

# ADVENTURE GEOMETRY

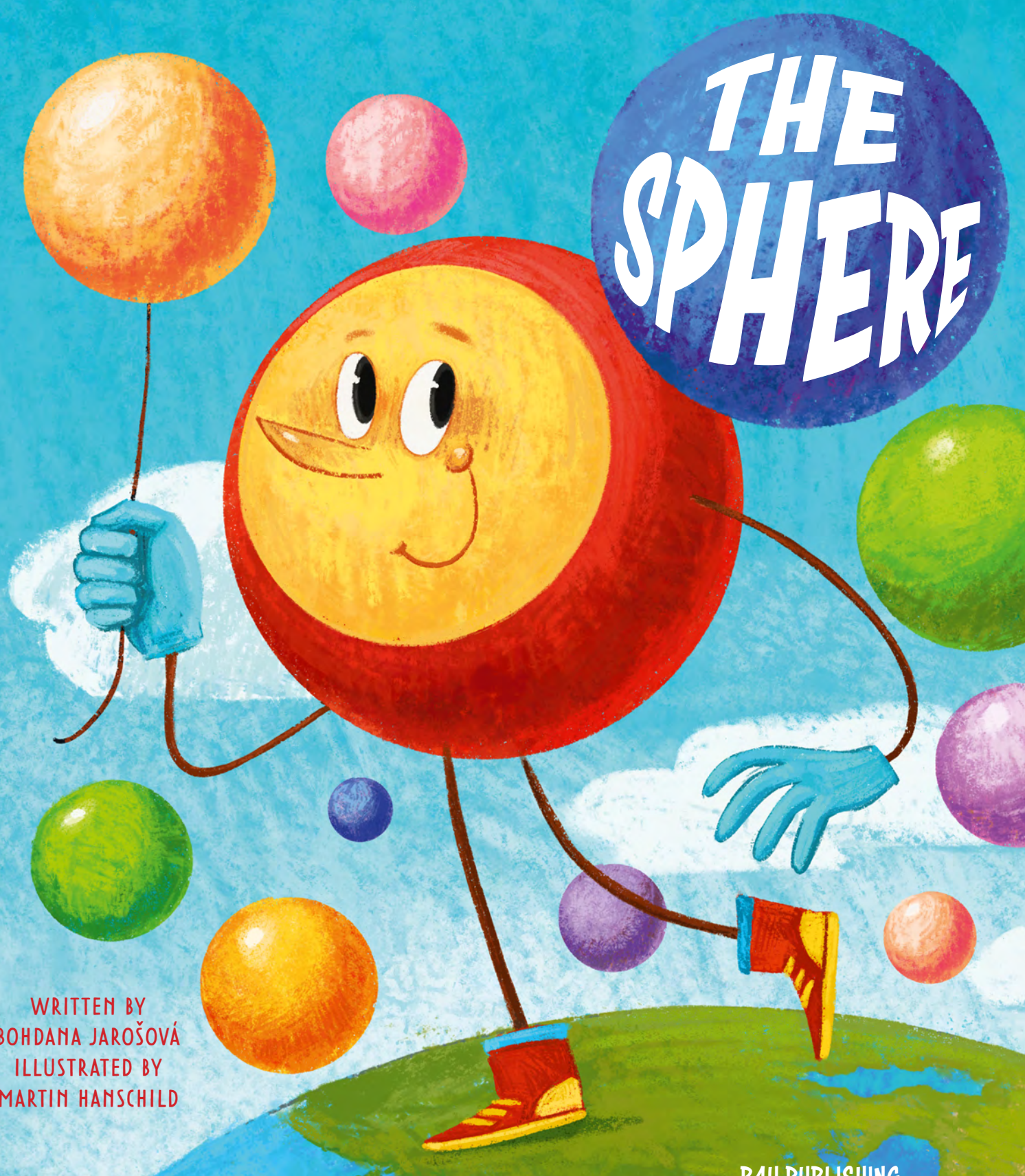
## THE SPHERE

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B4U PUBLISHING

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ADVENTURE GEOMETRY: THE SPHERE





# BALLS



Up here, I have a very different view. And these sports shoes will come in handy. The first story is about the kind of spheres you have surely kicked. The balls in it are large and small. Some are almost too heavy to carry; others are as light as a feather.



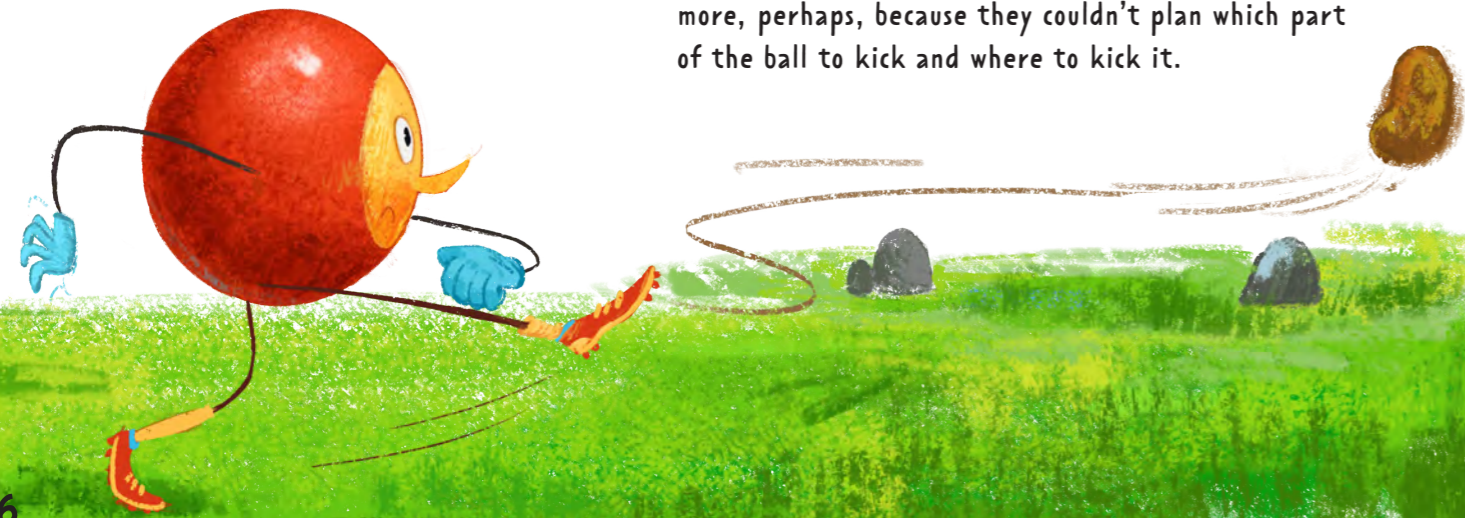
## SOMETHING WRAPPED IN LEATHER

If you were thinking that balls have existed for just a few decades, you couldn't be more wrong! Soldiers played a kind of football before the Common Era, too. In ancient China, they made balls from soft animal remains or horsehair wrapped in animal hide. Ancient Egyptian balls were stuffed with grain, while European ones used an inflated pig's bladder wrapped in pigskin.



## WHAT ARE YOU SHOOTING AT?

Balls like this were a far cry from the regular ones of today, of course. They had bulges and dimples. Some were like shapeless bags. They were pretty smelly, too. Still people had great fun with them—all the more, perhaps, because they couldn't plan which part of the ball to kick and where to kick it.



Charles Goodyear's original ball is kept at the National Inventors' Hall of Fame in the town of Oneonta, New York State.

## FATHER OF ALL BALLS

19th-century US chemist Charles Goodyear came up with vulcanized rubber, a revolutionary invention that was tough, elastic and highly durable. The rubber football was born! Covered with leather, it had a good bounce, didn't burst on impact, and—most important of all—was a regular sphere. At last!



## EASIER TO SEE

A blow from a ball covered with heavy leather was painful. So the first balls of lighter materials were made. The new balls were lighter in colour, too. On the field of play, the darker the ball was, the harder it was to see. The first black and white football was used at the 1970 World Cup in Mexico. The reason for the change was simple: it was easier to see on TV.

The Telstar soccer ball was stitched together in alternating black and white. It was named after the satellite of similar appearance.



## FOOTBALL TO BASKETBALL

Football spawned another sport—basketball. University teacher James Naismith came up with this game. At first, the object thrown into the baskets was a football.

## WHICH SPORTS USE A BALL?

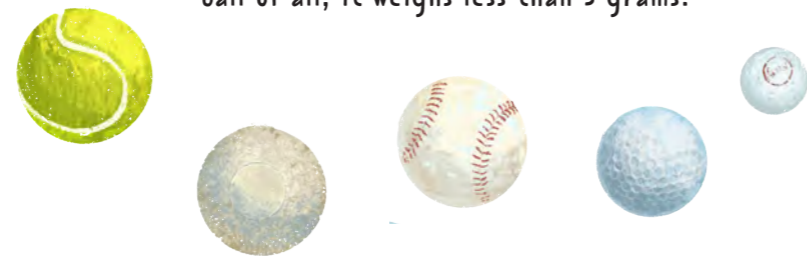
Lots of sports use a ball. They include volleyball, handball, korfball, football tennis, water polo, cycle ball and horseball. Each sport uses a slightly different ball. In general, a softer ball is better for throwing and a harder one is better for kicking.



People work out with balls. The heaviest medicine ball weighs 10 kilos.

## BALL AND RACKET

There are also sports where the ball is not held or kicked but struck with a bat or racket. Can you think of any? How about tennis, squash, lacrosse, padel, ... ? And there's table tennis, which has the lightest ball of all; it weighs less than 3 grams.



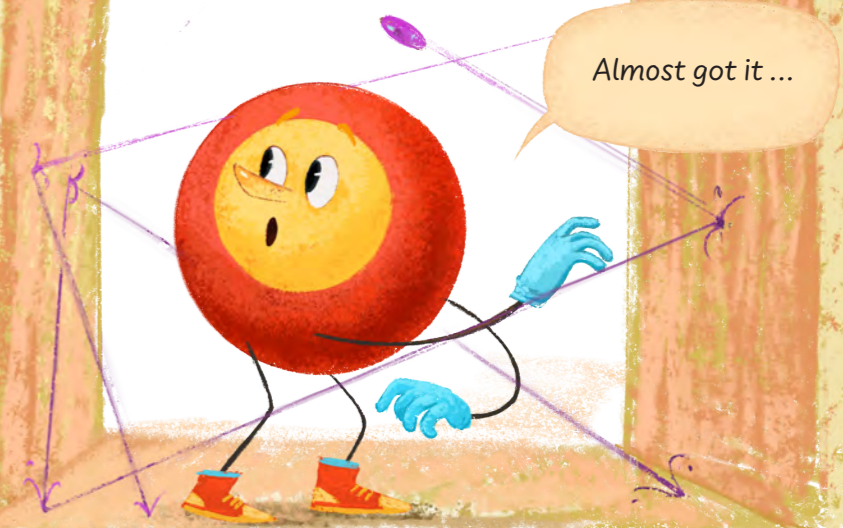
## BALL OLYMPICS

The very biggest ball is used in pushball. Weighing 22 kilograms, it is 183 centimetres in diameter. Players try to push it into the opposition's goal. A similar game is played on horseback. What fun that is!



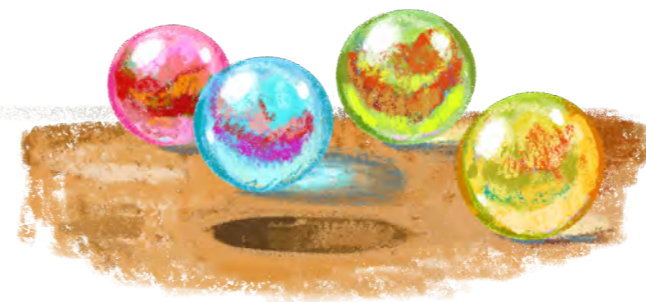
## RESTLESS LITTLE BALL

You can have great fun with a little ball made of rubber with energy to burn! In fact it won't stop bouncing! Invented in the 1960s by two US entrepreneurs, 20 million such balls were sold practically straight away. Amazing!



## GAME FOR GROWN-UPS

Do you know which ball for play is the smallest? Well, it's the marble. If you were thinking that only children flick and nudge these things, you couldn't be more wrong. In ancient Rome, marbles was played by the rulers Caesar and Romulus Augustus. In 16th-century England, men played marbles to win a lady's heart. Grown-ups still have marbles competitions.

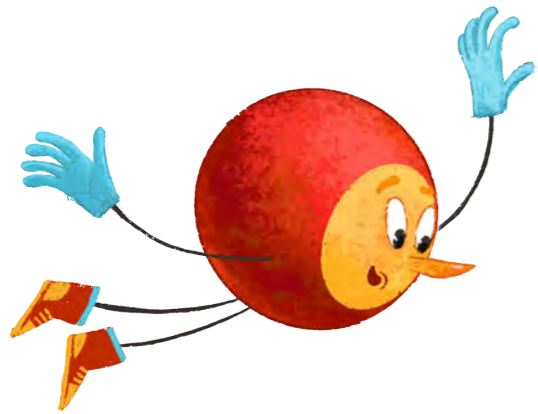


## HOW TO PLAY MARBLES

Although marbles is played all over the world, rules vary from place to place. They are flicked into one or two holes, flicked out of a circle, tossed against a wall, or tossed into a goal between two sticks. To flick a marble as far as you can, use your middle finger with your thumb as a spring.

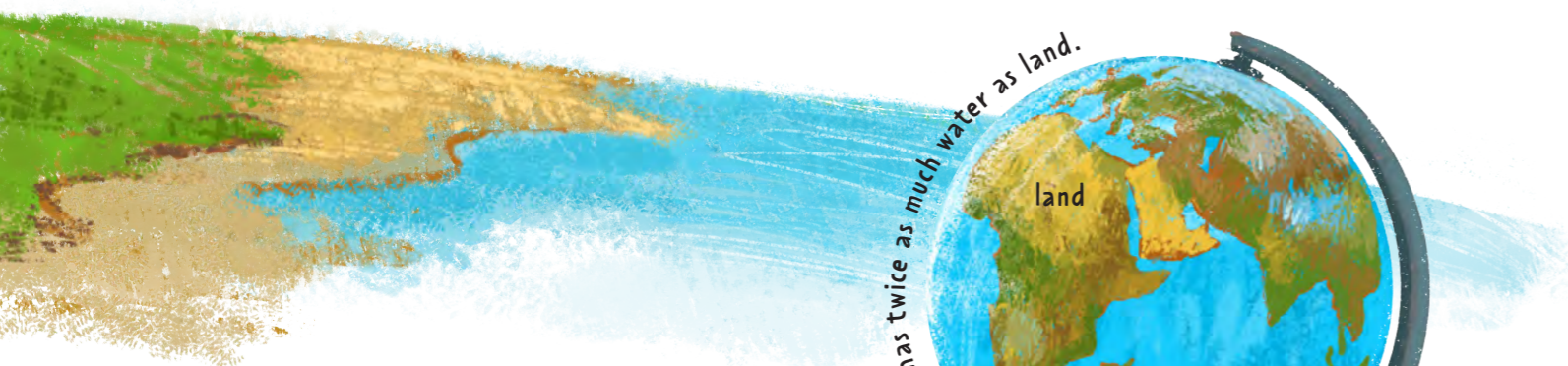
Marbles have been made out of pebbles, fruit stones, clay and bone. Glass is most common today.





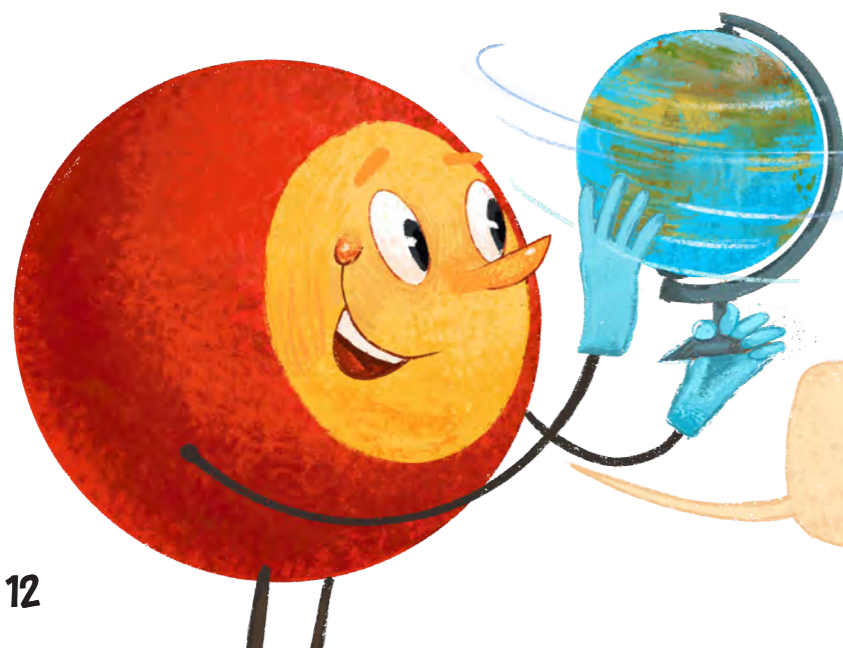
## WHY DON'T WE FALL?

How come we don't fall off our enormous globe? And how come an apple always falls from the tree to the ground and not into the sky? The physicist Isaac Newton came up with an answer to this. He discovered that what holds us down is gravity. The core at Earth's centre has such force that it keeps us all on the surface. But wouldn't you sometimes like to fly away?



## GEOGRAPHY IN THE HOME

Earth is so amazing that people put it in their homes. In the form of a globe, of course! A globe shows mountains and plains, oceans and rivers, states and cities. Does Earth have more land or more water? What do you think?



## TURN BY TURN

One of the best things about a globe is that it can be rotated and so viewed from all sides. Besides, rotation is exactly what Earth does as it moves around its axis. Look at the speed of this!

Earth isn't actually that fast. One revolution takes 23 hours, 56 minutes and 4 seconds—almost one day.

## BRIGHTEST SPHERE

As Earth rotates on its axis, the Sun shines on it first from one side, then from the other, giving us alternating night and day. The Sun, too, is a spherical miracle. It is a huge burning sphere—the largest sphere in our Solar System. Compared to the Sun, Earth is tiny.

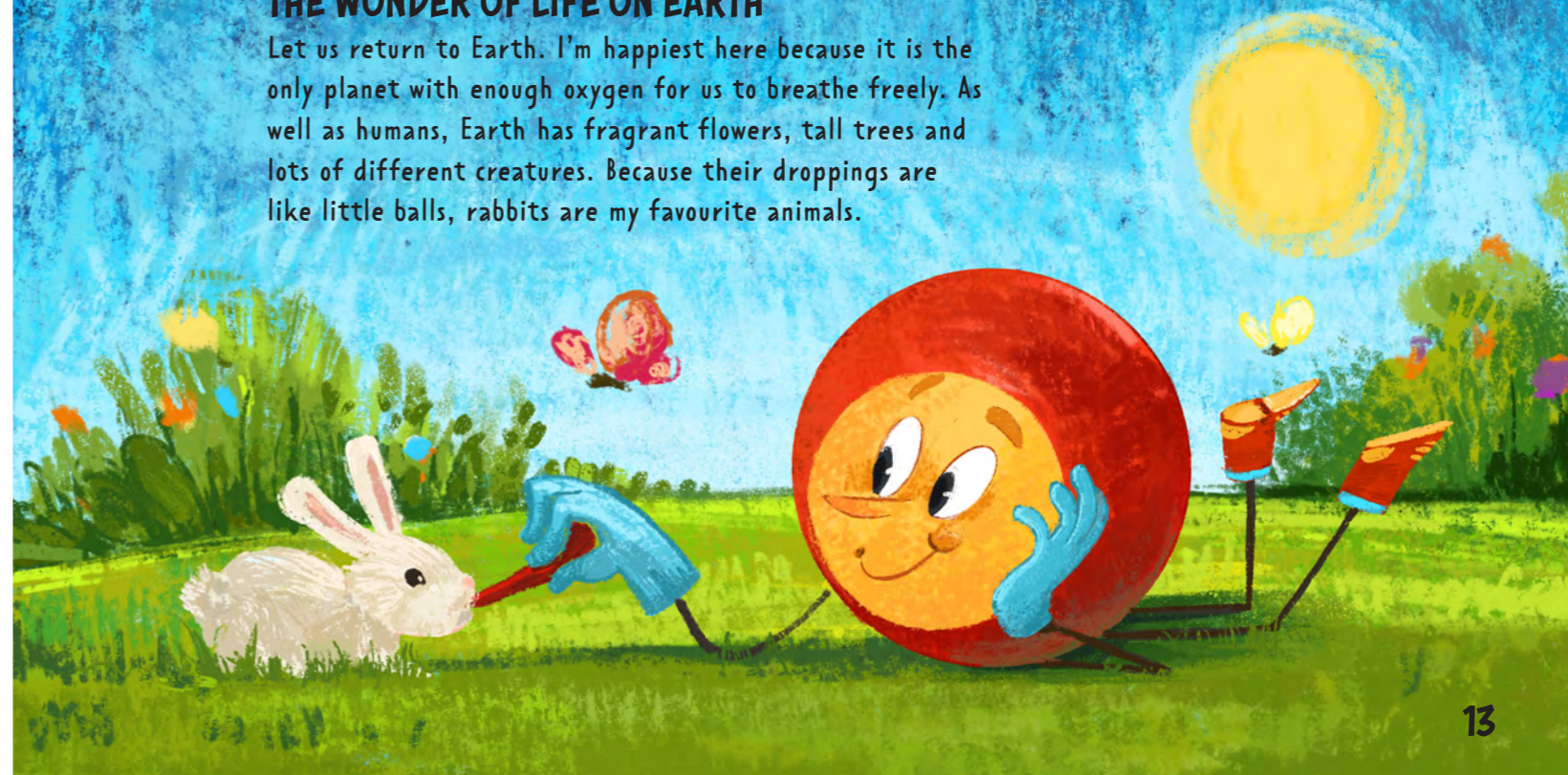


## A SPHERE-FILLED UNIVERSE

The Sun and Earth are not the only spheres in space, of course. They are joined by other spherical planets, notably Mercury, Venus, Mars, Jupiter, Saturn, Uranus and Neptune. All move around the Sun, in a kind of sphere-filled cosmic theatre. How lovely it is!

## THE WONDER OF LIFE ON EARTH

Let us return to Earth. I'm happiest here because it is the only planet with enough oxygen for us to breathe freely. As well as humans, Earth has fragrant flowers, tall trees and lots of different creatures. Because their droppings are like little balls, rabbits are my favourite animals.





## FAMOUS CULTIVATOR

Did your pea grow? If it didn't come off first time, don't give up, try again: not every seed will take. The germination of pea seeds caused one

scientist to become famous all over the world. Just imagine! This was the mathematician and naturalist Johann Gregor Mendel.

## FARMBOY

Johann Mendel grew up with his parents and two sisters on a farm. He helped his father in their orchard. Even as a child, he liked to plant seeds in the ground and wait to see what would grow from them. He was interested in everything natural and asked many questions. Why are some apples green and others red? Why do flowers have different shapes?



## SCIENTIST IN ACTION

His fondness for nature stayed with him. As a monk at the Augustinian abbey in Brno, Austria-Hungary, he could devote himself to plants as a scientist. He chose the pea as his subject of research. He noticed that pea seeds differed. He began to crossbreed them.

Great things are afoot ...



What will become of this, I wonder ...



## GENETICS IS BORN!

Are you wondering what Mendel the scientist grew? Peas, of course! In the process, he learned something very important: that plants pass their genes from generation to generation. And this was true not only of plants, but also of animals and humans. This explains how you have your dad's button nose and your mum's beaming smile.

I have my dad's round tummy and my mum's broad hips. Hee, hee, hee ...



## FATHER OF GENETICS

So it was that Mendel became the founder of modern genetics—the science of genes. Genetics reveals to us many more things than who we look like. It tells us which diseases our bodies are prone to and what we can do about them in advance. It helps agriculturalists breed plants that are resistant to fungus and produce a good harvest. In short, this science helps us every day of our lives.

## ROUND FEAST

As for fruit and vegetables, there are many more amazing, delicious, round things. Think of bilberries, currants, cherries, grapes, oranges, grapefruits, tomatoes, cabbages, watermelons ... Yum, yum, yum.

We'll move on to the next story once I've eaten a piece of melon.





### SWEDISH WARSHIP

Vasa was built to be the pride of the Swedish navy. No other ship was as large or as beautiful. Her two decks had 64 cannons with ammunition and space for almost 500 troops. As it turned out, however, such a large structure was beyond the skills of the shipbuilders. Vasa's cannons were to fire a number of volleys as she sailed out of the harbour. But as soon as the gun hatches opened, the ship began to take on water. Two kilometres into her maiden voyage, Vasa sank.

### HOW DID THE STORY END?

Years later, Vasa was raised from the ocean bed and made into a museum—where cannonballs are on display! Some were intended to attack a ship's hull, others its top deck, others to take down the sail. Each cannonball had its target.

### FROM LAND AND SEA

Cannons were used for attack and defence. Soldiers defended forts and ships with them. A certain old ship filled with cannons on several levels has her own museum in Stockholm, Sweden. What did she do to deserve this? Let me explain ...

That museum must be a pretty scary place ...



Targets for cannonballs:



### A BALL THAT INSPIRES FEAR

But enough about whooshing cannonballs! Let me now introduce you to a megaball that will destroy everything in its path. It's the wrecking ball—a monster used by construction workers to demolish tall buildings. It's the tops at bringing down a wall!



### BALL-LIFTING HELICOPTERS

A wrecking ball will demolish rock, too. Hooked to the undercarriage of a helicopter, it swings at a height no crane could reach, before smashing into the rock and causing it to crack and crash down. Stretches of rock in danger of collapse are broken up this way.

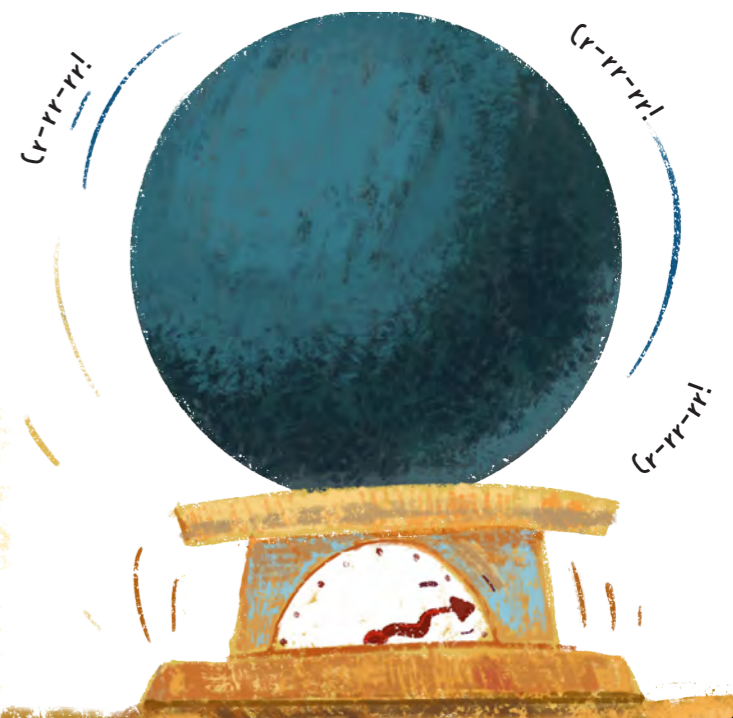
Can you guess how much a wrecking ball weighs? The answer is 6,000 kilograms—the same as four passenger cars or six cows. Let's now allow it to roll away, so we can move on to the next story.

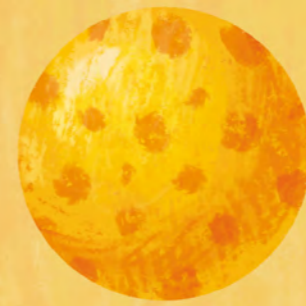


Thank goodness for my long legs!

### FOR SKILLED CRANE OPERATORS ONLY

Let me explain how this works. An experienced crane operator swings a heavy ball attached to the end of a strong cable so that the ball strikes an exact spot, taking great care that it doesn't also strike—and wreck—his crane. As this skill is so difficult, it is no longer in widespread use.







# ADVENTURE GEOMETRY


# THE SPHERE

WRITTEN BY BOHDANA JAROŠOVÁ  
ILLUSTRATED BY MARTIN HANSCHILD

You know what a sphere looks like. Everyone does. But the sphere in this book is quite something. She thinks herself beautiful—far lovelier than any cube. She doesn't lack self-confidence! She is happy to test lightning on a rainy day, take part at the Olympics, and help the greatest scientists with their experiments. Read on to find out about all the things a sphere can do!



ISBN + EAN

 b4u publishing  
www.albatrosmedia.eu  
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Illustrations © Martin Hanschild  
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