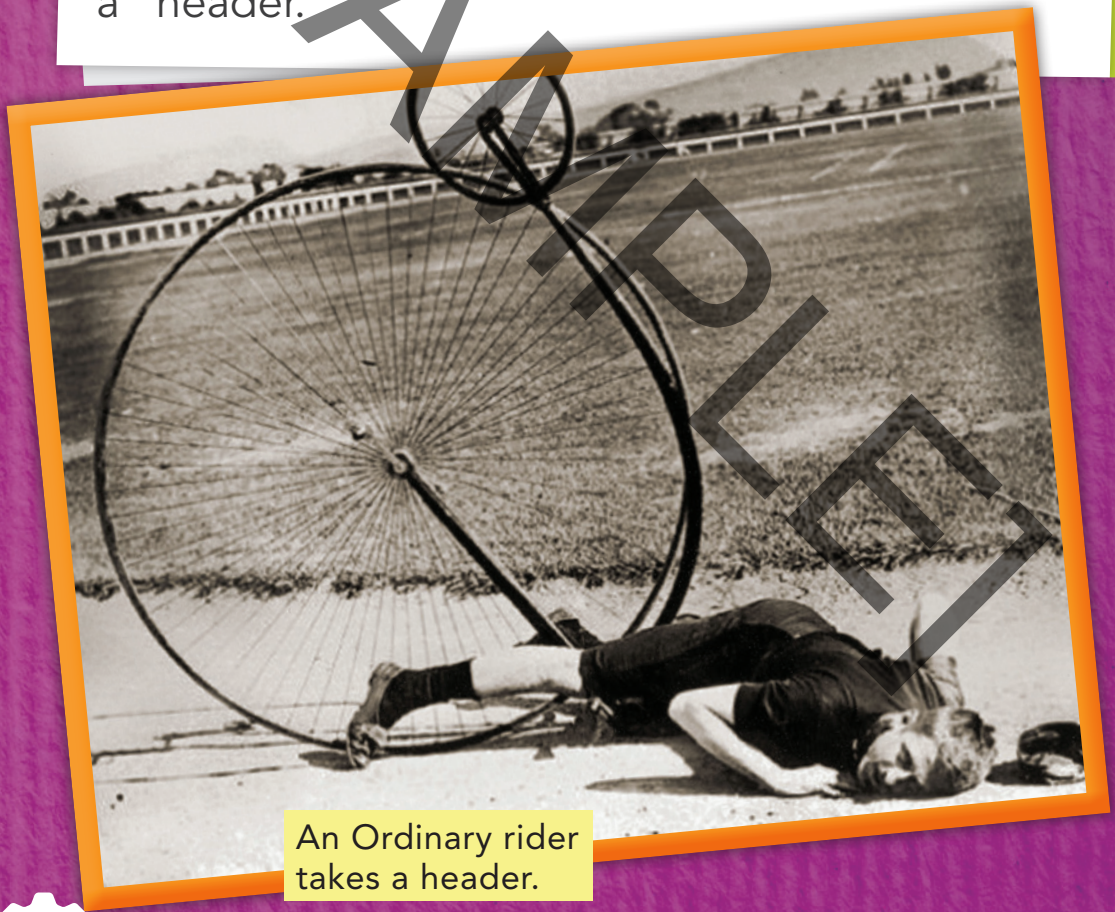
In the late 1860s, bikes started to become popular. Many adults rode them. The first bikes did not look like bikes that people have today.

About 10 years later, a new bike became popular. It had a huge front wheel and a small back wheel. A bike like this was called an Ordinary. Riders of these bikes sat high off the ground.

A man rides an Ordinary in 2015.

Ordinary bikes were light and fast. But they were not safe. They were hard to get on and off safely. Riders had to climb onto a seat that was about 1 meter (3 feet) off the ground.

Ordinary bikes also caused a lot of accidents. Riders sat on top of the big wheel, not in the center of the bike. When they had to stop fast, they could fly headfirst off the bike. This happened a lot! It became known as taking a "header."



An Ordinary rider takes a header.

This painting from around 1887 shows people riding types of Ordinary bikes.

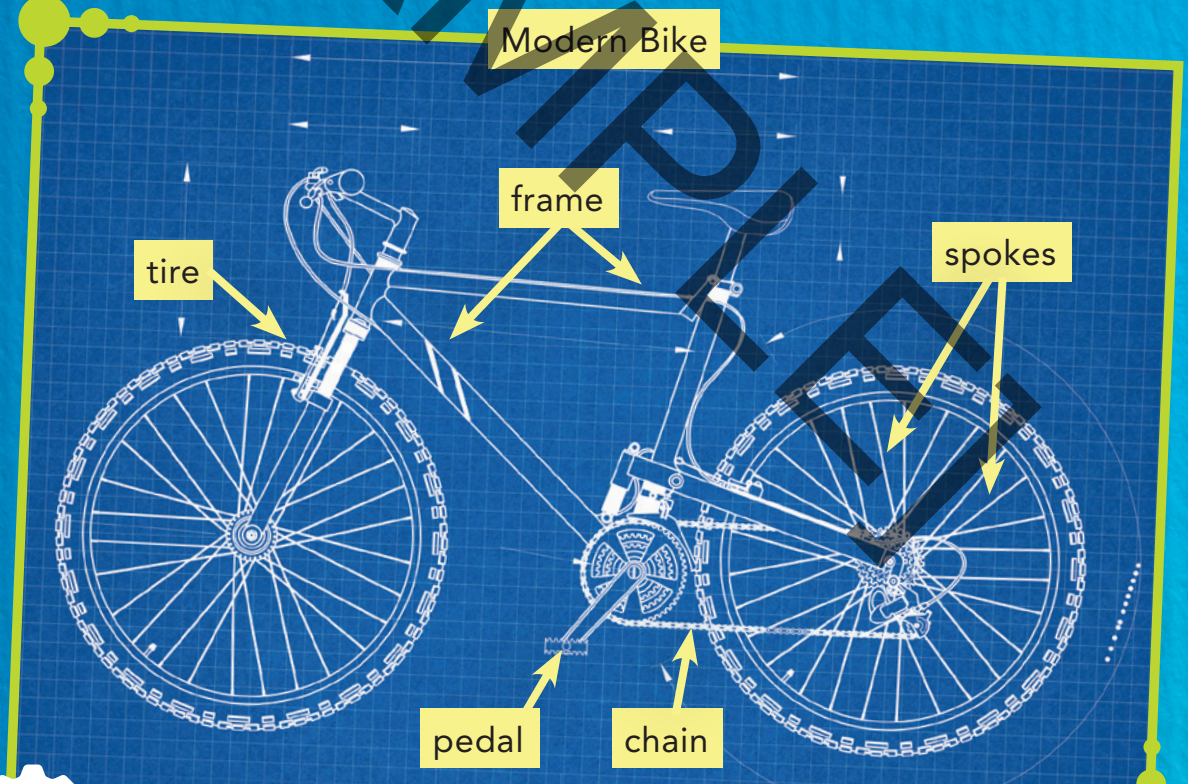
Technology & Engineering

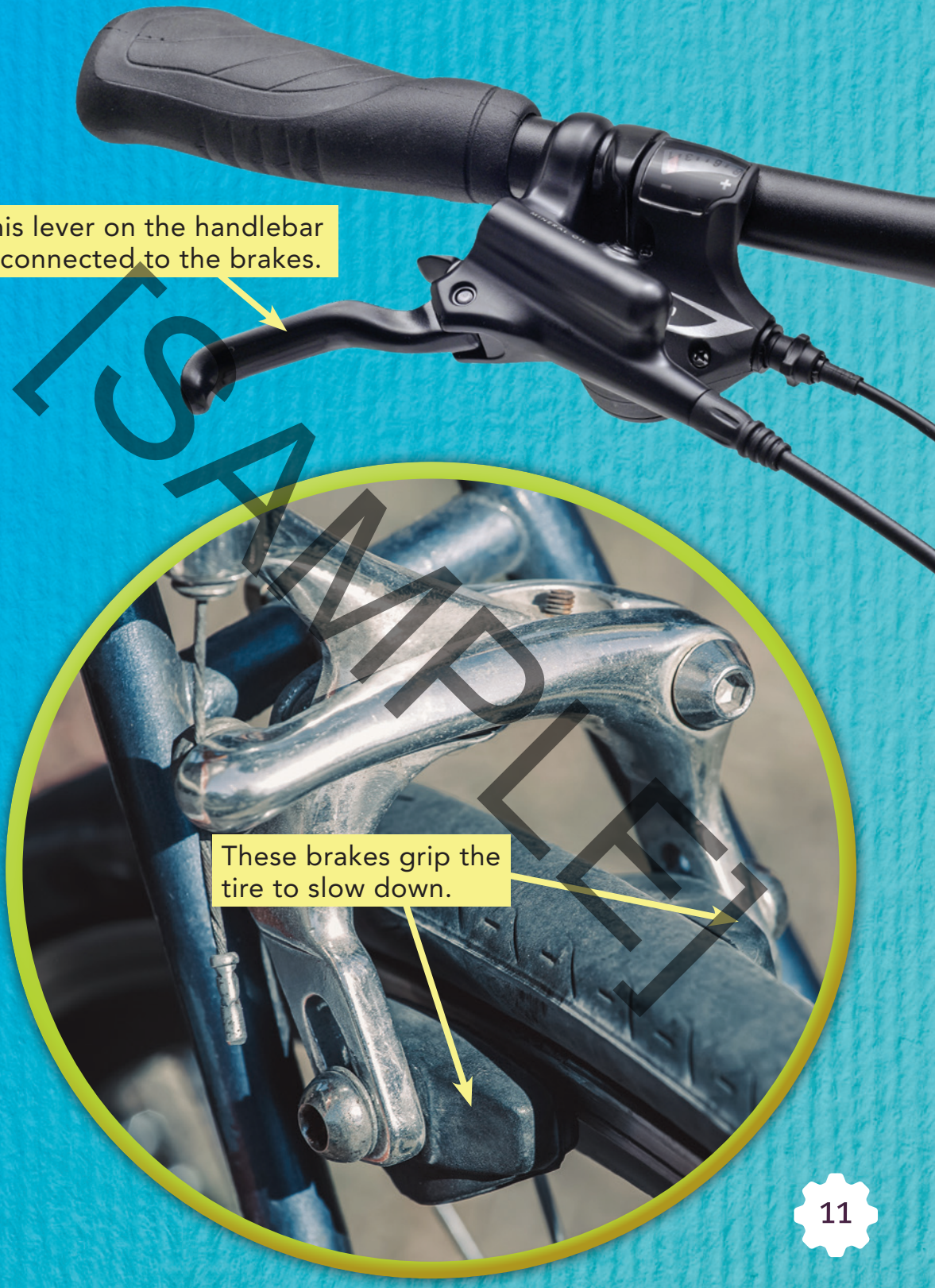
Wheel Size

Ordinary bikes were also called "penny-farthings." That nickname came from coins at the time. Pennies were big and farthings were small, just like the bike's tires. The big wheel helped riders go farther with less pedaling. The small wheel helped riders get on the bike easier.

Over the years, people built better bikes. They found ways to make bikes safer. Bikes today are much better than they were in the past. They are built to make cycling easy, fun, and safe.

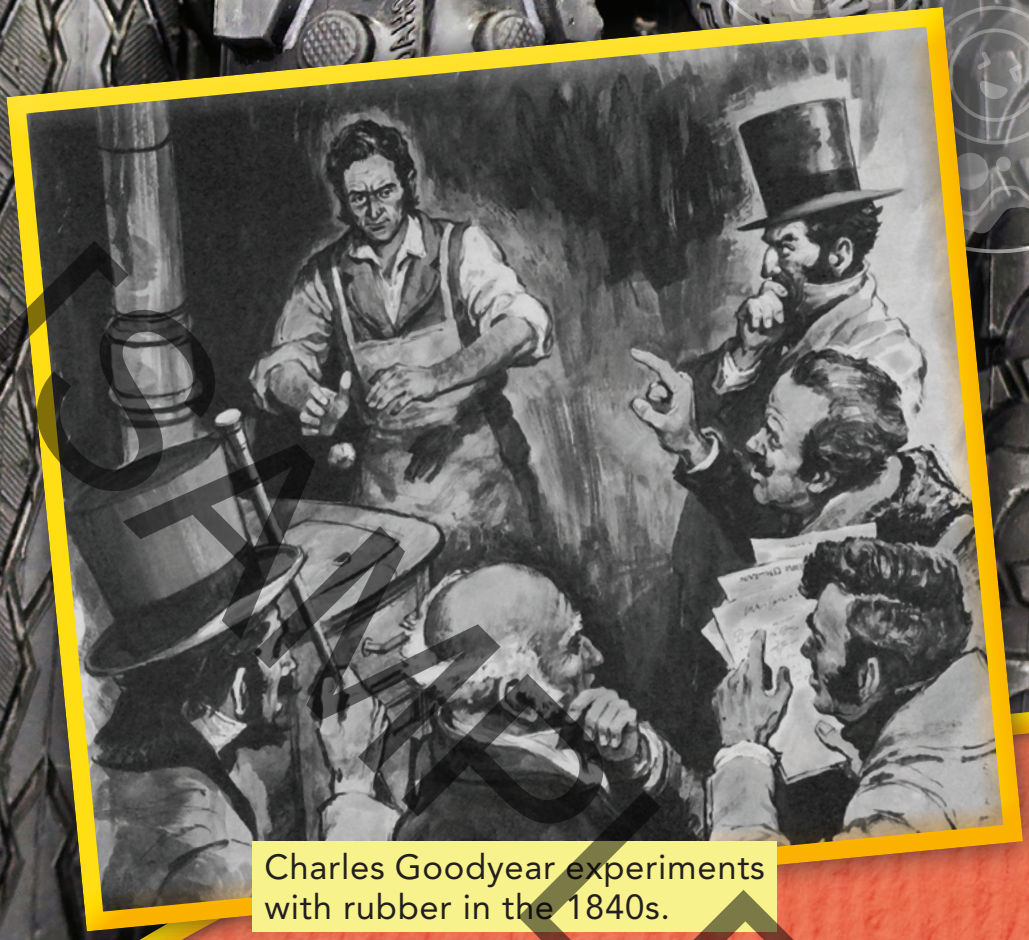
One way bikes were made safer is with **brakes**. Brakes help people stop. Also today's bikes sit low to the ground. Riders can put their feet on the ground to keep from tipping over when they are stopped.




This lever on the handlebar is connected to the brakes.
These brakes grip the tire to slow down.

Today's bikes are also safer because of their same-sized wheels. These wheels help riders get on and off bikes easily. Today's bike tires are made of rubber. Rubber is soft but strong. These rubber tires are filled with air. Air-filled tires make riding smooth. Bike tires have grooves, or **treads**, on them. These patterns grip the road. They keep bikes from slipping and sliding.

These patches can be used to fix holes in bike tires.



Charles Goodyear experiments with rubber in the 1840s.

Science

A Tread for Every Ride

Different treads are used to fight against **friction**. If a bike rider is trying to pedal forward, friction is the force that tries to stop them. Bike riders choose their tire treads based on what type of friction they will face.

Dress for Safety

Bikes are built to keep riders safe. But riders can still fall and get hurt. So it is important to wear the right **gear** to stay safe.

There is a lot of **equipment** riders can wear while cycling. Helmets, knee pads, and elbow pads are three key pieces of gear. Gloves and bright vests are also helpful. All these pieces of equipment help riders dress for safety.

A bike rider checks her elbow pads.

These bright vests help people see bike riders more easily.

This bike rider wears a helmet and a bright vest to stay safe.

Helmets

Safe cycling means wearing a helmet. In a lot of places, it is the law! A helmet protects a rider's head in two ways. The inside of a helmet is made of soft foam. The foam pads a rider's head. The outside of a helmet is hard plastic. It helps protect a rider from the **impact** of a fall. The two work together to help protect riders' heads.

A helmet should sit flat on your head. The front should be two fingers above your eyebrows, and the straps should form a Y shape over your ears.

Pads

Some bike riders wear pads when they ride. Pads protect riders' knees and elbows from scrapes and cuts. The outsides of pads are hard. They **absorb** the impact when riders fall, just like helmets do. The insides of pads are soft. This makes them comfortable to wear. Many pads have stretchy fabric on them. It helps riders move with ease.

A rider wears safety gear as he pedals downhill.

Gloves and Vests

Many riders also wear gloves and vests to stay safe. Gloves protect riders' hands if they fall. Bike gloves are not thick like snow gloves. They are thin and stretchy. This helps riders grip their handlebars when they wear them.

Many riders also wear safety vests. These vests are made of **reflective** fabrics. Light from cars or the sun reflects, or bounces, off the fabric. Drivers can more easily see riders both during the day and at night.

gloves

This rider wears a safety vest while riding in Serbia.

Arts

Shining Bright

Reflective material is made with tiny glass beads. The beads are so small that people need microscopes to see them. Light sources, such as sunlight or cars' headlights, shine on the beads. The beads reflect the light back like mirrors.

On the Road

There is a lot of gear that helps keep bike riders safe. But it is still important for drivers to be aware of bike riders. To help with this, some engineers are planning roads with bikes in mind.

There are a lot of ways to keep people safe on the road. One way is by using bike lanes. These are lanes that are marked just for bike riders. They keep bikes away from vehicles.

This sign reminds walkers and riders to use the correct sides of the road.

This street has lanes for bike riders and walkers.

bike lane

To keep bike riders safe, many towns have lower speed limits near bike lanes. This means that drivers must go slower when they are near riders. Slower speeds lead to safer roads.

Some cities have whole streets just for bikes. These streets are called "bicycle boulevards." Riders there do not have to look out for cars.

Riders use a bicycle boulevard in Brazil.

Mathematics

Speed Limits

Engineers use math to set speed limits. They first look at how fast cars will probably go on a road. They also look at how many lanes there are. Then, they think about who uses the road, such as bike riders. This helps them figure out the safest speed.

This sign reminds drivers to share the road with bike riders.

Rolling Along

Nothing beats the feeling of riding a bike. Cycling is fun! Good thing for us, riding a bike is now safe too. We can thank engineers for that.

Even today, engineers are finding new ways to make riding bikes safer. So, put on your gear. You are in for a fun—and safe—ride!


SAMPLE

STEAM CHALLENGE

Define the Problem

Bike riders need to stay safe while they ride. A company has asked you to build a model of a new bicycle helmet.

Constraints: You may only use cardboard, duct tape, glue, foam pool noodles, tissue paper, and plastic bags.

Criteria: Your helmet must fit and protect a honeydew melon when dropped from a height of 1 m (3 ft.).

Research and Brainstorm

What are the different parts of a helmet? How do they work together to protect a bike rider's head?

Design and Build

Sketch a plan for your helmet. Label the parts. What purpose will each part serve? What materials will work best? Build the model.

Test and Improve

Place your helmet on the melon. Drop the melon 1 m (3 ft.). Did your helmet keep the melon safe? How can you improve it? Improve your design and try again.

Reflect and Share

What other materials might keep your melon safe? How might your design change if you had to drop the melon from 3 m (10 ft.) off the ground?

Glossary

absorb—to take in

balanced—steady

brakes—devices for stopping or slowing things

engineers—people who use science to design solutions for problems or needs

equipment—tools or supplies

friction—the force that makes a moving object slow when it touches another object

gear—tools, supplies, or clothes

impact—the force or act of one thing hitting another

reflective—causing light, heat, or sound to bounce off

treads—patterns of raised lines on the surface of rubber

Index

Career Advice
from Smithsonian

Do you want to keep bike riders safe?
Here are some tips to get you started.

"Ride a bike to school or to visit friends. But remember to be responsible. Riding a bike will teach you how to be safe and make good decisions." ***—Peter Liebhold, Curator***

"Riding my bike lets me travel farther, go faster, and explore more. When I'm riding my bike, I feel free as a bird!"***—Ken Raham, Mass Digitization Program Officer***

Read and Respond

1. What gear keeps bike riders safe?
2. How are today's bikes safer than Ordinary bikes?
3. What things can you do to make cycling safer?
4. Should all streets have bike lanes? Why or why not?
5. Why do you think bike equipment is made with a mixture of hard and soft materials?
6. Write a list of features that a bike-safe town or city should have.