SCIENCE FOR Little Hearts AND Hands

THE BIG BOOK of SCIENCE STORIES

SPARKS and STARS

The Good AND THE Beautiful
CURRICULUM

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Ava's Tower of Atoms

Illustrated by
Bojana Stojanovic

Ava stepped into the schoolroom one sunny afternoon, searching for her favorite doll. She remembered using Dolly to help her answer her math facts earlier that morning. But Ava stopped short when she entered, noticing her mother hanging a large poster on the wall. The room was cozy, with bookcases lining the far wall and a calendar and charts decorating the wall where her mother was standing. A table sat in the middle of the room, and Dolly was sitting neatly on one of the chairs.

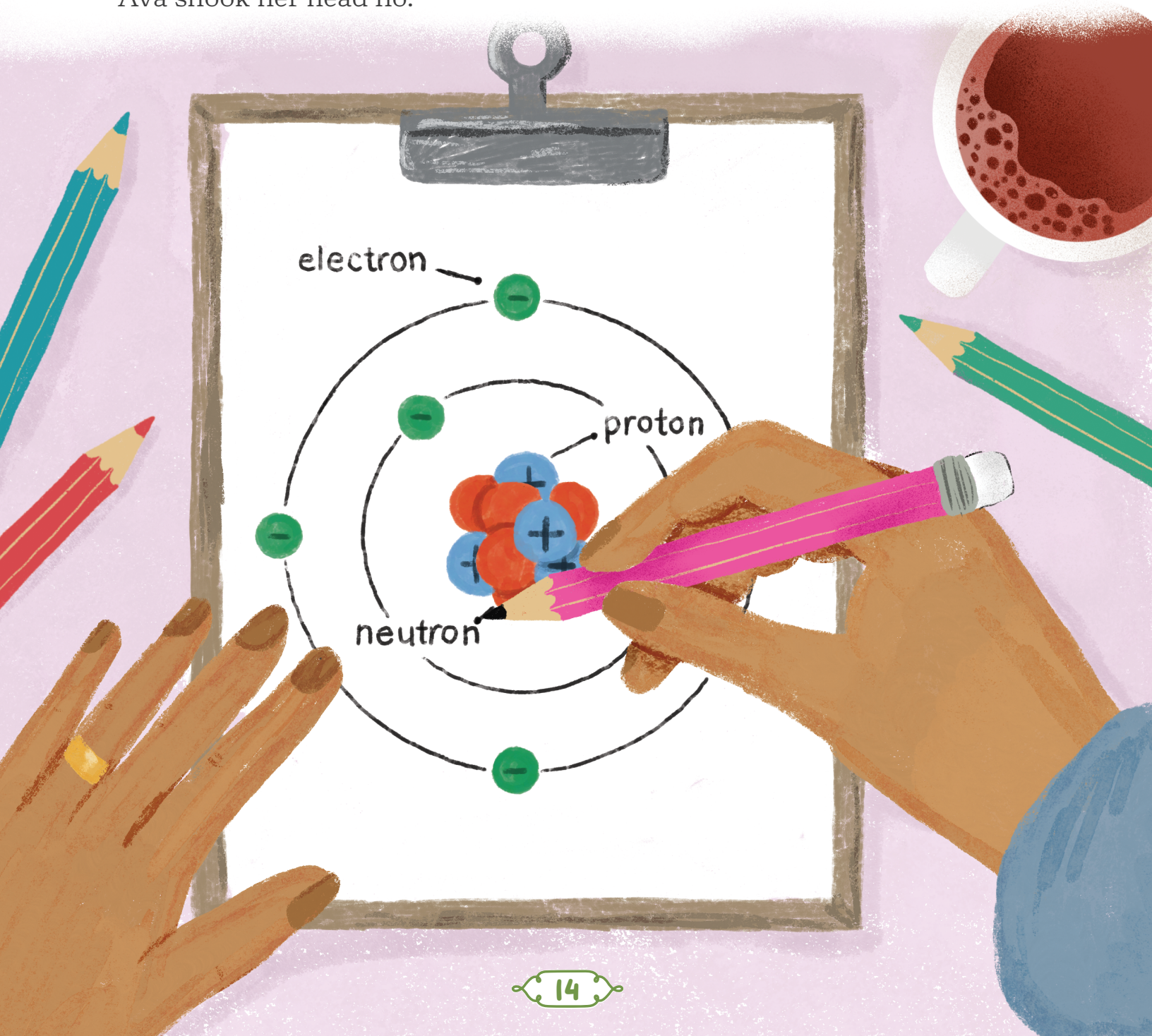
Ava was happy to see Dolly and scooped the doll up as she walked past, but she was more interested now in what her mother was doing with the large poster. Her mother occasionally swapped out posters on the walls when they learned about new subjects, and any kind of change was always exciting. The new poster had different-colored boxes all over it and letters too, but it wasn't any kind of alphabet or number chart Ava had ever seen.

"An atom has three basic parts: protons, neutrons, and electrons. The protons and neutrons clump together in the middle to make what is called a nucleus, while the electrons surround the nucleus in layers called shells," Mom explained.

"How does that connect to the chart you were putting up?" Ava asked.

"Let's explore more, and I think you'll understand. Look at these blocks Olivia is playing with. Each block is kind of like an atom. Do all the blocks look the same?"

Ava shook her head no.



Mom continued, “If I stacked all the pink blocks together, it would be like making a group of one kind of atom. A group of atoms that are all the same kind makes an element. The periodic table you were looking at shows all the different types of elements on the earth. You have seen many elements in real life. The gold in my wedding ring is an element, which means that it’s made up of only one kind of atom.”

"Oh, so each one of those boxes stands for an element? How many are there?" Ava asked.

"Scientists have discovered 118 elements so far. The different elements can work together to make something new, though. What if we built something out of different colors of blocks, such as a tower? The tower would be like us building something called a molecule, which can be made up of more than one element. The elements work together to build everything in our world. Pretty amazing, right? Elements can rearrange to form new molecules, just like these blocks can rearrange to build new things."

“Wow. That is a lot of information. Maybe I will need to listen in on the chemistry lessons next week to understand it better. Thanks for teaching me a little, though. Want to have a competition to see who can build the tallest block tower without it falling over?” Ava asked.

“Definitely! Let’s go!” Mom smiled and began stacking blocks.

Ava began stacking her blocks quickly too. Olivia’s was already getting tall, but as Ava added layers to hers, it fell with a clatter just after. They all giggled in the pile of blocks.

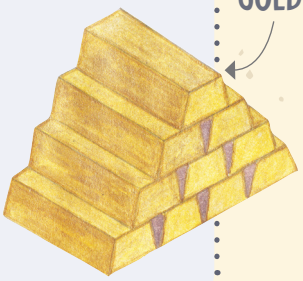
FUN FACTS ABOUT ATOMS AND MOLECULES

Our bodies are made up of atoms. There are so many in every body that it is almost difficult to think about. Even a baby has trillions upon trillions of atoms that make up his or her body.

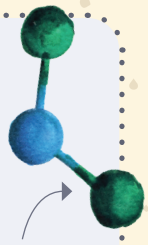
Each element has its own **atomic number** on the periodic table. This number describes how many protons the element has in its nucleus. Gold has 79 protons in its nucleus, so its atomic number is 79.

The tiny electrons inside atoms can actually move around, and they sometimes jump from one atom to another.

The elements on the periodic table exist in different states of matter. Some of the elements, such as hydrogen and oxygen, are gases. Some are solid metals, such as gold and iron. Mercury and bromine are two elements that can exist as liquids.



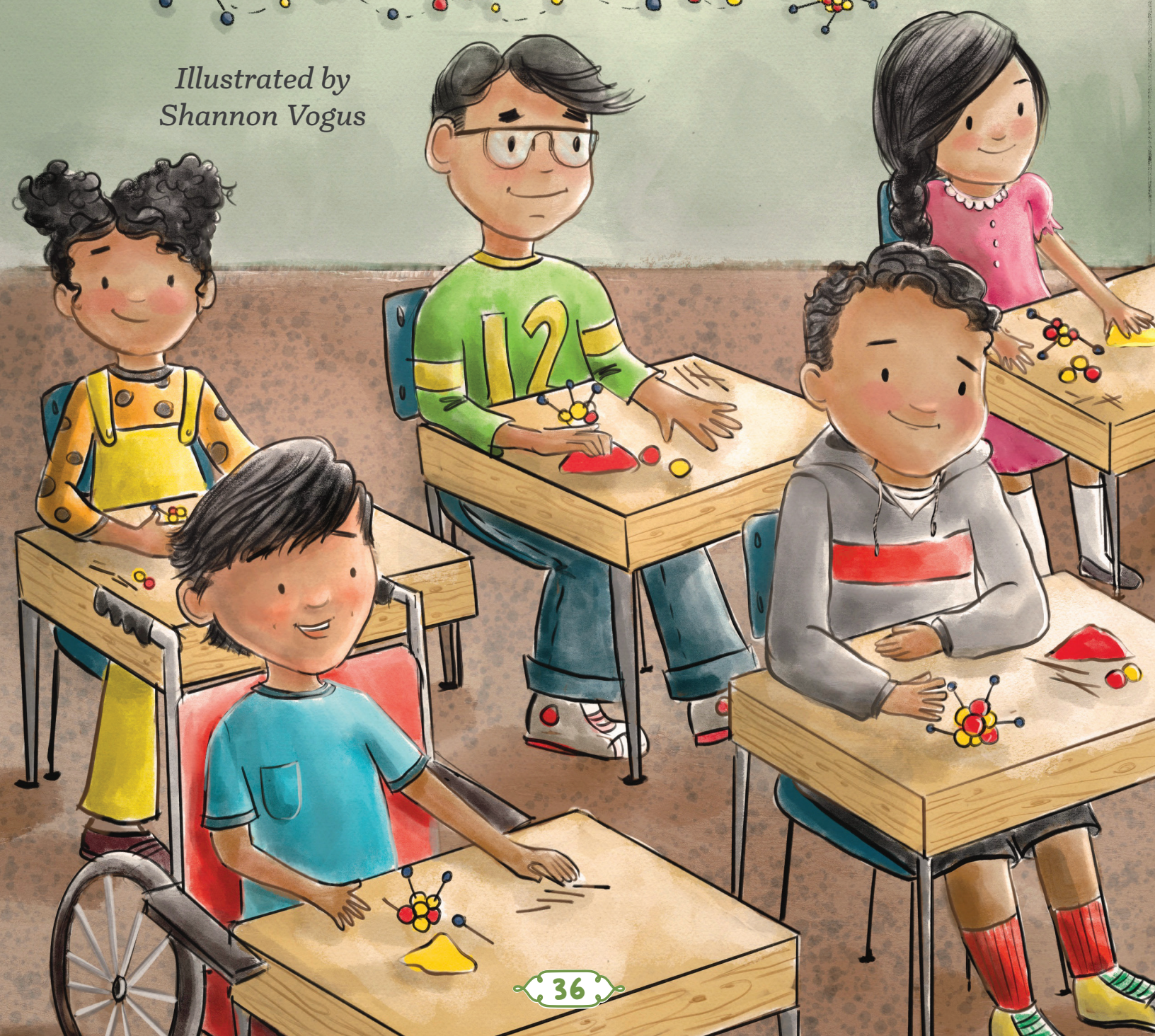
When atoms come together, they form something called a **molecule**. When two atoms of hydrogen are joined with one atom of oxygen, a molecule of water is created!



There are more atoms of hydrogen than any other kind of atom in the universe. There are hydrogen atoms inside all the parts of our bodies. There is a little bit of hydrogen in the air we breathe. Even the water we drink and take a bath in is made up of lots and lots of hydrogen atoms!

ELECTRONS on the MOVE

Illustrated by Shannon Vogus




ATOM
PROTON

It was raining outside as Miguel and his two best friends, Bruno and Carmen, entered their science classroom. Today was experiment day—Miguel's favorite day of the week.

As the three children reached their desks, they noticed little balls of different colors and sizes of play dough sitting on their desktops. Next to the play dough were handfuls of toothpicks.

When they had taken their seats, their teacher, Mr. Gomez, said enthusiastically, "Today we are going to build atoms!"

Mr. Gomez began, “All matter on Earth is made from tiny things that can’t be seen without microscopes, called atoms. In the center of an atom is a nucleus with even smaller particles called protons and neutrons. Let’s make a nucleus.”

Grabbing a handful of yellow and red play-dough balls, Mr. Gomez very gently pressed them together. “The red balls will be our protons, and the yellow balls will be our neutrons,” he explained. Everyone began working on their atom models.

Illustrated by Shannon Vogus


·PLANETARIUM·

Kevin slides on his shoes in a rush and grabs his water bottle off the counter. He skips out the front door and hops into the van, clicking his seatbelt.

"Ready, Kevin?" Mom asks, turning around with a grin.

"Definitely! I can't wait for this field trip!" he replies, wiggling excitedly in his seat.

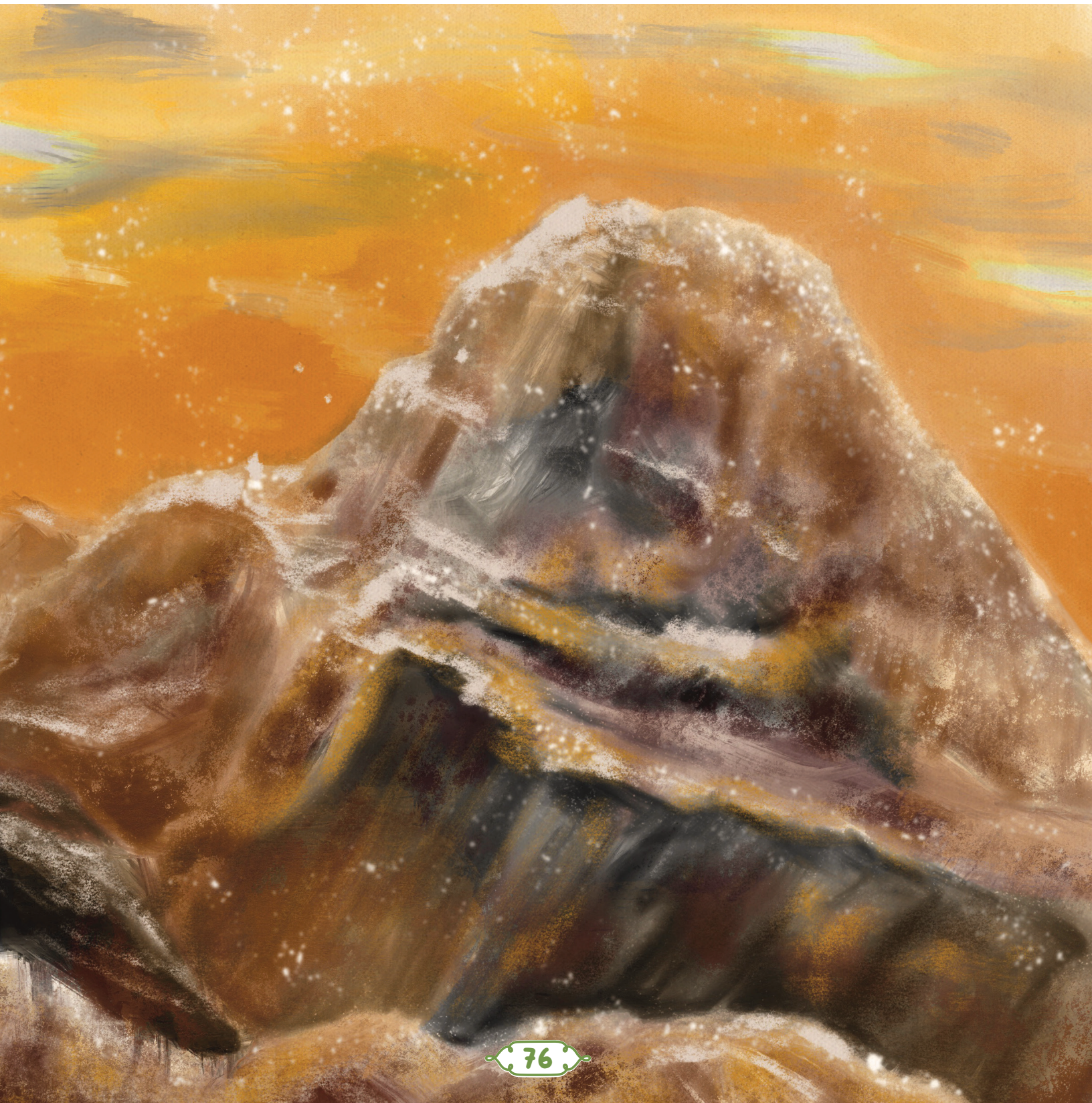
"Go, go, go!" Kevin's baby sister, Eleanor, chants from her car seat. Mom and Kevin laugh at how excited she is as they pull out of the neighborhood. Today, they are meeting up with their homeschool group at the local planetarium, which is a theater shaped like a dome that shows videos about space on the ceiling. Kevin doesn't think they can get there fast enough.

The video makes the audience members feel as if they are soaring over the land like birds flying low across the planet.

"Venus is rocky and has lava and many different types of volcanoes everywhere," Dawn continues. "Most of the volcanoes aren't very tall, and their sides aren't very steep, giving Venus's surface the appearance of rolling hills. One unique type of volcano here is called an arachnoid volcano. It looks a bit like a spiderweb."

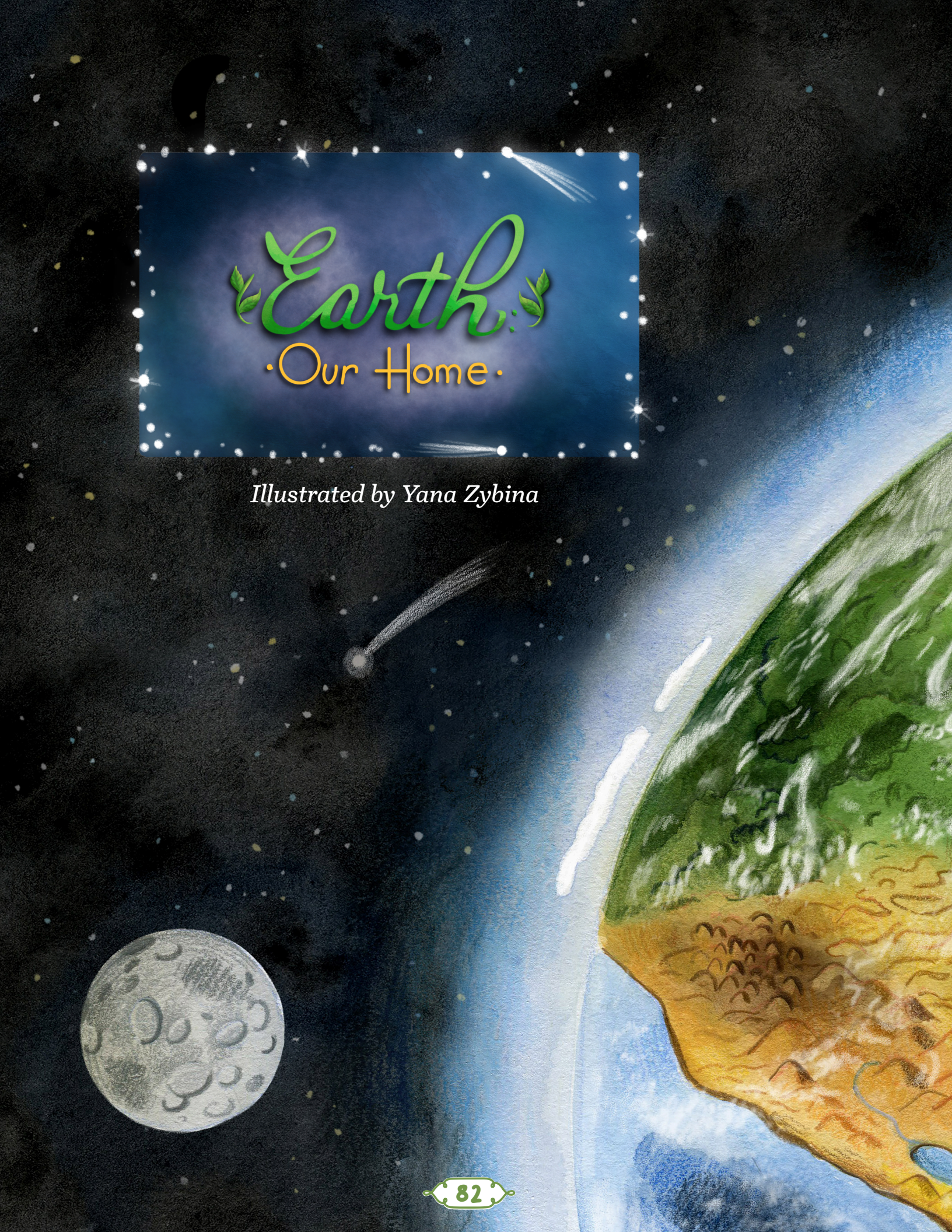
"That is so cool," Clark whispers to himself as the spiderweb volcano comes into view. He keeps watching the screen in fascination.

"The largest mountain range on Venus is called Maxwell Montes. Do you see the white areas that look like snow on the tops of the mountains? That's not actually snow at all; it's frost made from metals that boiled, evaporated into the atmosphere, cooled, and settled on the mountains," Dawn explains.



The view of the screen shifts, and the audience is now looking at Venus's sky. It is raining. Dawn continues narrating: "The rain on Venus isn't made of water like ours on Earth—it would actually burn your skin. But don't worry—because Venus is so hot, the rain actually dries up before it hits the surface."

Kevin almost puts his hands up to cover his body before remembering he is still sitting safely in his seat at the planetarium. It all looks so real.

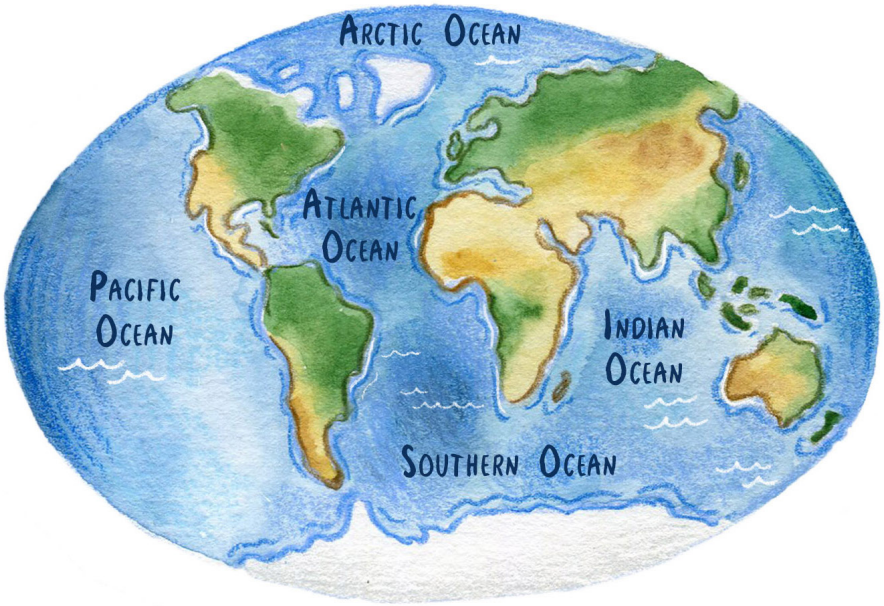


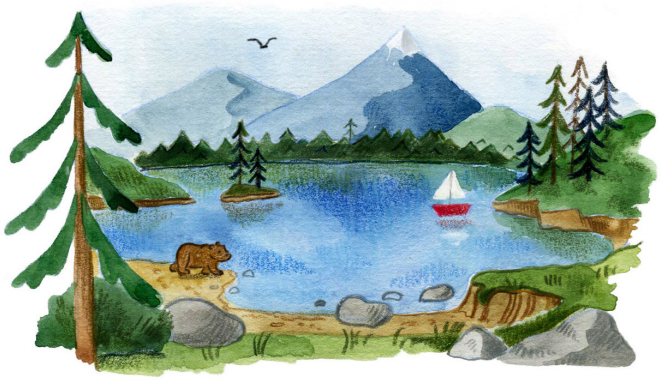
Illustrated by Yana Zybina

Early one morning as you lie in your warm bed, you open your eyes and look out your window. Peeking above the horizon is a glowing yellow light. The sun is rising, as it does every single day, bringing light and warmth to our home planet—Earth.

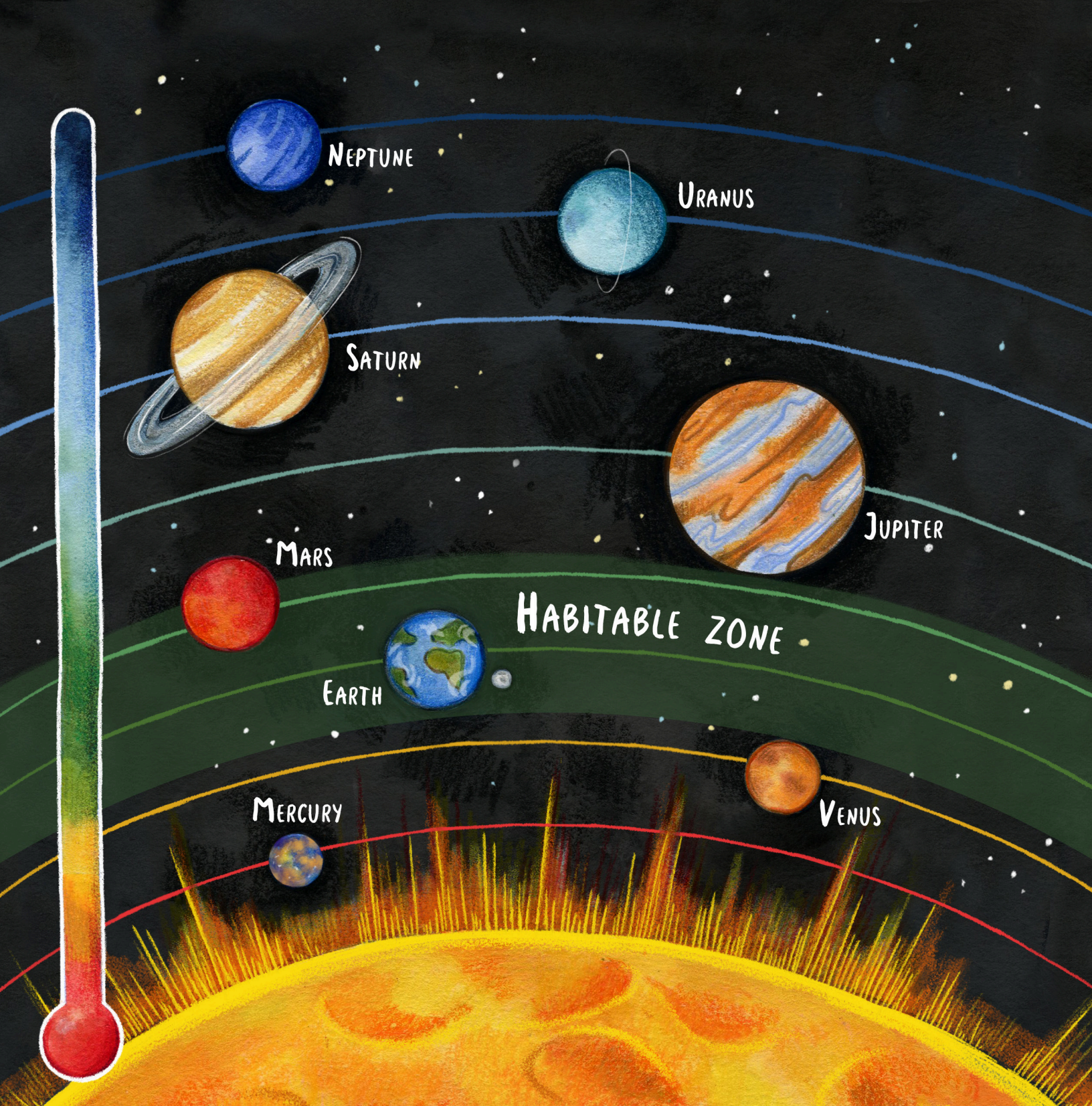
God created the earth to be different from all other planets in our solar system. Out of all the planets, Earth is the only one where anything is known to live—but how can this be? How can there be plants and animals, trees and flowers, fish and insects, and even people on Earth but no other planet?

For life to exist on the planet, there needs to be water. The earth's surface is a thin layer of rocky material called the crust. Swirling around on the crust is water. Water provides a home for animals, liquid to drink, and rain for plants to grow. Every single living thing needs water to survive, and because Earth always has a supply of water, life is everywhere on this planet.



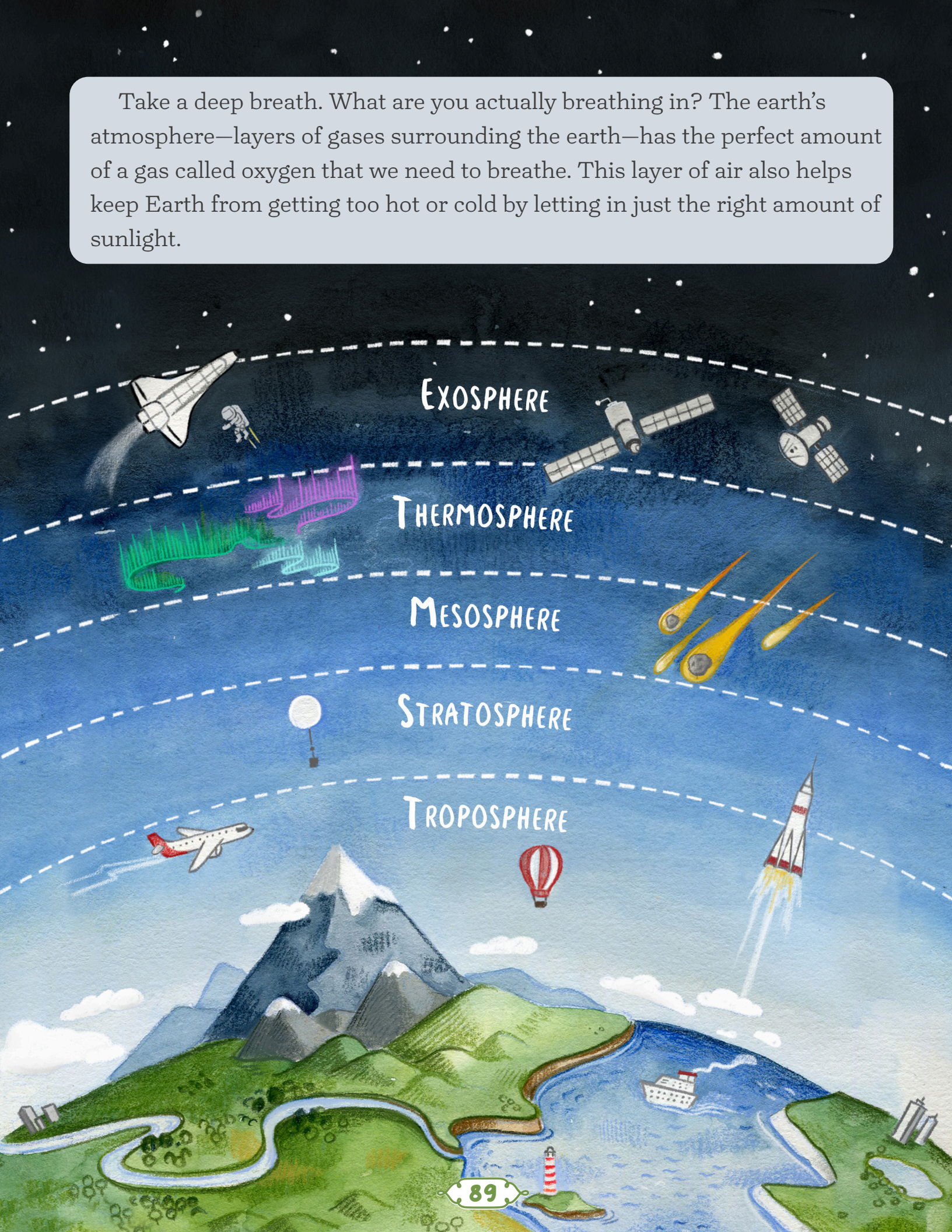


What living things are found on Earth? There are so many plants, animals, and humans that it's impossible to observe them all! This is Earth's biodiversity: the combination of all living things on our planet. It may be difficult to believe, but there are animals, plants, and other creatures that haven't been discovered yet!

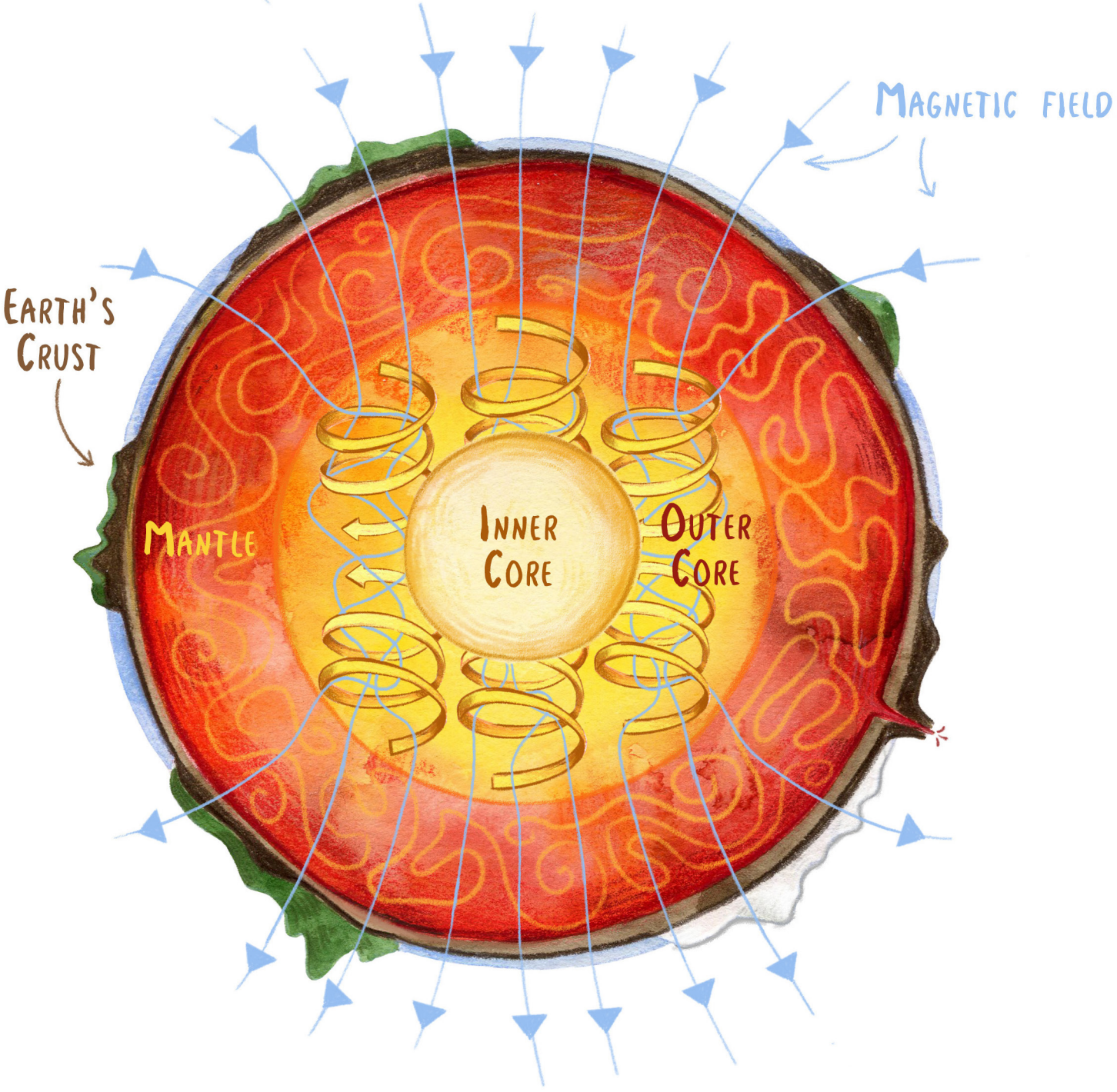


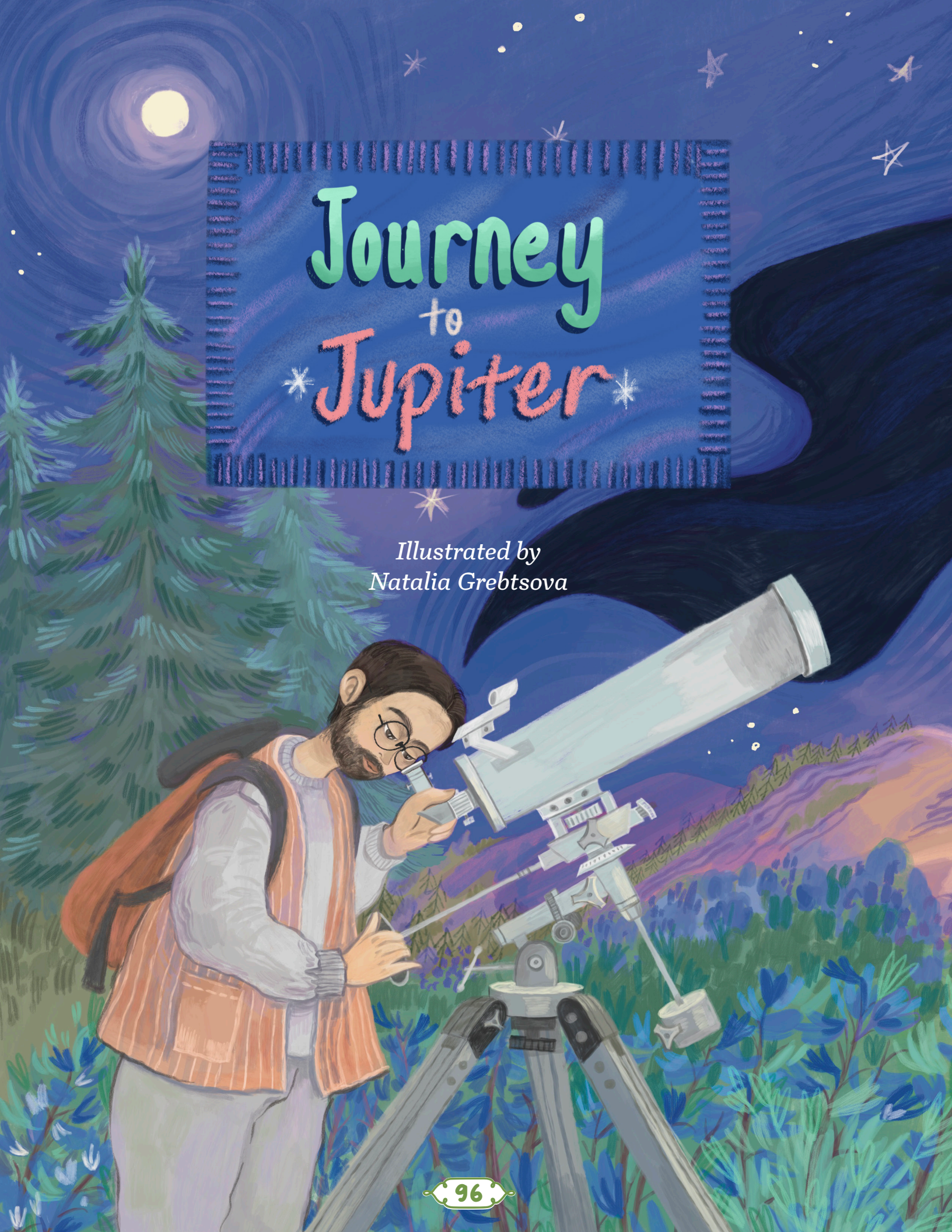
We know that water is necessary to support life, but what else is important? How about a planet's distance from the sun? Earth is in just the right spot: far enough away from the sun that it won't get too hot but still close enough to the sun that it won't get too cold for things to live.

Take a deep breath. What are you actually breathing in? The earth's atmosphere—layers of gases surrounding the earth—has the perfect amount of a gas called oxygen that we need to breathe. This layer of air also helps keep Earth from getting too hot or cold by letting in just the right amount of sunlight.



Another thing that makes life on this planet possible begins deep inside the earth. Under the planet's crusty surface is a thick layer filled with melted rock, or magma, called the mantle. Under the mantle is a layer called the outer core. In the outer core, melted iron swirls around and acts like a magnet, creating an invisible "bubble" surrounding the earth. This bubble, or Earth's magnetic field, protects us from harmful things that come from the sun, such as solar winds and beams of energy called solar rays.





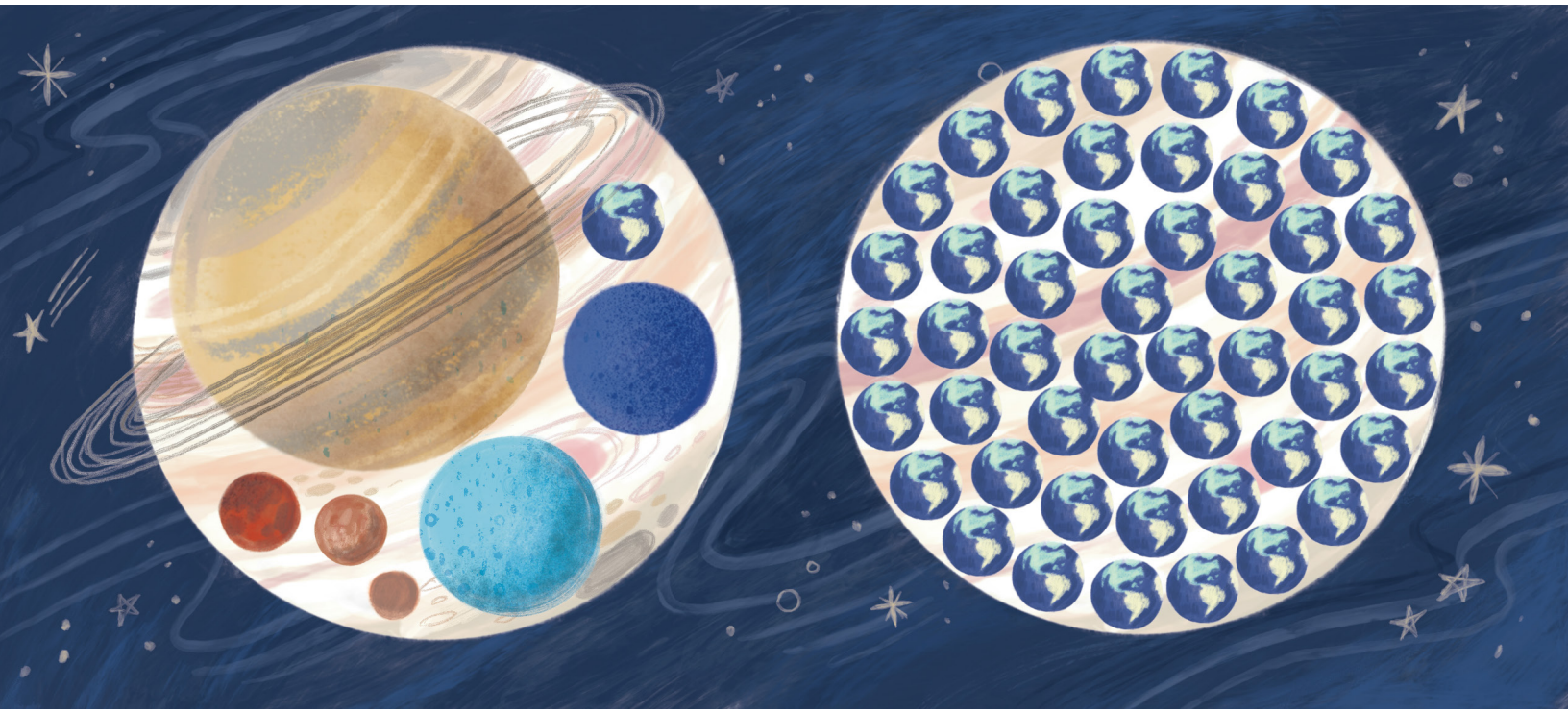
Illustrated by
Natalia Grebtsova

Hello, space explorers! I'm Phillip, a scientist studying objects found in space. I work at the National Aeronautics and Space Administration, which is called NASA for short. I heard you wanted to learn more about the planet Jupiter today. You have come to the right place: I was just studying some data, or information, from our spacecraft that is circling Jupiter right now. I'd love to tell you about it!

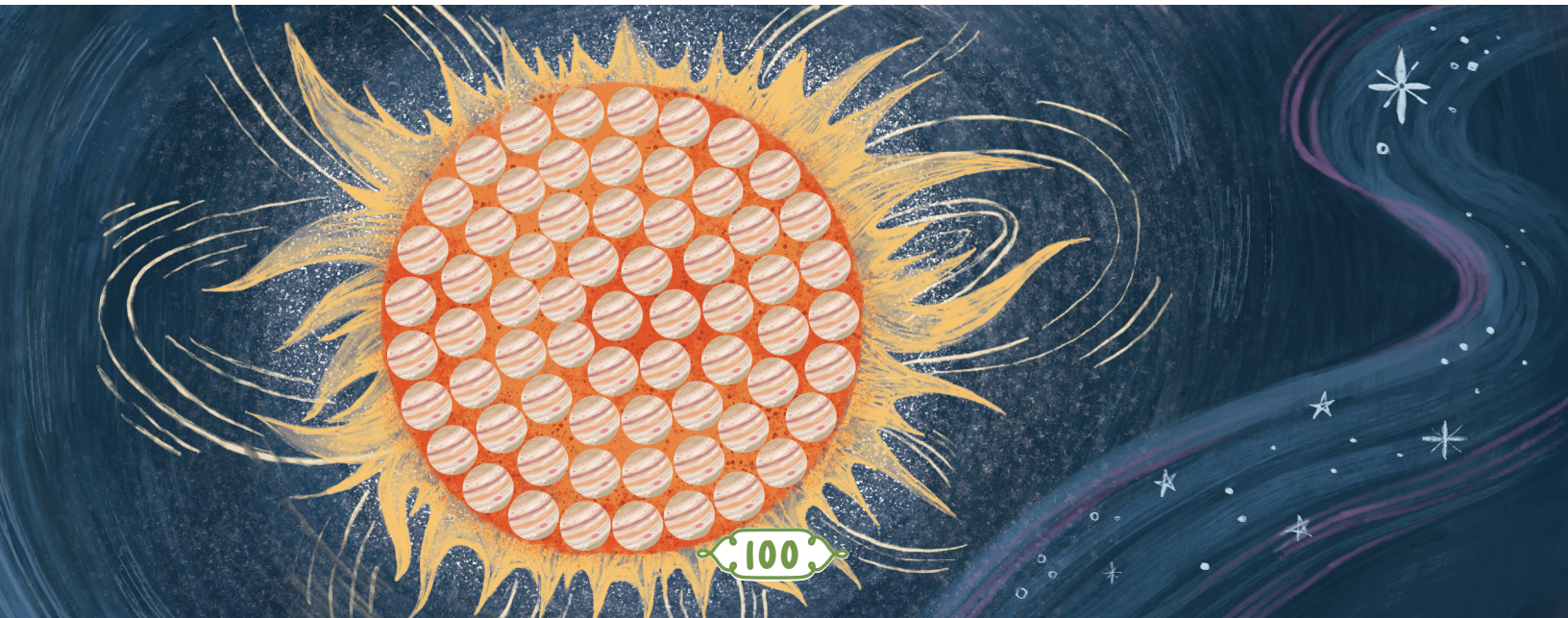
When scientists like me want to learn more about an object in space, we sometimes build a spacecraft that is specially designed to travel safely to that object. *Juno*, the spacecraft we built to explore Jupiter, doesn't have any people on it, but we're hoping it will gather a lot of information so we can learn more about the planet.

Juno took five years to get to Jupiter's orbit! We already knew some information about Jupiter, but right away, *Juno* started taking amazing photos and teaching us new things about the planet. We learn more about what it looks like underneath Jupiter's clouds every day.

So what do we know about Jupiter? Well, Jupiter is the fifth planet from the sun, and it is massive! We could take all the other planets in the solar system and fit them inside Jupiter without a problem. Or we could fit more than 1,000 Earths inside Jupiter; it is that large!



Now, you might be wondering—if it is that big, is it bigger than the sun? It is not. We could fit about 1,000 Jupiters inside the sun. I don't know about you, but I think that is getting too huge to imagine. Let's just say Jupiter is really big, but the sun is still bigger.



Jupiter is also really beautiful. The twists and spirals of the gases on its surface blend together in a splash of colors. Look at all of those swirls. Do any of them stand out to you? Whenever I look at Jupiter, my eyes go straight to the giant red spot on one side.

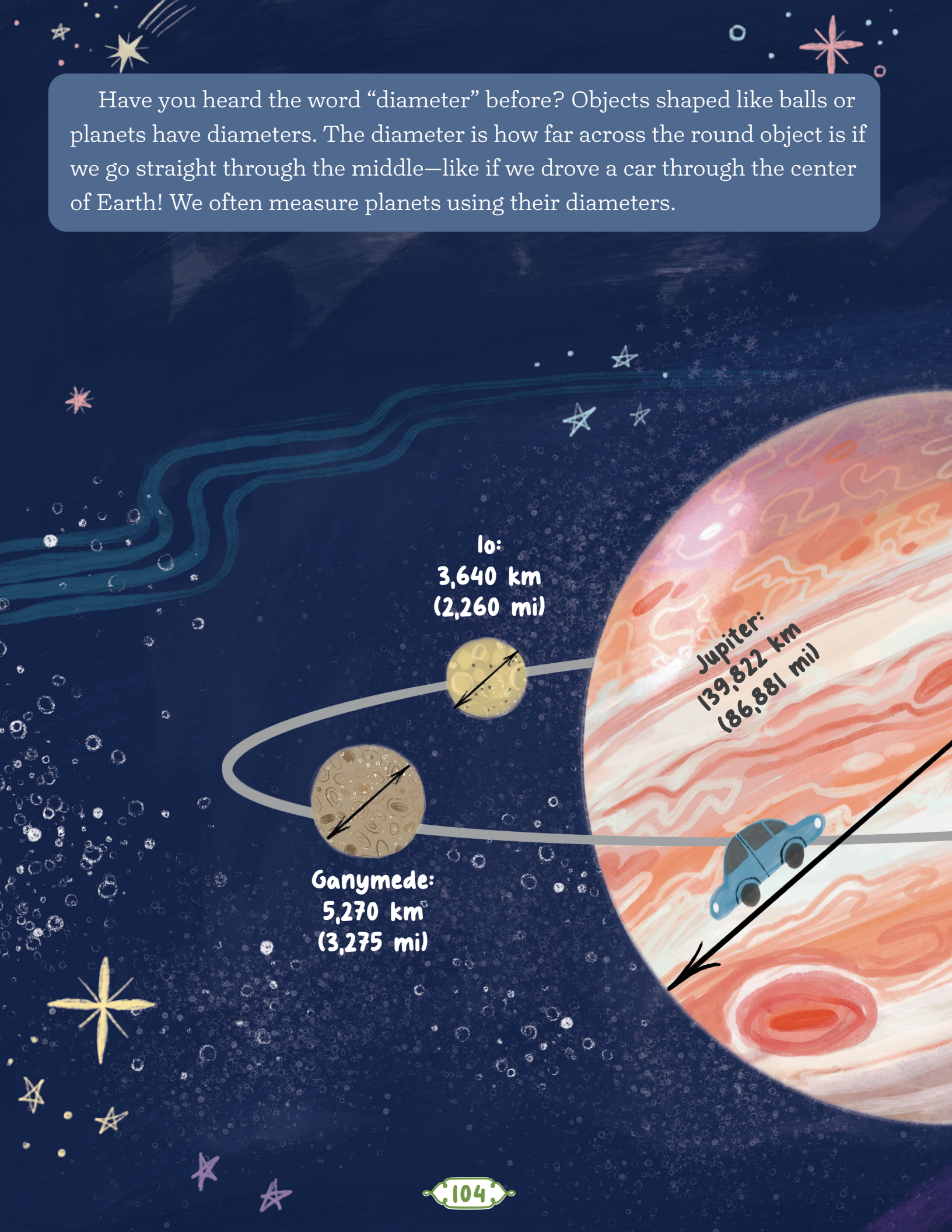
That fascinating spot is a giant storm that has been on the planet for at least 150 years. When Earth has storms, big gray clouds gather in the sky and then fade away when the storm ends, usually after only a few hours or days. The storm on Jupiter is slowly shrinking, but it is still bigger than the size of planet Earth and won't stop anytime soon.

Can you imagine a storm bigger than our entire planet? And that storm lasting for more than your entire life? That would be a pretty wild storm!

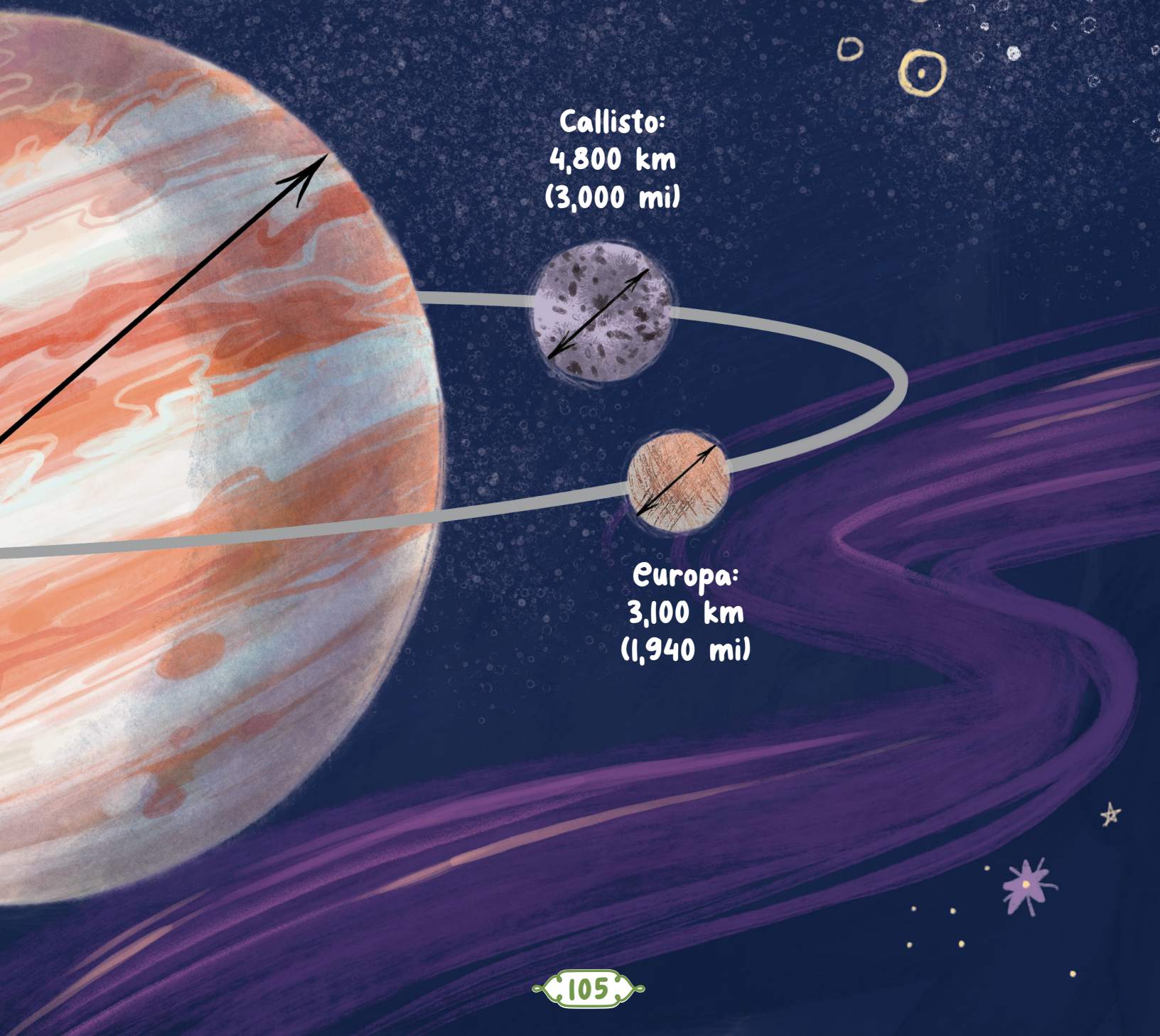
You might have guessed that nothing could live on a planet with a storm that big, and you are correct. But even if something wanted to live on Jupiter, it wouldn't have a place to land—there is no surface!

Our spacecraft, *Juno*, has showed us that the center of Jupiter is probably not the same as Earth's. Scientists aren't sure whether it's solid or made of a thick, extremely hot liquid. It kind of looks like a ball, but not a solid one. Jupiter's loose and fuzzy core takes up half the diameter, or size, of the planet.

Have you heard the word "diameter" before? Objects shaped like balls or planets have diameters. The diameter is how far across the round object is if we go straight through the middle—like if we drove a car through the center of Earth! We often measure planets using their diameters.



Earth and Jupiter are very different sizes. If Earth were the size of a nickel, Jupiter would be the size of a basketball! Which one do you think has the bigger diameter? You're right—Jupiter. We can also use diameters to measure the sizes of Jupiter's 80 moons. Here are the diameters of a few of them. Can you find the moon with the biggest diameter? You're right: It is Ganymede [GAN–eh–mede]. Ganymede is actually the largest moon in our solar system.



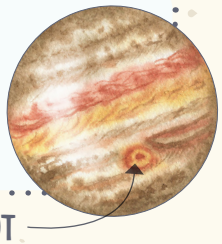
What else is interesting about Jupiter? Oh, here's a good fact: Jupiter is like a vacuum cleaner for the solar system. Because Jupiter is the biggest planet in the solar system, it has the most gravitational force. Sometimes, Jupiter's gravity pulls in comets and asteroids that might have been on a path to hit Earth. Other times, Jupiter's gravity causes these big space rocks and ice balls to slingshot, or veer away, from the planets altogether and head back out into space.

Well, thanks for stopping by NASA today. I have a lot more research I need to get back to. There are so many new things to learn about space, and I get to be one of the first people to discover them. I have a wonderful job! Come back anytime if you want to learn more about Jupiter. The only thing I love as much as learning about space is sharing what I learn with others.

FUN FACTS ABOUT JUPITER

Because Jupiter spins so fast, its shape has flattened out a bit. Now, it bulges at its equator and is not a perfectly round sphere like a baseball.

There are lots of facts about space that we have yet to discover. For example, we still aren't quite sure why Jupiter's large spot is the color red.



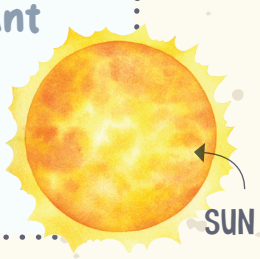
JUPITER'S RED SPOT

Jupiter was named by a group of people called the Romans a long time ago. They also named Mercury, Saturn, Venus, and Mars.

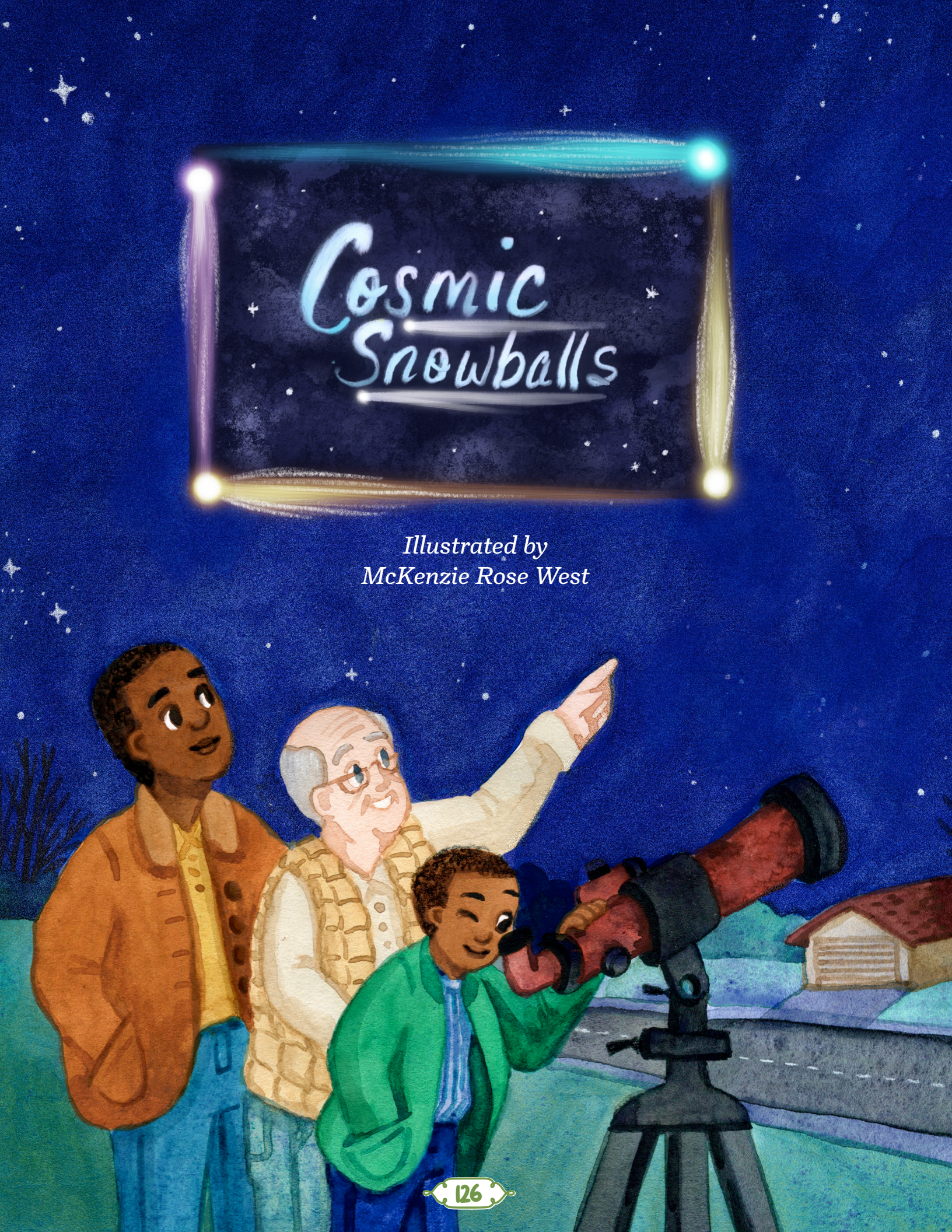
When a scientist named Galileo Galilei saw Jupiter with a telescope over 400 years ago, he saw four of Jupiter's moons orbiting around it. This was really important at the time because most people believed that Earth was the center of the universe and everything in space revolved around the earth. Galileo's discovery made people question if that was really true.

We measure the length of a year based on how long it takes for a planet to go around the sun. It takes Earth about 365 days to complete the journey, which is what we call one year here on Earth. It takes Jupiter about 4,333 of our days to go around the sun, so one year on Jupiter is more than 11 years on Earth.

Jupiter is often called a gas giant because it is a giant planet made up of gas. The two main kinds of gases on Jupiter are helium and hydrogen, which are the same gases that we find in the sun.



Jupiter has rings. They are very thin and faint, and they are not easy to see, even with a telescope.



Illustrated by
McKenzie Rose West

Ben closed the front door and shouted, “I’m home, Mom!”

He sprinted up the stairs two at a time and flung open his bedroom door. It was the day after his 10th birthday, and he had spent a lot of time thinking about the gifts he had received. The gift he was most excited about was the telescope his neighbor Mr. Peterson had given him.

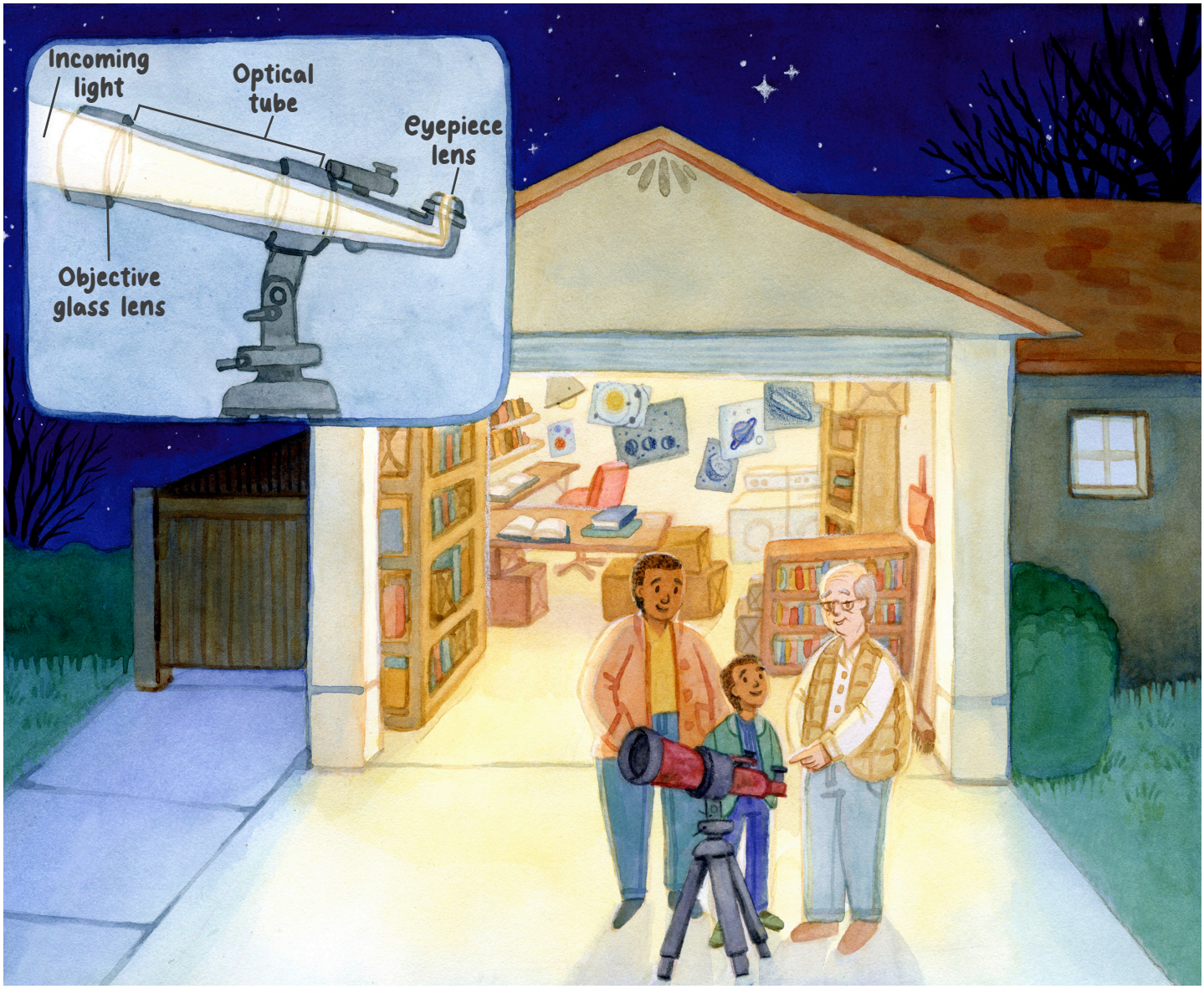
Mr. Peterson was a retired high school science teacher who loved sharing his vast scientific knowledge with Ben. The telescope had caught Ben's eye every time he joined Mr. Peterson in his garage to talk about tropical fish, flowering plants, or Ben's favorite topic, astronomy. The telescope wasn't new or shiny, and it squeaked loudly when it swiveled on its base, but it was definitely his favorite birthday present.

As Ben was washing the dinner dishes, he was excited to see the light inside Mr. Peterson's garage flicker on. After finishing the dishes, Ben turned to his dad and said, "The light is on inside Mr. Peterson's garage. Can we go over there together and see if he has some time to explain how my new telescope works?"

Ben's dad smiled broadly and replied, "That's a great idea. If you can wipe the table, I'll bring your telescope downstairs."

Mr. Peterson peered out from his garage and spied Ben and his dad walking toward him. “Is that the birthday boy I see?”

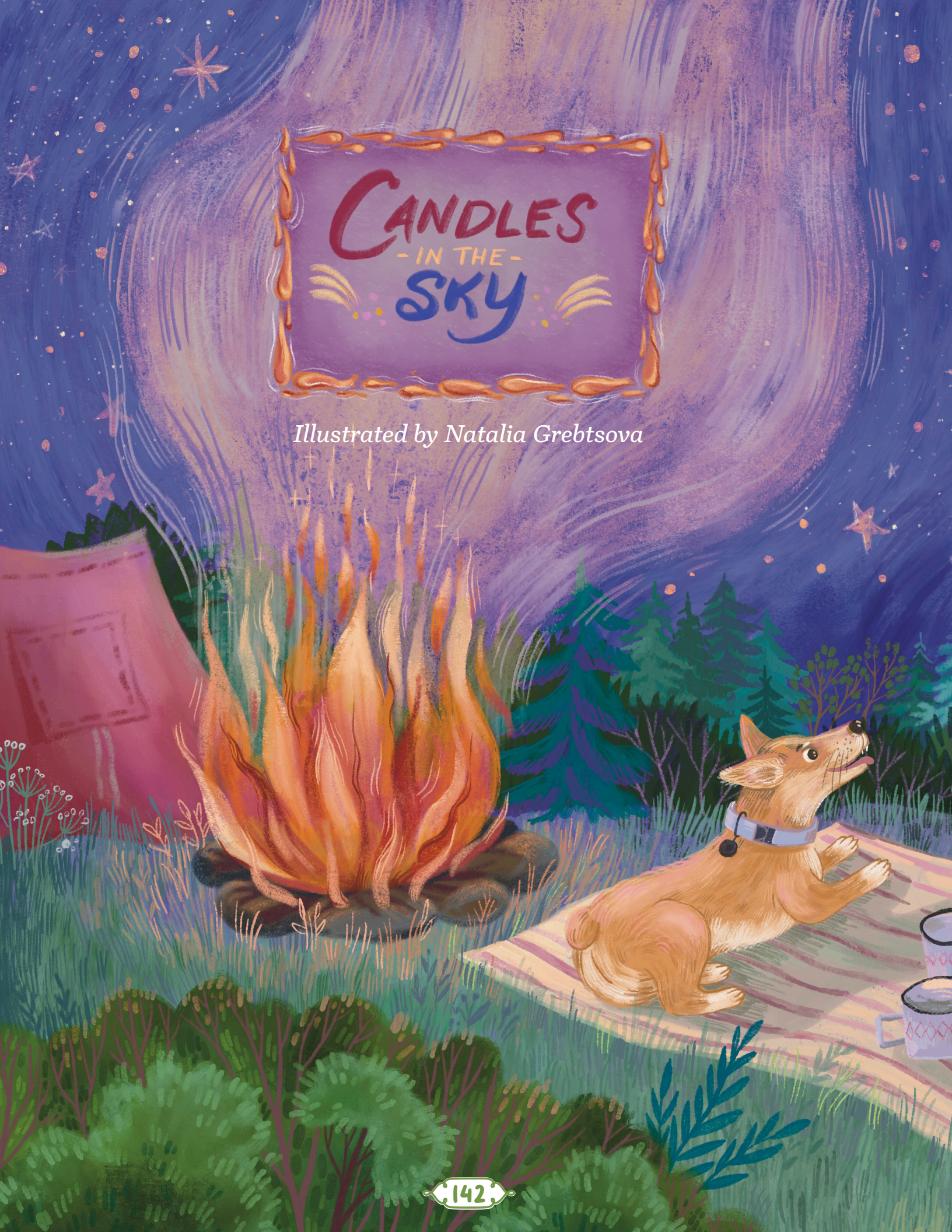
“It is!” Ben exclaimed. “Mr. Peterson, I was wondering if you have time to show me how my new telescope works.”



“Absolutely! This is a refracting telescope, which uses a curved piece of glass at one end to collect and bend light from faraway objects. Then the light travels down the rest of the telescope tube to this eyepiece. That’s the part you look into, and it makes the object look even bigger. Newer reflecting telescopes use mirrors, which weigh a lot less and are cheaper to make, instead of glass lenses,” Mr. Peterson told Ben.

Mr. Peterson opened the book to one of the first pages and said, “This diagram shows us a picture of some famous comets. It explains that comets are made up of the ‘leftover’ materials from when God created the solar system. Some of the rocks, dust, and ice that were not used to make stars, planets, or moons became comets.” Dad and Ben crowded around the book to look.

"Here is a picture of the different parts of a comet," Mr. Peterson said, pointing to the book. "A comet's nucleus is a frozen round ball of rock, dust, and ice loosely held together. A nucleus may sound small, but the nucleus of a comet can be the size of a small town! Around the nucleus is the coma [COH-muh], which is made of gases. This is the part we can see best from the telescope."



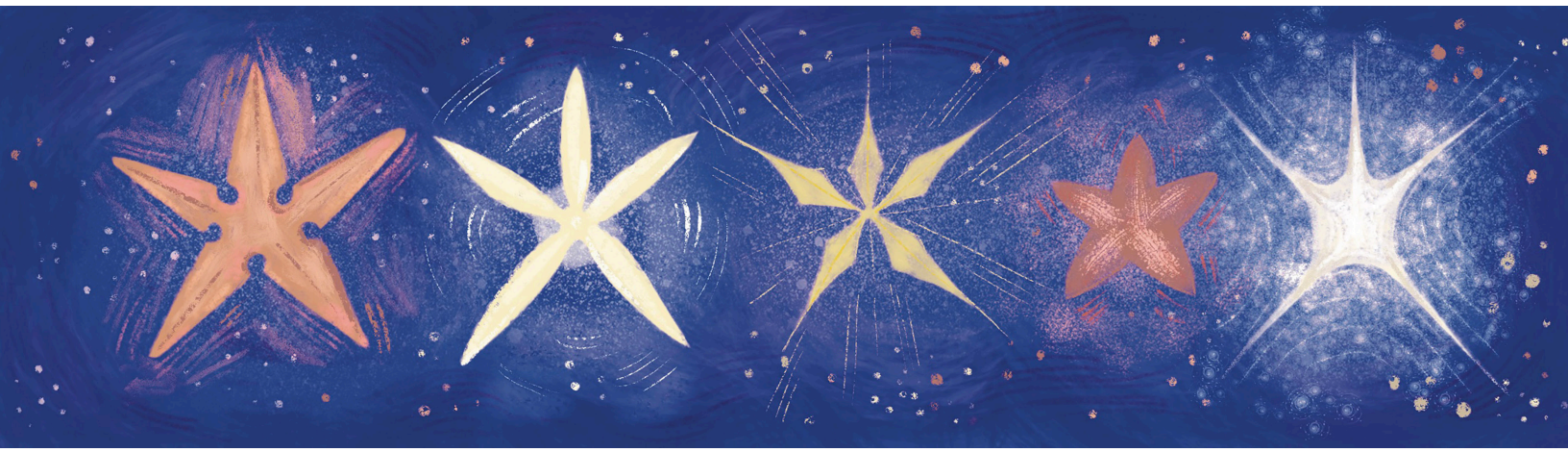
Illustrated by Natalia Grebtsova

Look up in the sky on an inky-black night and notice the thousands of twinkling lights. You can almost imagine a massive city up there with little candles burning in every window.

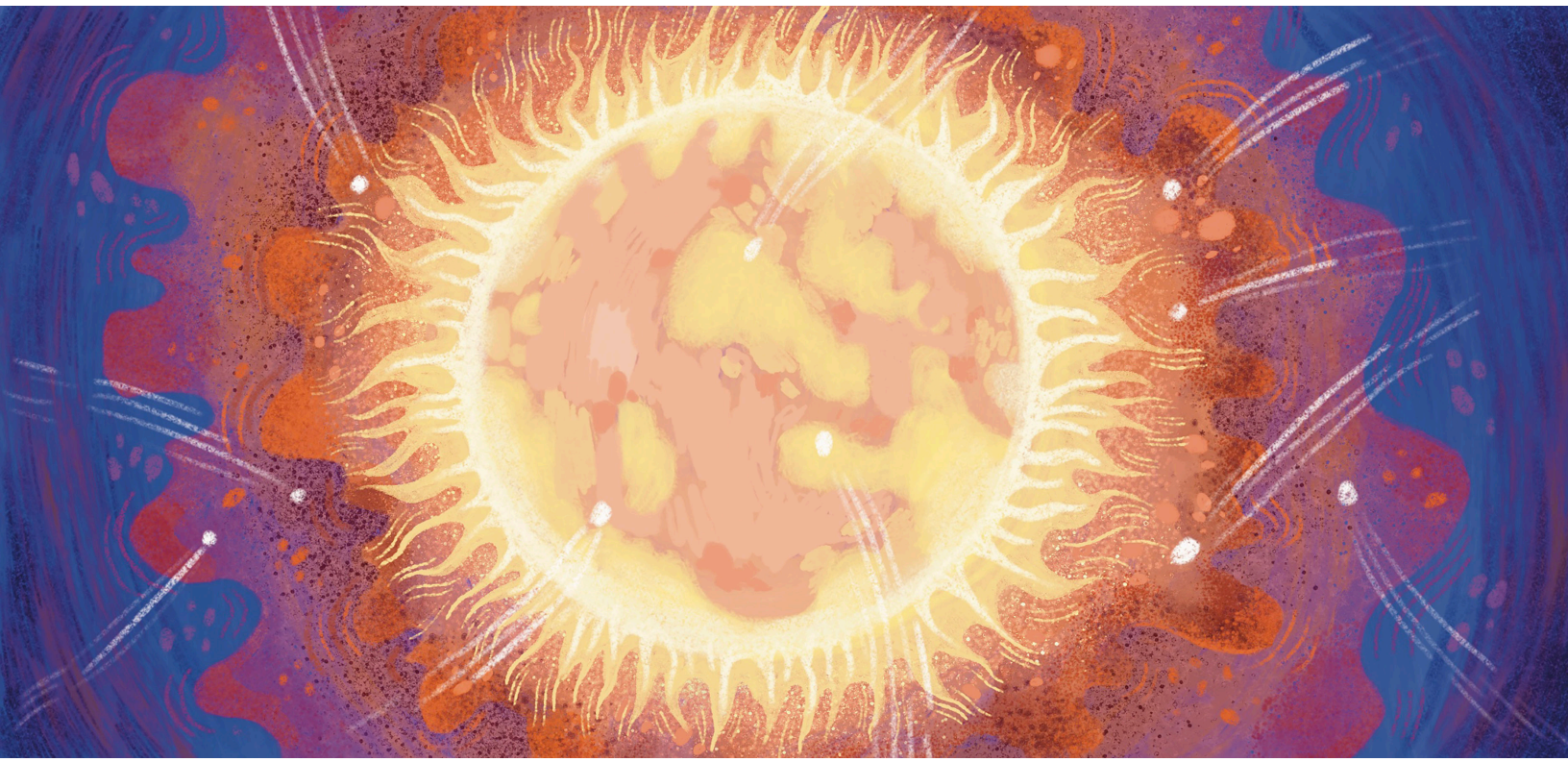
With a simple command, God created stars to shine light and warmth on the planets, to guide ships and weary travelers safely home, and to dazzle us with their sheer number and beauty.

The closest star to Earth, called Sol [SAHL], is our sun—but it is still very far away! Its glow keeps our earth warm, and its light helps trees and plants grow. There are an uncountable number of stars in the universe, which includes everything in space. We think a lot of the stars have solar systems revolving around them in a way similar to ours.

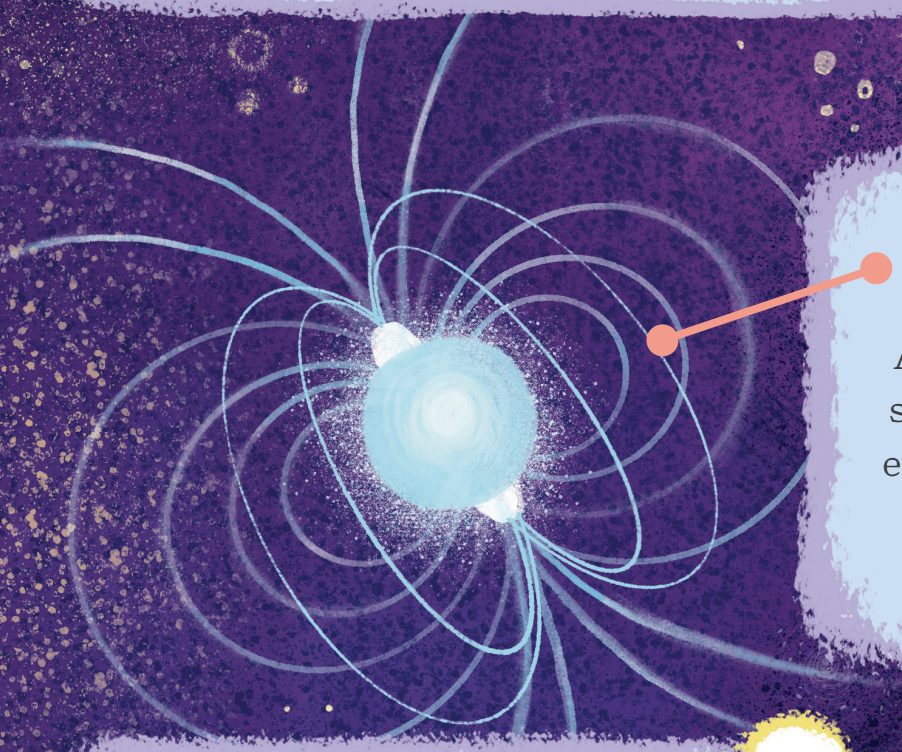
You might have seen stars in picture books that look like these:



But did you know that a star is actually a ball of burning gas?



At any time, stars are being born and are dying. Gazing up in the night sky, you can see so many stars in all different phases of life. How can people make sense of the countless stars they're seeing?



8

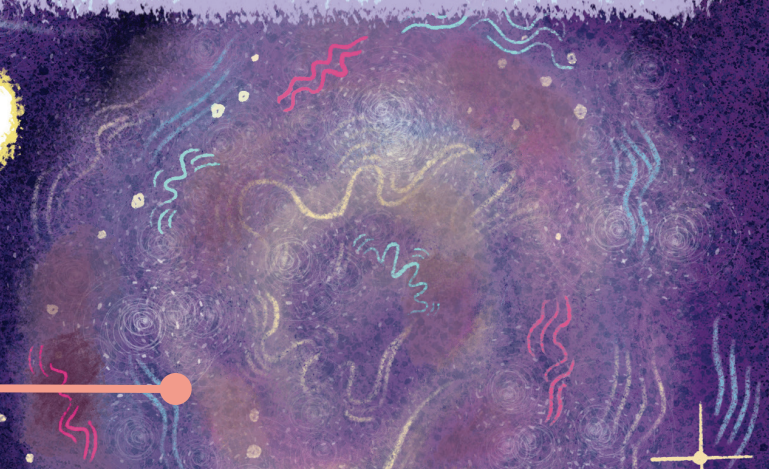
Neutron Star

After exploding in a supernova, some white dwarf stars collapse even more into an object called a neutron star.

7

Supernova

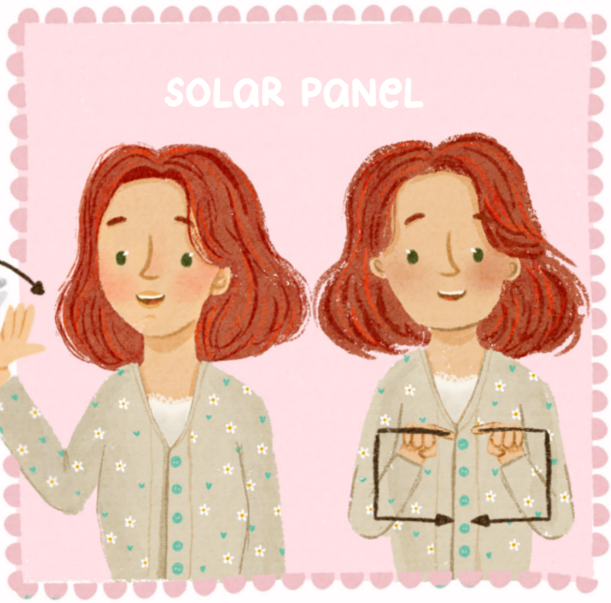
Instead of gently cooling and dying out, bigger stars lose the fight with gravity and explode in a spectacular event called a supernova.



Look at this beautiful sky lit with stars. Can you connect the star "dots" to form a shape or simple picture? Since the beginning of time, humans have studied the stars in the night sky. Many years ago, as people gazed up, they saw pictures formed by the stars, and they named the pictures after animals and heroes from their cultures. These are called constellations.

Illustrated by Bojana Stojanovic

Many deaf people in the United States and Canada use American Sign Language. This language uses hands, facial cues, and body language to communicate since most of its users cannot hear some or any sounds.



Here are a few signs that are used in this story. See if you can find the characters using them in the pictures.

It was a typical Saturday morning in the summer. I was playing games with my little brother, Jackson, when I heard a sound outside and looked up.

Jackson signed "What?" in American Sign Language. My brother and dad are both deaf and don't hear sounds.

I signed back, "I heard something. Let's go look." We both got up and hurried over to the window. A van with a picture of the sun on the side was in front of our house, and several men were unloading big rectangular boxes.

Illustrated by Shannon Vogus

Hi! My name is Felix, and this is my farm. Here in the state of Illinois, in the United States, we grow a lot of sweet corn. Have you ever wondered where the corn on your plate comes from? Well, today I am going to show you how corn goes from a kernel, or tiny seed, to the delicious corn you eat for dinner!

One of my favorite things about being a farmer is using the large, loud farm machines that help me grow and take care of the corn! A long time ago, farmers pulled their planters and carts using their own strength or teams of animals, such as horses.

The machine I use the most is a tractor: a very large, powerful vehicle made to replace those animals and make a farmer's work much easier. My big green tractor carries me all over the farm. It has two very tall wheels in the back and two smaller ones in the front. My tractor can pull things that would need 200 horses to pull! It also pulls several smaller machines that help me grow lots of corn.

FUN FACTS ABOUT FARM MACHINES

The juicy sweet corn you eat is different from the hard field corn eaten by farm animals or made into other products, such as cornstarch, corn oil, corn syrup, and even ethanol fuel.

The word "tractor" comes from the Latin word *trahere*, which means "to pull."

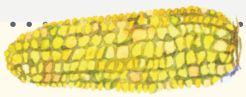
There are approximately 4.2 million tractors on farms and ranches in the United States.

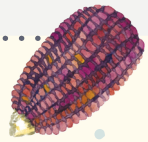
Farm machines started using fuel-powered engines in the early 1900s. Many companies told people these machines were "better and cheaper than horses" to convince them to buy tractors.

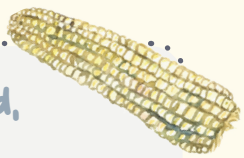
Early harvesting machines were called threshers and were powered by steam.

Farmers grow corn on every continent except Antarctica.

Corn isn't always yellow. It can be green, blue, red, or white. Cobs always have even numbers of rows.







The world's tallest cornstalk ever recorded was more than 14 m (45 ft) tall.