



WHAT'S OUT THERE?

A TRUE OR FALSE BOOK
ABOUT THE UNIVERSE

CONSERVATORY LAB CHARTER SCHOOL
2012 – 2013 4TH-GRADE CLASS

About Conservatory Lab

Conservatory Lab is a K1 – 8 music-infused charter school in the heart of Boston. We believe in the power of music to transform the lives of children and adolescents.

We use **Expeditionary Learning** as a framework for our unique, interdisciplinary curriculum that deepens students' appreciation of the role of music in the world and promotes opportunities for students to achieve scholastic benchmarks.

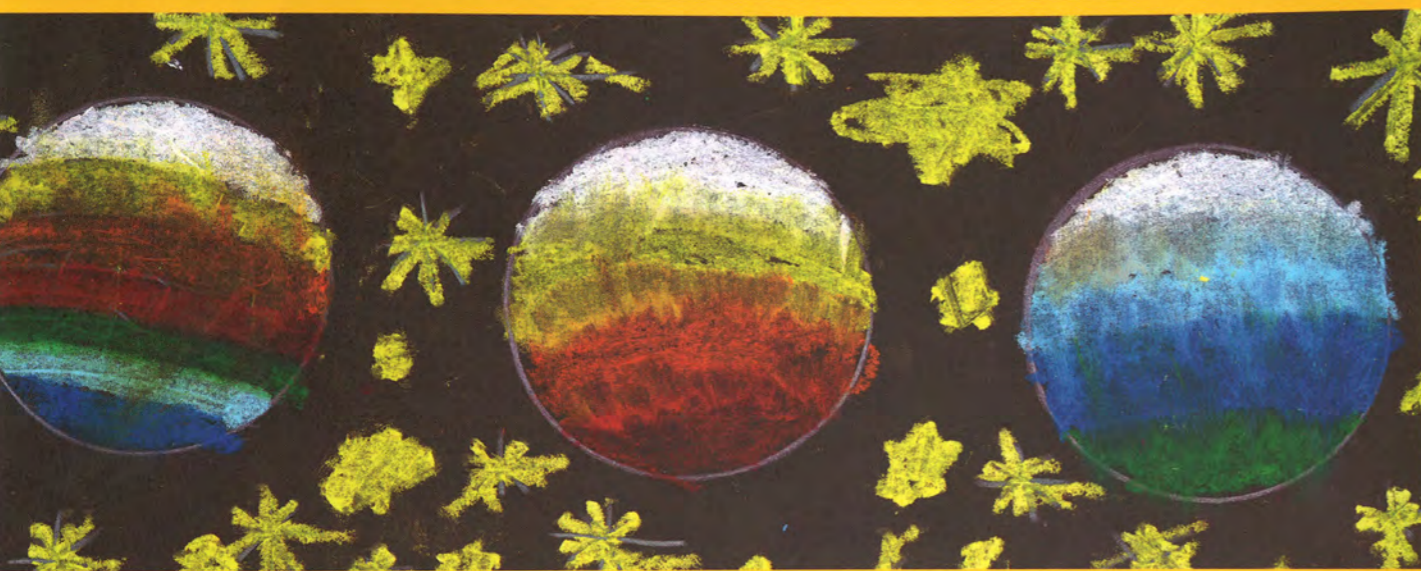
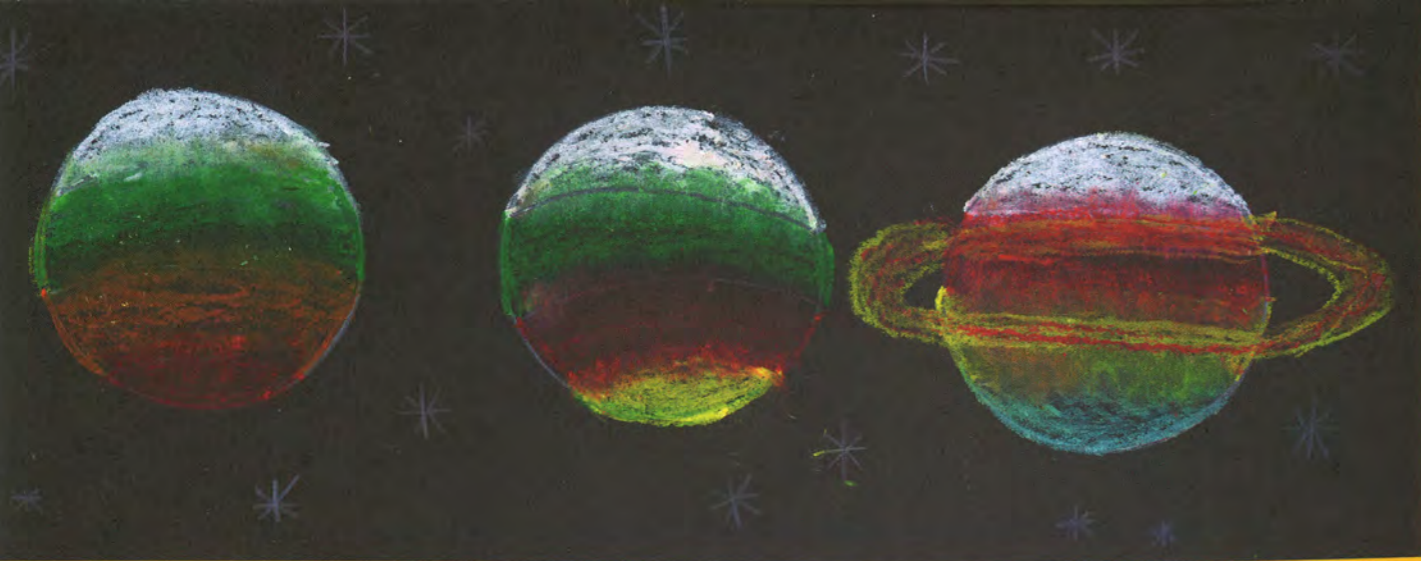
Our learning expeditions are discovery operations. They start from scratch and travel light, relying on courage, compassion, and creativity as much as on intellectual acumen. We cherish active, hands-on situations where what we are doing matters to us and has consequences. To encourage deeper learning, our expeditions demand fieldwork and assistance from experts. When you have a need to know, when you have to do something, a different level of energy kicks in.

Conservatory Lab is also the only school in the country to incorporate **El Sistema** Program and Methods into its core school day. **El Sistema** is a unique program designed to effect social change and nurture promising futures for underserved communities through intensive, ensemble-focused music education.

In their learning expedition on the Solar System and beyond, fourth graders grappled with questions about the universe, applying research, writing, and artistic skills to synthesize their learning and create this interactive true or false book. Music, including John Williams' scores for the films *Star Wars* and *E.T.* and Gustav Holst's orchestral suite *The Planets*, animated their scientific inquiry, allowing students to explore how artists give expression to the awe-inspiring wonders of outer space.

Our students will remember their experience at **Conservatory Lab** with stories about problems they solved, ways they helped the community, performances they participated in, and exciting projects they worked so hard on. They will remember how one idea led to another and how they followed those ideas like true detectives until they understood them and made them their own. They will remember being challenged to push themselves to accomplish things they did not think they were capable of accomplishing. I am exceptionally proud of our fourth graders' creativity, dedication, and perseverance.

Diana Lam, *Head of School*



Introduction

We were very excited to begin our fourth-grade expedition on the Solar System and beyond because we love science and were eager to learn more about what is out there!

To begin, we studied our own home, planet Earth. We learned all about why it is the best, and only planet so far, to support life. We recreated the layers of the Earth with play dough and used a flashlight and globe to better understand how the Earth rotates on its axis and revolves around the Sun to cause day, night, and seasons.

After learning all about the Earth, we studied Earth's only satellite, the Moon. We kept our own moon journals and found out there are eight different phases of the Moon. We also wrote our own moon myths. It was really fun hearing each other's creative stories!

During this expedition, we listened to musical scores from popular science-fiction movies, such as *E.T.* and *Star Wars*, as well as *The Planets Suite* by Gustav Holst. As we listened to Holst's suite, we tried to match each piece with the planet it represents based on rhythm, dynamics, and other music elements, as well as the nicknames of the planets. For example, it was easy to match Mars, known as "The Bringer of War," because the orchestral piece was very loud and powerful, as opposed to the quiet, calm music for "Venus, The Bringer of Peace."

Our fieldwork at the Charles Hayden Planetarium in the Museum of Science sparked interest in researching different topics for our true or false informational essays. Some of us had already chosen topics, but changed them after visiting the museum and seeing the amazing planetarium show.

Before we started to write our book, we read many other true or false books to learn about the elements that make a high-quality true or false book. We looked closely at the formatting and how to write strong statements. Once we wrote our true or false statements, we dove into our research. After reading several different books on our topic and taking notes, we were ready to write. As we worked on our drafts, we also created illustrations with oil pastels to provide a visual of our topic for our readers. Lauren Griffin, an expert artist from the Museum of Fine Arts, helped us and critiqued our work. Working with art materials was one of our favorite parts of the expedition!

In publishing this book, we learned a very important lesson about writing informational essays. You have to check your facts. Sometimes you might find information in one source that is different from information in another source. It's important to know your sources and to check when they were written. If a source was written a long time ago, the information could be outdated, especially if your topic is the Solar System! We worked with a science specialist to double and triple check our facts to make sure we were giving the right information to you, our readers.

We hope you enjoy this journey through space. Turn the page and find out how much you know about what's out there!

THE 2012-2013 FOURTH-GRADE CLASS





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***A solar eclipse
happens when
the Earth is
between the Sun
and the Moon.
True or False?*** →



← False.

A **solar eclipse** happens when the Moon is between the Sun and Earth. When the Earth is between the Sun and Moon, it is called a lunar eclipse. For example, if the Sun was the first car in a race, the Moon would be second and the Earth would be third during a solar eclipse. During a lunar eclipse, the Earth and the Moon switch places. This happens because the Moon **revolves** around the Earth while the Earth revolves around the Sun.

An eclipse is when one astronomical object blocks the view of another, which leads to darkness. A solar eclipse is when the Moon is blocking the Sun, but it does not always cover it completely. During a solar eclipse, the Sun and the Moon look like they're the same size, however, the Sun is actually larger and farther away than the Moon.

Eclipses don't happen every month because the Earth and the Moon are tilted at different angles. At least two solar eclipses happen each year, but most of them are partial. If you want to see the next solar eclipse, you'll have to be in Africa on November 3, 2013.

A black hole takes you to a different solar system.
True or False? →



← False.

A black hole takes you nowhere. It's actually not even a hole, but more like a whirlpool. A black hole is a place in space with a strong **gravitational pull** that takes things in, and is so powerful that nothing can escape from it, not even light. Imagine that you're flushing a toilet. The black hole is like the water that spins around until it goes down the drain.

A black hole forms when a gigantic star dies. A star is able to be alive because it has **hydrogen** and **helium**, and that's what keeps it burning. When a star burns, heat pushes out and gravity pushes in. When the star runs out of hydrogen, the star dies. The heat of the star is gone but the gravity still pushes in, making the star collapse into itself.

Scientists can't see black holes with telescopes, or send up equipment to study one, because the equipment would be destroyed if it got sucked into the black hole. Any object that goes by a black hole would be sucked in within a millionth of a second.

Scientists have discovered that black holes vary in size. Some are known as stellar mass black holes (10 to 24 times as big as the Sun). Stellar mass black holes can grow into super massive black holes (millions or billions of times greater than the Sun). Although there are still many unanswered questions about black holes, one thing is certain: a black hole does not take you to another solar system!

There are more than 800 confirmed exoplanets.
True or False? →



← True.

There have been new **exoplanet** discoveries almost every day since the first discovery in 1992. As of today (June 6, 2013), there are 895 confirmed exoplanets! Exoplanets are planets outside of our **Solar System** that **orbit** a star other than our Sun. They are most often found in the **Oort cloud**. Exoplanets are also called extrasolar planets. The prefix *extra* means beyond and *solar* represents our Sun.

Exoplanets can be different colors like blue, red, green, brown, grey, and white. They don't have names like Earth or Neptune; instead they have names like MOA-2007-192-BLG-Lb.

Did you know that most exoplanets are made of gas and are bigger than Jupiter? Some exoplanets are bigger than our Sun, which has a **diameter** of around 900 thousand miles! Exomoons are objects that orbit exoplanets, similar to our Moon. Exomoons are mostly black, brown, and grey.

Now some facts about a specific exoplanet: MOA-2007-BLG-192-Lb. It is orbiting a brown dwarf. MOA-2007-BLG-192-Lb is 2,283 **light years** away from Earth. One light year is around 10 trillion kilometers. To make it clearer, Earth is 150 million kilometers from the Sun. Can you imagine anything farther?

**Halley's Comet can
be seen without
a telescope.
True or False? →**



← True.

Halley's Comet can be seen without a telescope while others can't because its tail is 94 million kilometers long and it **orbits** close to the Earth! Halley's Comet actually has two ion tails instead of one. One tail has been recorded as blue and one as yellow, so don't be surprised if you see two different colors. Halley's tail is like a very powerful jet leaving a cloud behind it. It melts and gets dimmer as it nears the Sun.

A **comet** is a ball of ice, dust, and gas that has a tail and its own orbit. Halley's Comet can be seen every 75-76 years. The reason it takes this long to be seen is because it has an **elliptical orbit**. Halley's orbit is oval shaped and is delayed by the **gravitational pull** of Jupiter and Saturn.

Halley's Comet was last seen in January 1986 near the **constellation** Pegasus. It was dim, but could be seen with binoculars. In late March, it was still dim, but could be seen near the constellation Scorpius.

Halley's Comet has been seen for around 3,000 years. **Astronomers** think it was even seen in 240 BCE (Before Common Era). An interesting fact is that Halley's Comet was orbiting close to the Earth both on the day that author Mark Twain was born, and on the day that he died. What a coincidence!

We won't see Halley's Comet again until 2061! If you see it, don't be afraid of it hitting Earth, even though it may seem that way. The orbit is actually too far away.

***Saturn has rings
that are made out
of dust and ice.
True or False? →***



← True.

Saturn's rings are made out of dust and ice. Some scientists think that hundreds of millions of years ago, a large **comet** or **asteroid** hit an icy moon. The ice and dust debris started to mix and Saturn's **gravity** pulled them in to form the rings we see today.

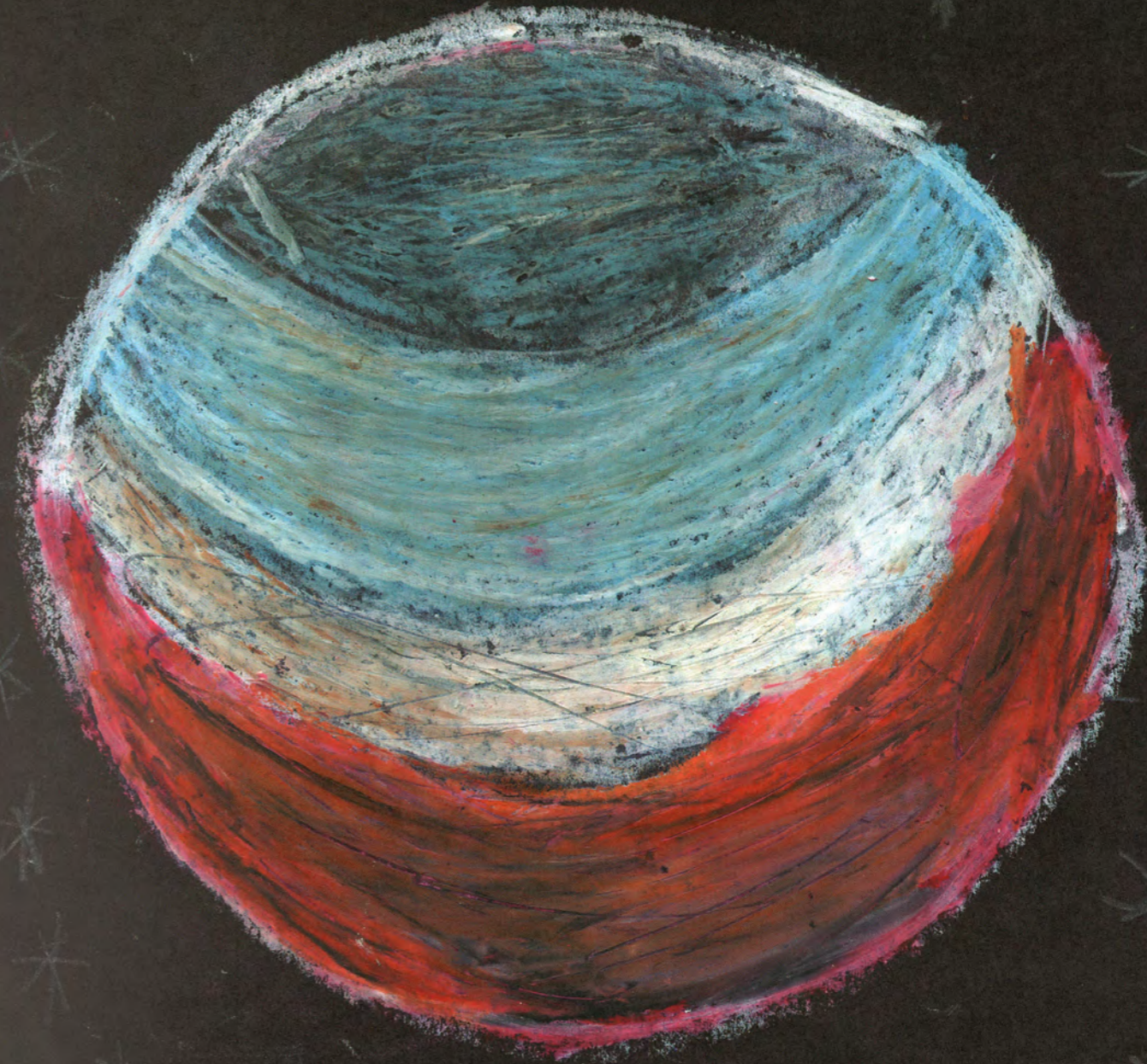
Saturn is the sixth planet from the Sun. It takes 10,759.22 Earth days, which is 29 ½ Earth years, to **revolve** around the Sun. Earth takes 365.2 days to revolve around the Sun. Saturn takes about 29 times longer to revolve around the Sun than the Earth does.

In 1610, an **astronomer** named Galileo Galilei first observed Saturn and thought that Saturn's rings looked like ears. Do you know how many rings Saturn actually has? You can see eight with a telescope, but with the **spacecraft** Cassini astronomers have discovered more than 30. In total, Saturn's rings have a **diameter** of 175,000 miles, or 282,000 km. Would you like to measure the rings? Good luck—you will end up freezing!

Saturn has 53 known named moons and 9 unnamed moons, for a total of 62 moons. Titan, Saturn's biggest moon, was discovered first in 1655. Titan is the only moon in our **Solar System** with clouds and an **atmosphere**.

People call the great planet Saturn the "Ringed Planet." If you're interested, take a telescope and look for Saturn!

***In 2006, four men
went to Jupiter
and lived there for
one year.
True or False? →***



← False!

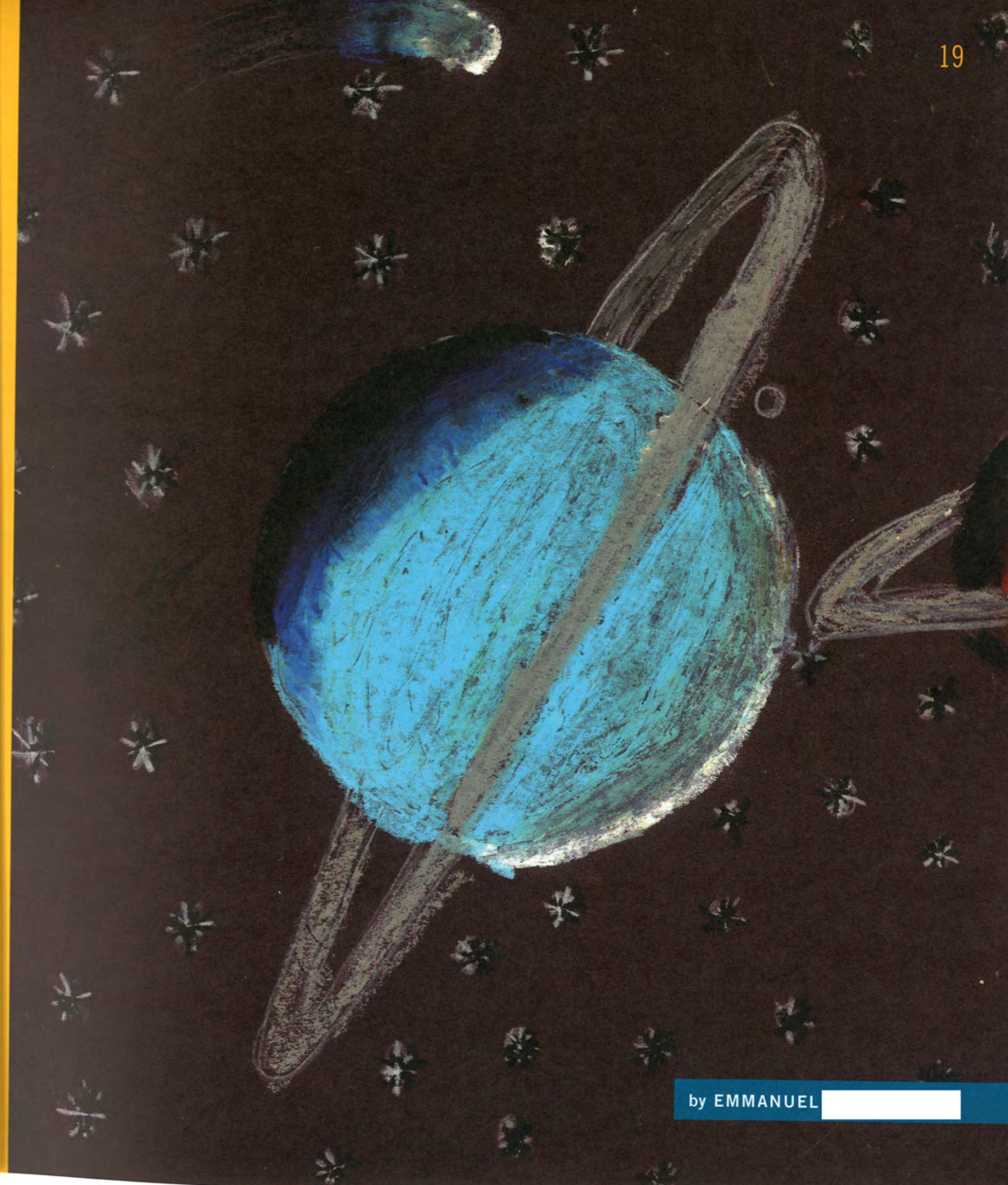
People can't live on Jupiter because there is no solid surface. It's made of liquid **hydrogen**—you would sink if you tried to land there. Jupiter is farther from the Sun than Earth is. It receives less of the Sun's warmth and light. Can you believe that Jupiter can drop to around 200 degrees below freezing? People could not survive there. You also can't live on Jupiter because Jupiter **rotates** twice as fast as Earth.

Jupiter is different from other planets because it has a Great Red Spot (GRS) that is a hurricane storm. The winds travel at over 200 miles per hour. The first record of the GRS being seen was 300 years ago. The storm is big enough to swallow two Earths! **Astronomers** are still trying to figure out what made the Great Red Spot form on Jupiter.

Jupiter is the fifth planet from the Sun and it's the largest in our **Solar System**. It is known as a gas giant. It is mainly made out of hydrogen and **helium** gas. Jupiter's **atmosphere** is full of clouds of ice. Jupiter also has brownish stripes made of a gas called ammonia hydrosulfide, which smells like rotten eggs!

The Romans named this gas giant Jupiter and the Greeks named it Zeus. Zeus was one of the most powerful Gods. Do you think that's a good name for the biggest planet in our Solar System?

***The planet
Uranus has more
rings than the
planet Saturn.
True or False?*** →



← False.

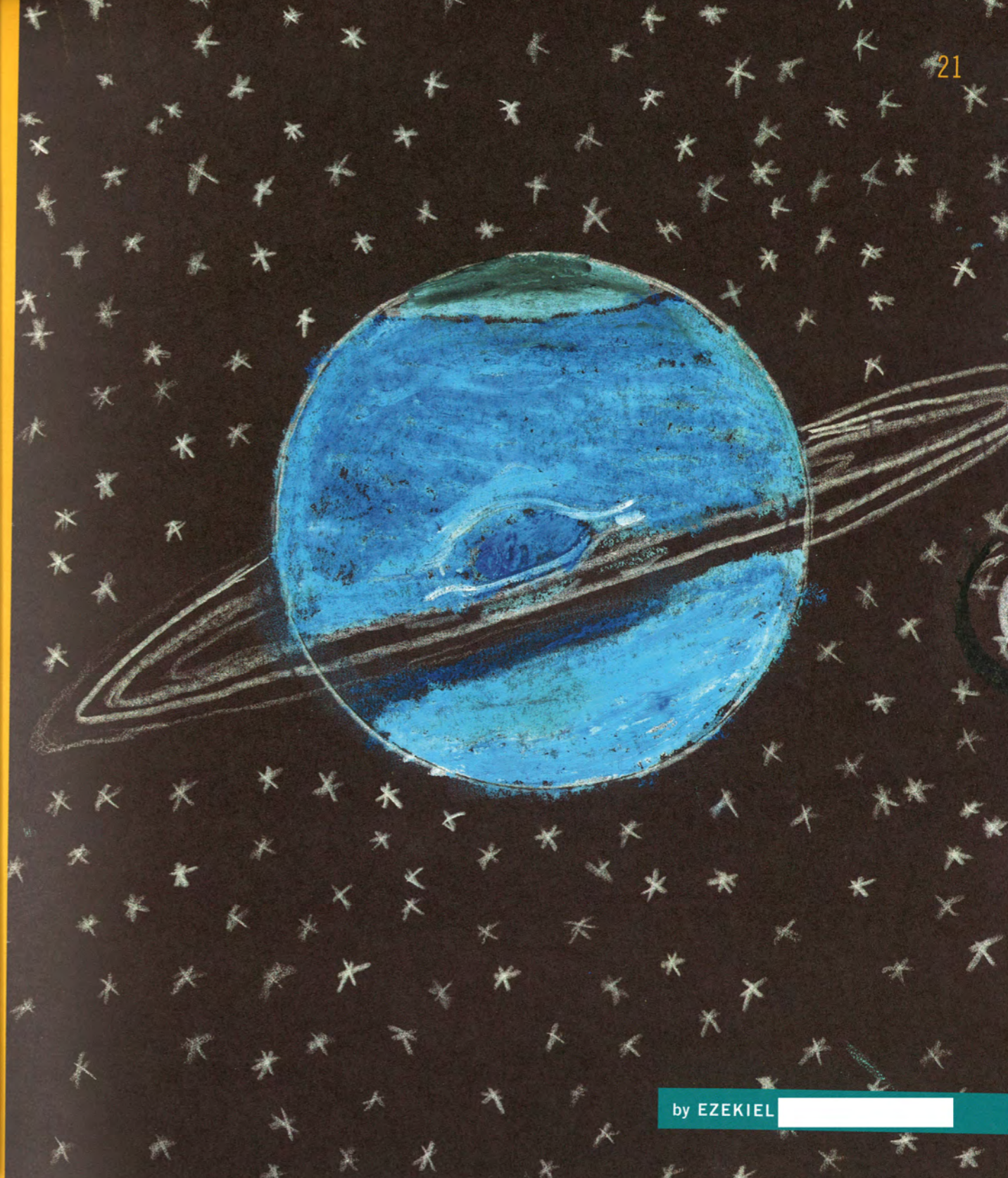
Saturn has the most rings. Like Saturn, Uranus has rings in **orbit**, but it has fewer rings. Saturn has more than 30 rings and Uranus has 13 rings around it.

Early in Uranus's formation, an **asteroid** hit Uranus and made it **rotate** on its side. Some of the asteroid pieces formed as Uranus's 13 rings. Uranus's rings are made of rock and ice because the asteroid that hit it was made of those materials.

Saturn and Uranus are not the only planets in our **Solar System** with rings. Jupiter and Neptune also have rings. Jupiter has about seven rings and Neptune has about six rings. The rings of these planets are made of rock, ice, and dust particles. The dust **particles** range in size from as small as an eyelash to as big as a house.

Here's a comparison that might help you imagine how planet rings form. Picture a tornado as a planet and all the things it picks up as the rings. Just as a tornado picks up things of different sizes like cars and books, planet rings also contain things that are big and small.

Neptune and Uranus have a lot in common. True or False? →



← True.

Neptune and Uranus have a lot in common. They are both gas giants, which are large planets that are made up of different gases. The gases in their **atmospheres** are **hydrogen** and **helium**. Uranus and Neptune are the seventh and eighth planets in our **Solar System**.

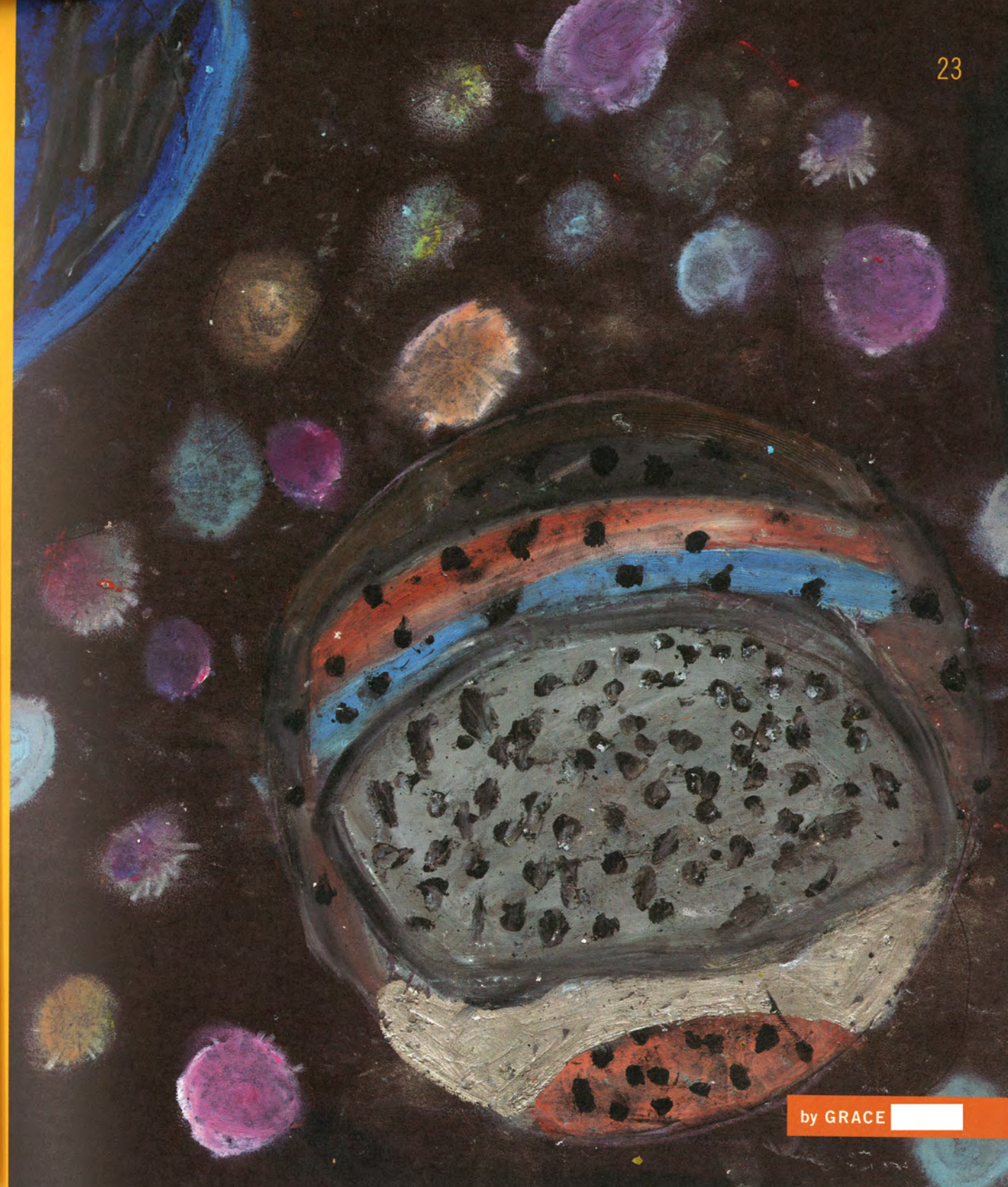
Let me tell you more about what Neptune and Uranus have in common. Their lengths of day are similar. Neptune's is 16.1 hours long and Uranus's is 17.2 hours long. Earth's day (24 hours) is longer than both Neptune's and Uranus's because Earth has a slower **rotation** than Neptune and Uranus. Even though their days are similar, Neptune and Uranus have different year lengths, which are formed by a planet's **revolution**.

Another way that Neptune and Uranus are similar is that beneath their atmosphere they have huge hot oceans of liquid gases, including **methane**. Methane is the gas that makes both planets blue. Neptune has more methane than Uranus and that's what gives it that azure blue color, like the ocean. Uranus has less methane and that's why its color is lighter.

One last similarity is the **diameter** of both planets. Uranus' diameter is about 31,763 miles and Neptune's diameter is about 30,777 miles. Both planets are about four times the size of Earth.

As you can see, Neptune and Uranus have several important similarities.

Triton, Neptune's moon, is bigger than the dwarf planet Pluto.
True or False? →



← True.

Triton is bigger than Pluto, which is a small **dwarf planet**. Triton has a diameter of around 1,678 miles and Pluto's is 1,430 miles. Triton is the seventh largest moon in our **Solar System**. **Astronomers** think that Triton might have been taken from the **Kuiper Belt** by Neptune's **gravitational pull** and crashed into other **asteroids** or moons on its way.

Triton was discovered by astronomer William Lassell on October 10, 1846. It is Neptune's largest moon. It is the only large moon with a **retrograde orbit**. This means it **orbits** in the opposite direction of its mother planet, Neptune. It was pulled so fast from the Kuiper Belt that after crashing it began a backwards path. Have you ever thrown something in the air that gets hit by something else? It changes course and goes the opposite way of what you wanted. That's a backward path.

Thinking of visiting Triton? Don't even try! You would turn to ice and probably fall into a crater or a crack. Maybe in the future we'll find a safe way to travel to Triton and you will be the first human to go that far in our Solar System!

**The Oort cloud
has 300,000,000
objects in
solar orbit.
True or False?** →



← False.

The **Oort cloud**, named after **astronomer** Jan Oort, actually has up to two trillion objects in solar **orbit**, and that's way more than three hundred million objects! Almost all the objects in the Oort cloud are made out of frozen rocks and gases, like **methane** and ammonia. All the objects go through a daily routine of solar orbit, but in many different directions.

A solar orbit is when an object orbits a star, like our Sun. For example, Mercury, Venus, Earth, Mars, the **asteroid belt**, Jupiter, Saturn, Uranus, Neptune, and other objects orbiting the Sun follow a routine of solar orbit. To make a long explanation short, almost anything that's orbiting a star is doing solar orbit.

Did you know that the Oort cloud's **comets** take over thousands of years to orbit? In comparison, the **Kuiper Belt's** comets take less than 200 years to orbit the Sun. Mathematically, it takes about 365,000 days for a comet from the Oort cloud to make a full orbit, while it takes about 72,635 days for a comet from the Kuiper Belt to make a full orbit. The Oort cloud extends all the way to our **Solar System's** closest neighbor, Proxima Centauri, a red dwarf star.

***In 2004, robots
landed on Mars.
True or False?*** →



← True.

Robots, not people, landed on Mars, the fourth planet from the Sun, in 2004. The **National Aeronautics and Space Administration (NASA)** created robots called the Mars rovers and sent them into space. A rover is a space vehicle that lands and travels on planets, but is controlled by humans on Earth using a computer.

Steve Squyres supervised the creation of the two Mars rovers named Spirit and Opportunity. NASA asked him to build these improved rovers so they could find out if there is water on Mars. If there's water, this means that there could be life on Mars.

The Mars rovers have six wheels that can move independently to handle the craters on Mars. They each have an antennae with two navigation cameras called Navcams that help the rovers drive in the right places. They also have two panoramic cameras called Pancams that take wide pictures. The rovers have arms, with elbows, that hold different tools. The Mars rovers also have solar panels that turn sunlight into electricity.

On June 10, 2003, Spirit blasted into space. Opportunity took off on July 7, 2003. The rockets experienced difficulties on the way. Luckily, Spirit landed on January 4, 2004 and Opportunity landed on January 25, 2004.

Spirit stopped moving in May 2009 and stopped communicating with NASA in March 2010, but Opportunity is still on Mars learning new things.

***Stars live forever
in the sky.
True or False?*** →



← False.

Stars are balls of gas and dust that live around 10 billion years. They are born in a great cloud of **hydrogen** gas and dust called a **nebula**. The inside of a star is filled with hydrogen and it's always burning. As the hydrogen burns, it pushes out heat while **gravity** pushes in. This is what keeps a star alive. When hydrogen runs out, a star fades. A way to visualize this is to think of the wood and fire in a fireplace. The fire would be the star and the wood would be the hydrogen. As the wood runs out, the fire dims. Similarly, when hydrogen runs out, the star fades away.

A star goes through different stages during its lifetime. When a star is born, the center of it becomes so incredibly hot that it turns hydrogen into **helium** energy. The young star glows brightly and gives off a lot of heat. Eventually, it can become a red giant. A red giant is an old star that has swollen to many times its normal size. The biggest stars may swell into super giants, which are 2,000 times the size of our Sun. A white dwarf is the core of a star left over billions of years that fades and dies. It is the final stage of a star's life cycle.

***Before Earth
was fully formed,
it crashed
with a large
planetesimal.
True or False?*** →



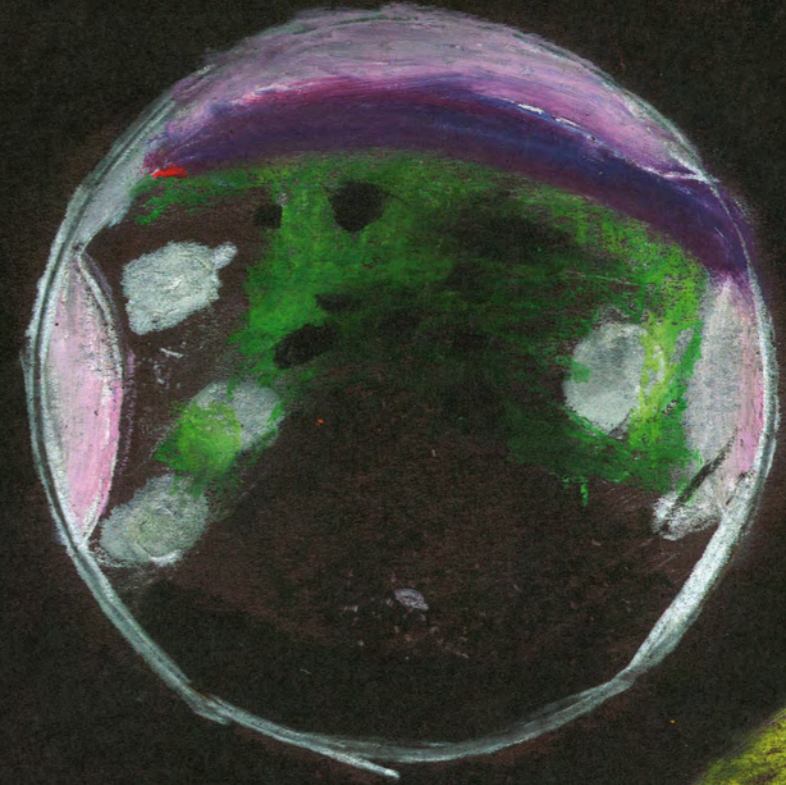
← True.

About 4.5 billion years ago, before Earth was fully formed, it crashed with a large **planetesimal**. The crash caused a lot of material from Earth's surface to fly into space and then some of it came together to form the Moon. The Moon is a natural **satellite** that **orbits** Earth. Some scientists think that there is no life on the Moon because it has no water or plants.

Unlike the Moon, there is life on Earth. This is because the Earth is not too close (or we would burn) or too far (or we would freeze) from the Sun. It is 93 million miles away. On Earth, we have land and water. About 70% of Earth is water. The ozone layer in the Earth's **atmosphere** protects us from the sun's harmful **UV (ultraviolet) rays**. Thank you atmosphere! Finally, we have **gravity**, which keeps us from floating away.

The Earth is tilted on an axis that runs through the center of our planet between the North and South Poles. There are times during the year when the North Pole is tilted towards the Sun and other times when the South Pole is tilted towards the Sun. This is what causes summer and winter. This happens because the Earth **revolves** around the Sun in an orbit. The Earth also **rotates**, or spins, while revolving. This causes night and day.

***Ganymede,
Jupiter's largest
moon, has
no layers.
True or False?*** →



← False.

Ganymede has three main layers. It has a core, a mantle, and a very thick ice shell on the outside. In other words, it is like a grapefruit cut in half. The fruit is the core; the white part (or pith) is the mantle; and the skin is the ice shell. The core is a sphere made of metallic iron and sulfur. The mantle is a spherical shell of rock that surrounds the core. Finally, the ice shell on the outside is very thick. It's around 800 km (497 miles)!

Ganymede was discovered in 1610 by Galileo Galilei. Its surface is a mixture of two types of **terrain**. 40% of Ganymede's surface is covered by dark regions, which are craters. The other 60% is a ridged or bumpy light region. Some of Ganymede's ridges are as high as 700 meters (2,100 feet). These two types of terrain form a detailed pattern across Ganymede that gives it its unique appearance.

Did you know that Ganymede is not only Jupiter's largest moon, but it's the biggest moon in our **Solar System!** Ganymede has a **diameter** of around 5,000 kilometers. Another interesting fact is that Ganymede's year length and day length are basically the same.

Even though all this information might be high-tech, I think it is awesome. If you feel the same way, check out more information.

**Venus has
acid rain.
True or False?** →



← True.

There isn't much pure water on Venus because it rains **sulfuric acid**. It's like a downpour on Earth, but with acid rain. Venus's **atmosphere** is very thick. The carbon dioxide atmosphere traps in heat, causing the surface temperature to be 860 degrees Fahrenheit. Along with acid rain, very strong winds and poisonous atmosphere gases are common on Venus.

Venus can be seen with the naked eye, which means you don't need anything to see it. In fact, it is the brightest thing in the night sky after the Moon. Venus actually has the same **phases** as the Moon.

Venus is a rock planet that may have active volcanoes, and is 67 million miles from the Sun. It is the second planet from the Sun. Did you know that Venus and Earth are about the same size? The **diameter** of each planet is only about 400 miles different.

The Magellan **Space Probe** was launched in 1989. Fifteen months later, it landed on Venus. The Magellan Space Probe uses radar for scanning Venus to capture images.

In conclusion, don't judge Venus by its tough conditions. Venus could help us find out information about our own planet!

***The Moon is
an unimportant
satellite in
the sky that
has no craters.
True or False?*** →



← False.

There are millions of craters on the Moon. The craters look like big, carved bowls. The craters were actually caused by **asteroids** hitting the surface of the Moon. Picture a chocolate chip cookie. If you take all the chocolate chips out of the cookie, it will look like the craters on the Moon.

The Moon is very important to us. The Moon **revolves** around the Earth and the Earth revolves around the Sun. The Moon can help us see at night because the Sun's light reflects off the Moon. The Moon also affects the tides, which is when the water level changes. When you are at the beach and the water is low, it is low tide. When the water is high, it is high tide. Low tide and high tide depend on the Moon.

Do you want to walk on the Moon? Someone already has. Neil Armstrong and his partner, Buzz Aldrin, were the first men to walk on the Moon on July 20, 1969. They rode a **spacecraft** named the Apollo 11. Neil Armstrong's and Buzz Aldrin's footprints are still on the Moon because the dust is so thick and there's no wind to remove them!

Now you know why the Moon is important to us. Maybe you will walk on the Moon, just like Neil Armstrong did!

***There can be
animal life
on Makemake.
True or False?***



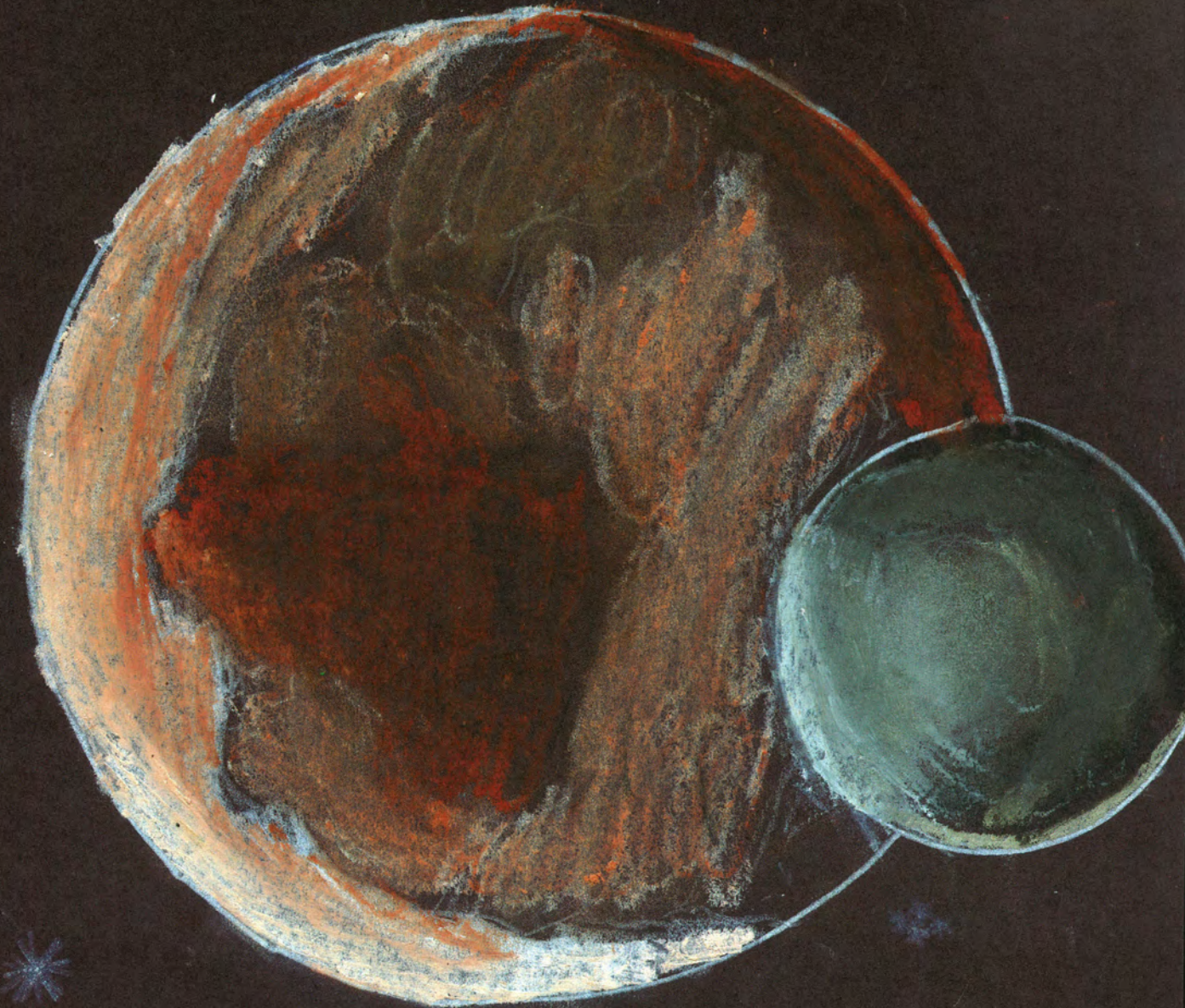
← False.

There cannot be animal life on Makemake (MAH-keh MAH-keh). It has no oxygen in its **atmosphere**. Humans and animals need oxygen to breathe or we will die. The atmosphere of Makemake is filled with **methane** and **nitrogen** gas, which are highly poisonous and impossible to breathe. On a summer day, the temperature on Makemake is -405 degrees Fahrenheit. The coldest day recorded in Massachusetts was -35 degrees Fahrenheit in 1981. That means that Makemake is 11.5 times colder than it has ever been in Massachusetts. We would freeze to death on Makemake!

Makemake is the third largest **dwarf planet** in our **Solar System**. The **diameter** of Makemake is 446 miles. It is a smaller dwarf planet than Pluto. If Pluto were the size of a grape, Makemake would be the size of a pea. As a result of its orbit and size, Makemake takes 310 Earth years to orbit the Sun.

Did you know that Makemake was originally named Easterbunny because it was discovered on March 31, 2005? No **spacecraft** or **space probe** has visited Makemake because of its atmosphere and temperature and how far away it is. The reason we know it exists is because of **satellites** that have been sent into space. We need to do more research in order to create a space probe or spacecraft that will be able to land on Makemake to learn more.

**Only one space
probe has ever
visited Pluto.
True or False?**



← False.

New Horizons, the first **space probe** ever to visit Pluto, is still on its way. That means that it has yet to arrive at Pluto. New Horizons blasted off Earth in 2006 and is scheduled to get to Pluto sometime in July 2015. It has been flying for seven years!

Before 2006, **astronomers** wanted to study Pluto, but no one had any close-up photographs, only artists' interpretations. That means that some artists had an idea of what Pluto looked like and sketched it. What did their sketches look like? Picture a small brown ball. Scientists wanted *real* scientific pictures of Pluto. So, in 2006, **NASA** sent a space probe, New Horizons, to Pluto. Then the scientists settled down to wait.

The phrase *new horizons* means new areas or learning new things, so NASA named the space probe New Horizons for the new places and new findings it would discover.

Astronomers made it easier to measure space by calling the distance between the Earth and the Sun (about 93,000,000 miles) one AU. Since Pluto's **orbit** is oval shaped, meaning its distance from the Sun varies at different times, Pluto can be 30 to 50 AU away from the Sun.

At present, New Horizons has flown 22 AU and has 10 AU, or roughly 930,000,000 miles, to go before it reaches Pluto. Good luck, New Horizons!

A comet's orbit is exactly the same a planet's orbit.
True or False? →



← False.

A **comet's orbit** is different from a planet's orbit. A comet has a high **elliptical orbit**. Comets are usually very far away from the Sun, but sometimes orbit very close to the Sun. When comets get close to the Sun, they form tails because they're melting. Planets stay about the same distance from the Sun all the time.

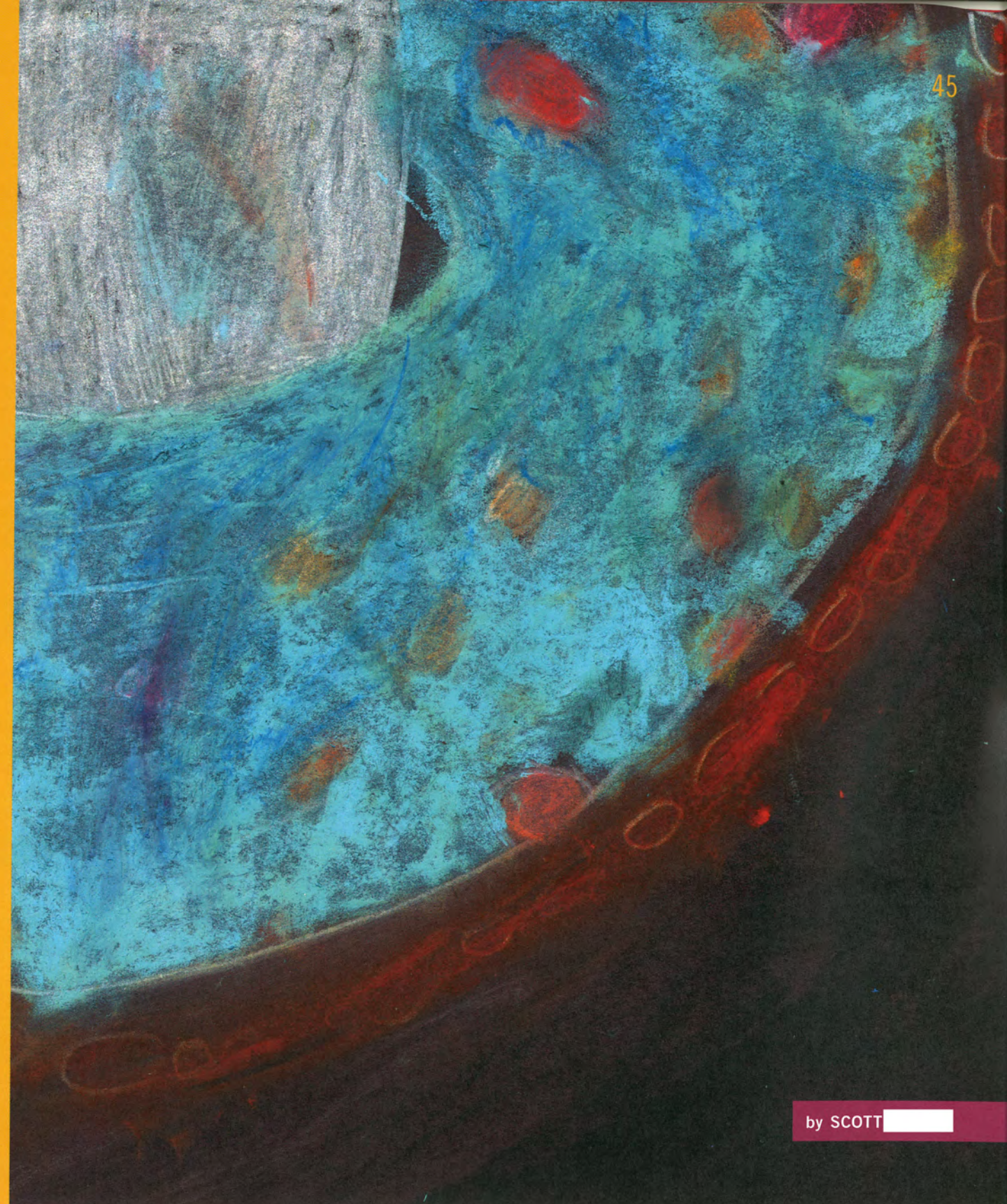
A comet is made of ice and dust. Did you know that comets are related to **asteroids**? The main difference is that asteroids are made of mostly rock because they are leftover pieces from when the **Solar System** formed.

Comets are found in the **Kuiper Belt** or the **Oort cloud**. When two comets crash together, they sometimes leave the Kuiper Belt or Oort cloud. Then they form an orbit around the Sun because of the **gravitational pull** in our Solar System.

Some comets have larger orbits than others. For example, Encke's Comet has a small elliptical orbit and takes three years, and Halley's Comet's orbit takes around 75 years. That means it is rarer to see Halley's Comet. Did you know that Halley's Comet will pass us in 2061 while it is orbiting?

You might be wondering how fast a comet travels. They can sometimes travel as fast as 150,000 miles per hour. That's faster than supersonic speed!

**All galaxies
are calm.
True or False?** →



← False.

A small amount of **galaxies** have violent explosions in their cores. The explosions force giant streams of gas, rocks, and dust. **Astronomers** believe these are the aftershocks of the **Big Bang**, which some people believe created our **Universe**.

These explosions are deadly. If you get too close to or in the way of a blast, you could be vaporized! Also, the heat source that powers the explosions is not just the stars, but also giant black holes!

New galaxies are created when a cloud of gas shrinks and becomes dense. These active galaxies are much denser than normal, especially in their cores with a lot of excess rocks, gas, and dust. These streams of gas can go on for thousands of **light years**!

The special name for these active galaxies is Quasars. The light from these galaxies takes billions of years to reach us. Luckily these galaxies are the most distant from ours, so we won't be hit with a blast anytime soon.

In conclusion, research shows that there is such a thing as active galaxies, but nobody knows how many there are. Nobody even knows how many galaxies there are. New ones are created everyday; one could even be forming right now, and now, and now...

Don't worry – we live in a non-violent galaxy!

Glossary

ASTEROID: a rocky space object that orbits the Sun. An asteroid is similar to a comet but does not have a tail.

ASTEROID BELT: an immense, doughnut-shaped ring of asteroids orbiting between Mars and Jupiter

ASTRONOMER: scientist who studies planets, stars, and galaxies

ATMOSPHERE: a mixture of gases that surround a star (like our Sun) or a planet (like our Earth)

BIG BANG: a super-powerful explosion, thought to have started the creation of our Universe

COMET: a big ball of dirty ice and snow that has a tail

CONSTELLATION: a group of stars that makes an imaginary shape in the night sky

DIAMETER: the length from one end of a circle to the other, going through the center

DWARF PLANET: a small object that resembles a planet and orbits the Sun. Dwarf planets have a low amount of gravitational pull. They are too small to be considered planets.

ELLIPTICAL ORBIT: going around another object in a path shaped like an oval

EXOPLANET: a planet outside of our Solar System

GALAXY: a giant collection of gas, dust, and stars held together by gravity

GRAVITY: the invisible force between objects that makes them attract each other

GRAVITATIONAL PULL: the attraction an object has to another object due to the invisible force of gravity

HELIUM: colorless, odorless gas

HYDROGEN: colorless, odorless gas that easily catches fire

KUIPER BELT: a ring of icy comets that orbit the Sun at a fast pace; located past Pluto

LIGHT YEAR: the distance light can travel in one year (about 6 trillion miles)

METHANE: colorless, odorless gas that easily catches fire

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA): a United States government agency that studies space

NEBULA: a cloud of gas and dust in outer space, usually the remains of an exploded star

NITROGEN: a chemical that is colorless and odorless and makes up a large part of the atmosphere

OORT CLOUD: a swarm of a trillion or more objects which circle the Sun in several directions, far beyond Pluto

ORBIT (NOUN): the path of a space object as it revolves, or circles, around another body

(VERB): when an object in space goes around another object

PARTICLE: a very, very tiny piece of matter

PHASES: the shape of the sunlit (illuminated) portion of an object, like the Moon

PLANETISMAL: a small space body that existed at the early stage of our Solar System. Planetismals are thought to have come together to form the planets we know today.

RETROGRADE ORBIT: when an object orbits or moves

around another object but in the opposite direction

ROTATE: to turn around from a center point, or axis, like a wheel turns on a bicycle

REVOLVE: to move in an orbit, or circle, around an object

SATELLITE: an object that moves around a larger object. There are both natural satellites, like moons, and man-made satellites, like the Hubble Space Telescope.

SOLAR ECLIPSE: when the Moon passes between the Sun and Earth, and blocks the Sun from Earth's view

SOLAR SYSTEM: the Sun and all of the objects that orbit around the Sun

SPACECRAFT: a vehicle or machine that is designed to fly into outer space, carrying cargo or humans

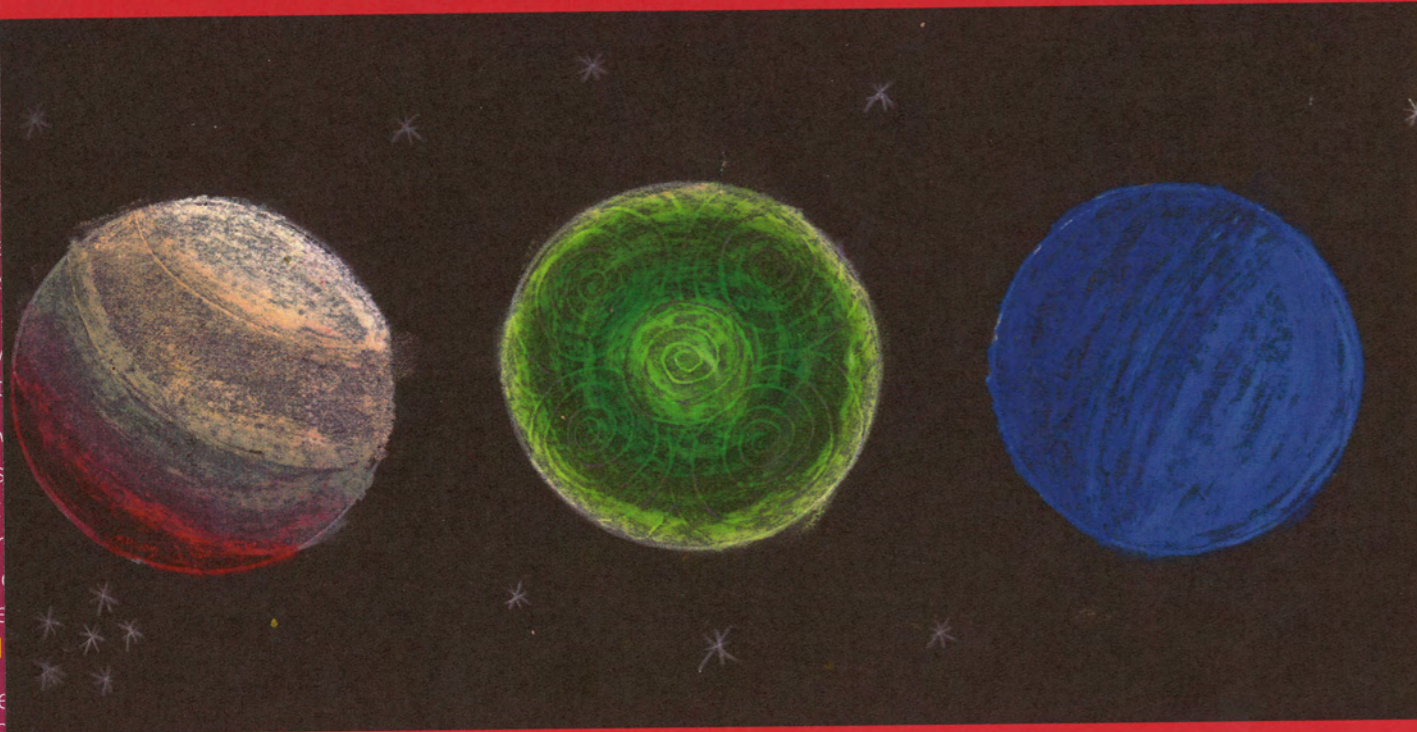
SPACE PROBE: a research craft sent into space without humans on it

SULFURIC ACID: a strong liquid that corrodes or wears away and can harm another substance

TERRAIN: a piece of ground having specific physical features, such as mountains, craters, and valleys

UV (ULTRAVIOLET) RAYS: an invisible form of energy given off by the Sun. These are the rays that cause humans to get sunburned.

UNIVERSE: the huge space that contains all the matter and energy in existence



Thank you!
Thank you! Thank you!
Thank you!
Thank you!
Thank you!

Thank you!

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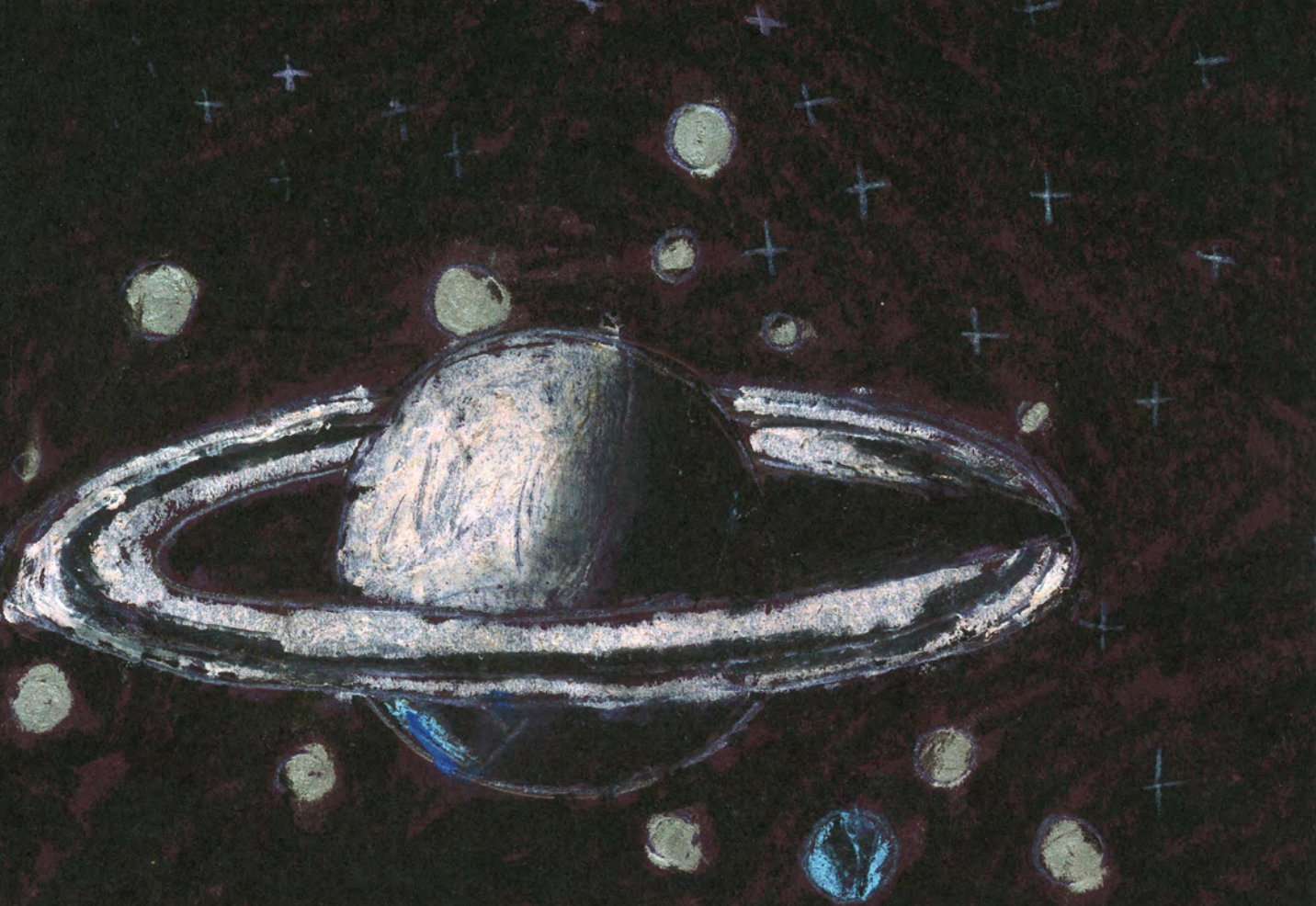
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Are Saturn's rings made out of dust and ice?

Do stars live forever in the sky? Do black holes take you to a different solar system? Test your knowledge of the Solar System and beyond with this true or false book created by the fourth-grade class at the Conservatory Lab Charter School.

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