IN BRIEF

Gravity Game is a story about a boy called Galileo, who noticed something interesting about the way objects fall. This pack is inspired by his tale – it includes facts about the fascinating world of physics and even has some experiments for you to do!



1. LITERACY LESSON IDEAS

- The tales in this month's issue of ***Storytime*** use words and phrases that your pupils may not be familiar with. Encourage them to look up the meanings of any new words in the **Storytime Glossary**. Once they have learned what a new word means, ask them to use it in a sentence!

- The **Class Discussion Sheet** is about a force that is all around us and affects our lives every day! The questions will encourage children to think about gravity and its importance in the universe. The answers they come up with may inspire them when they do the writing exercise in this pack.

- The **Reading Comprehension Sheet** challenges pupils to spot a *possessive pronoun* and an *adjective*, and also includes an exercise where they have to match pronouns with possessive pronouns.

- Can your students put the events on the **Story Sequencing Sheet** in the right order? They should number them from 1-11 to show the sequence in which they should be read. Children should refer to Galileo's story in the magazine if they get stuck.

- What would happen if gravity stopped working for one minute? That's what your pupils will write about in the **Gravity Tale** activity! Before they start writing, ask them to think about the effects of gravity and what would happen if it suddenly 'turned off'. What would happen to them, their classmates, nearby objects, and even the planet Earth? What would they be able to do? Once your students have some ideas, they should start writing their fun and imaginative stories...

Continued on page 2...

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2. HISTORY LESSON IDEA

- Galileo Galilei was a real-life scientist who came up with fascinating ideas about gravity and our solar system. The **Know Your Physicists!** page has fact-filled profiles about him and five other physicists who changed how we look at the world. In fact, you can read stories about several of them in previous issues of ***Storytime***!

3. MATHS LESSON IDEA

- Physicists use maths when working out how the universe works, and the **How Much Mass?** page has an activity in which students have to use a scale to measure how much objects weigh They should sort the objects by how much they *think* they weigh and then use the scales to check their actual weights. Pupils should record their results on the activity sheet.

4. SCIENCE LESSON IDEAS

- The **What Is Physics?** sheet introduces basic physics concepts in an easy-to-understand way. In its simplest form, physics is about *matter*, *energy*, and the ways in which they interact! We recommend going through this page with your class before moving on to the other physics-related activities in this pack.

- Physics is just one branch of science! Can your students match the scientists on the **Who Does What?** page with the things that they study? Ask your pupils which subjects sound the most interesting and why. Which ones would they like to study in the future? It's worth noting that scientists of different disciplines often work together on projects. They all have something unique to contribute... just like the students in your class!

Continued on page 3...

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4. SCIENCE LESSON IDEAS CONTINUED

- In our universe, energy is what makes things happen! Pupils can find out more about it on the **Many Forms of Energy** sheet. Seven types of energy are listed, and your students should match each one with an activity they use it for.

- The **Roll It!** page has a simple and fun experiment in which students can observe gravity in action! There are instructions for building a simple ramp which they can roll different balls down. How far does each ball roll, and how do one or more bits of fabric placed in their way affect the results? Pupils should measure how far each ball rolls and record this information on the activity sheet. What conclusions can they draw from this data?

5. ART LESSON IDEA

- Light is a form of energy – and when you split white light with a prism, you get all the colours of the rainbow! The **Colours of the Rainbow** page has a picture to colour in, and children should complete it using red, orange, yellow, green, blue, indigo and violet. These are the 'traditional' colours of a rainbow, though in reality there are lots of other shades in between. Or would your students prefer to come up with their own group of cool colours? They should list the colours they used on the table on this page and fill in the swatches beside each one.

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STORYTIME GLOSSARY

You can look up the meanings of words and phrases you don't know here!

The Wolf's Shadow (Page 6)

- **Trotted:** walked or ran with short steps
- **Den:** home or shelter of an animal
- **Thicket:** thick group of trees or bushes
- **Realised:** suddenly understood something
- **Boasted:** talked with pride about himself
- **Antelopes:** graceful horned mammals
- **Embarrassed:** feeling silly or shy about something
- **Stalked:** sneaked carefully as if hunting
- **Pounce:** jump forward to catch something
- **Swivelled:** turned from side to side
- **Boulder:** very large rock
- **Magnificent:** very impressive
- **Immense:** extremely big
- **Predator:** animal that hunts other animals

Gravity Game (Page 9)

- **Gravity:** force that pulls things towards each other
- **Cathedral:** large, important church
- **Cobbles:** small rounded stones used to make roads
- **Basin:** wide bowl for holding water
- **Sway:** move from side to side
- **Tutor:** teacher for one child or small group
- **Memorising:** learning something by heart
- **Philosopher:** person who thinks deeply about the world
- **Spire:** tall, pointy bit of a building
- **Inched:** moved slowly and carefully
- **Vacuum:** space with no air in it

The Blue Parrot (Page 15)

- **Ferocious:** very fierce or scary
- **Wizard:** person who can use magic
- **Wickedness:** bad and cruel behaviour
- **Spoiled:** given everything she wants
- **Selfish:** only caring about herself
- **Summoned:** called for someone
- **Vulture:** large bird that eats dead animals
- **Rumours:** stories that may not be true
- **Furious:** extremely angry
- **Courtiers:** people who assist a king
- **Disappeared:** went away suddenly
- **Impostor:** someone pretending to be someone else
- **Enchantment:** magical spell
- **Sheepish:** feeling shy or embarrassed about something

The Gully of Stench (Page 21)

- **Gully:** small valley
- **Stench:** very bad smell
- **Endless:** seemingly going on forever
- **Steep:** rising very sharply
- **Snow-capped:** with snow on top
- **Hidden:** out of sight and hard to find
- **Destructive:** causing damage or harm
- **Avoid:** stay away from something
- **Pestered:** asked again and again in an annoying way
- **Slanted:** went at an angle
- **Retching:** coughing as if about to be sick
- **Gorge:** steep, narrow valley
- **Troll:** kind of large humanlike monster

Continued on page 2...

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STORYTIME GLOSSARY

Pond Life (Page 28)

- **Precious:** very special and important
- **Gaze:** look at something for a long time
- **Mucky:** dirty and unpleasant
- **Secretly:** without anyone else knowing
- **Shrink:** become smaller
- **Webbing:** skin between fingers or toes
- **Reflected:** shown back, as in a mirror
- **Swayed:** moved gently from side to side
- **Waterweeds:** plants that grow in the water
- **Zipping:** moving very fast
- **Chorus:** group of voices talking or singing together

The Ghost Ship (Page 30)

- **Howling:** making a loud, scary noise
- **Creak:** squeaking sound
- **Jagged:** rough and sharp
- **Hauled:** pulled very hard
- **Tiller:** handle used to steer a boat
- **Gusts:** sudden strong blasts of wind
- **Vessel:** boat or ship
- **Starboard:** right-hand side of a boat
- **Vast:** very large
- **Galleon:** very big sailing ship
- **Ghostly:** like a ghost
- **Eerie:** strange and a bit scary
- **Phantom:** ghost
- **Mythical:** from a myth or legend
- **Pluck:** pull
- **Horizon:** line where the land or sea seems to meet the sky

Jenny's World (Page 35)

- **Exclaimed:** said loudly and excitedly
- **Dragging:** pulling something heavy along the ground
- **Bustled:** moved quickly and busily
- **Stomping:** walking with heavy steps
- **Mischief:** playful behaviour that causes a bit of trouble
- **Minister:** leader of a church
- **Flop:** fall heavily
- **Curtseyed:** bent slightly at the knee as a polite greeting
- **Parlour:** room for entertaining guests
- **Inspired:** filled with ideas and the desire to do something

The Three Peoples (Page 41)

- **Bottomless:** so deep it seemed to have no bottom
- **Stake:** strong wooden post to be driven into the ground
- **Declared:** said clearly and firmly
- **Mammals:** family of animals that have fur or hair and warm blood
- **Reptiles:** family of cold-blooded scaly animals like snakes and lizards
- **Worship:** show great love and respect
- **Grumbled:** spoke in an annoyed way
- **Dissolved:** broke apart and melted away in liquid
- **Thrived:** grew and did very well
- **Mistreated:** treated badly or unkindly
- **Kernels:** small seed parts of corn cobs

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CLASS DISCUSSION SHEET

LET'S TALK ABOUT...

Gravity! In our **STEM Time** story, we saw young Galileo doing a gravity experiment. But what *is* gravity, and why is it so important?

1. What do you think gravity is? How would you describe it?

2. How does gravity help us in our everyday lives?

3. Does gravity affect things in space like moons, planets, stars and astronauts?

4. Why do you think bubbles, planes or birds can fly or float instead of falling?

WHY I'M GLAD WE HAVE GRAVITY...

Can you come up with five fun and creative reasons why gravity is a good thing? Think about all the ways it affects our lives!

1. _____

2. _____

3. _____

4. _____

5. _____

NAME _____ CLASS _____

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READING COMPREHENSION SHEET

Can you find a *possessive pronoun* and an *adjective*?

"The boy and his donkey wandered through the city. Could they get into the cathedral's tall spire? No, the grumpy bishop chased them away!

But then, the boy saw a tall tower with lots of pillars and arches. It tilted to one side as if it was about to fall over.

"That's perfect!" Galileo grinned. "You stay here and watch!"

Leaving his donkey outside, the boy sneaked into the Leaning Tower of Pisa and began climbing up the spiral staircase."

1. A *possessive pronoun* is a little word that tells you who or what something belongs to. Can you spot a possessive pronoun in the first sentence?

_____

2. In the third sentence is an *adjective* (describing word) that describes someone's mood. What is it?

_____

3. In this extract, can you find a word that means 'as good as it could possibly be'?

KNOW YOUR POSSESSIVES!

Match a possessive pronoun to each of the pronouns below!

Me: _____

They: _____

She: _____

Us: _____

THEIR | OUR | MY | HER

ANSWERS: 1. *his*. 2. *grumpy*. 3. *perfect*.
Know Your Possessives! Me: my, They: their, She: her, Us: our.

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STORY SEQUENCING SHEET

Oh, no! The events of Galileo's adventure have been jumbled up by Pippo the donkey. Number them to show the order they *should* be read in!

Pippo bumped into a ladder, and a worker dropped a brick and a chisel in front of Galileo. Both hit the ground at the same time. ☐

Galileo asked Master Lucio how fast things fell. The man said that a philosopher called Aristotle decided that heavy objects fell faster. ☐

Galileo was out of breath when he arrived at his tutor's house. Master Lucio told him to tie up his donkey outside. ☐

After his lessons, Galileo collected some objects at home and then took them to the Leaning Tower of Pisa. Then, he climbed the tower. ☐

While Pippo watched from below, Galileo dropped a hammer and a doll and a ball of string and a lead weight from the tower. ☐

A lady called out as she splashed water out onto the street. Luckily, it didn't hit Galileo! Nearby, workmen were repairing the cathedral. ☐

But the boy thought that Aristotle might be wrong! He decided to do an experiment to find out how fast things *really* fell. ☐

The boy had learned an important lesson: when you want to find something out, you should do an experiment! ☐

Galileo ran through the streets of Pisa with his faithful donkey, Pippo. Pippo told him to hurry up, because they were late! ☐

Pippo said that both pairs of objects hit the ground at the same time. Galileo was very excited when he heard this. ☐

The boy spent the morning memorising Greek words, but he kept getting distracted by things outside the window. ☐

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PHYSICS IN ACTION!

Complete these sentences using the *verbs* (doing words) below!

1. If I push a ball down a slope, it will ☐☐☐☐ downhill.

2. If I ☐☐☐☐ an object, it will move closer to me.

3. If I ☐☐☐☐ an object, it will move further away from me.

4. If I hold an object and let it go, it will ☐☐☐☐ to the ground.

5. If a rolling object hits something, it will ☐☐☐☐.

6. If I pull something made out of rubber, it will ☐☐☐☐☐☐☐.

7. If a very light object is placed in water, it will ☐☐☐☐☐.

8. If a heavy object is placed in water, it will ☐☐☐☐.

9. If I push on a plastic ruler from both ends, it will ☐☐☐☐.

VERB LIST

SINK
FLOAT
PUSH
PULL
STRETCH
BEND
ROLL
STOP
DROP



ANSWERS: 1. ROLL, 2. PULL, 3. PUSH, 4. DROP, 5. STOP, 6. STRETCH, 7. FLOAT, 8. SINK, 9. BEND.

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GRAVITY TALE!

What do you think would happen if gravity suddenly stopped working for one minute? Write about this imaginary experience below!

Some *heavy* things to think about!

- Where does your story take place, and what would be nearby?
- What do you think would happen to you without gravity?
- How would having no gravity affect things around you?
- What do you think would happen if gravity started working again?

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NAME _____ CLASS _____

KNOW YOUR PHYSICISTS!

Physicists are scientists who find out how the universe works! Here are six physicists who made amazing discoveries that changed the way we look

Galileo Galilei (1564–1642)
From: Italy
Galileo is often called the father of modern science. He didn't just read what other people had written – he tested ideas for himself.
Great Discoveries:
Galileo believed that nature could be measured and described using mathematics. He built powerful new telescopes and used them to observe craters on the Moon, sunspots on the Sun and the rings around Saturn. He also invented a kind of thermometer!
Amazing Fact: Galileo's theory about the Earth orbiting the Sun got him in trouble with the Catholic Church. He was placed under house arrest and was forbidden to teach or publish his ideas. Today, we know that Galileo's idea was actually correct. *Read more in issue 138!*

Sir Isaac Newton (1634-1727)
From: England
Great Discovery: Newton came up with the three Laws of Motion (about how things move) and the Law of Universal Gravitation (which explains how gravity works).
Amazing Fact: Newton was also a Member of Parliament and ran the Royal Mint, which made coins! *Read more in issue 129!*

Physics isn't just about *facts* – it's also about *curiosity*.
Each of these physicists thought hard about the world, tested ideas and made amazing discoveries.
And it all starts with asking questions, just like Galileo did.

James Clerk Maxwell (1831–1879)
From: Scotland
Great Discovery: He showed that light, electricity and magnetism are different forms of the same energy.
Amazing Fact: Maxwell wrote his first scientific paper when he was just 14!

Marie Curie (1867–1934)
From: Poland
Great Discovery: Ground-breaking research into radioactivity and she discovered the elements polonium and radium!
Amazing Fact: Marie Curie is the only person to win two Nobel Prizes in different sciences. *Read more in issue 85!*

Albert Einstein (1879–1955)
From: Germany
Great Discovery: Relativity, which explains how space, time and gravity are connected, and he showed that the speed of light is always the same
Amazing Fact: Einstein was offered the job of President of Israel in 1952, but he turned it down to keep working on science. *Read more in issue 102!*

Stephen Hawking (1942–2018)
From: England
Great Discovery: He conducted research into black holes, which are collapsed stars with very strong gravity. He discovered that they give off energy called Hawking radiation.
Amazing Fact: Although a disease paralysed his body, Hawking kept working! He used a wheelchair and a speech device controlled by his cheek muscles. *Read more in issue 99!*

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HOW MUCH MASS?

We can find out how much mass something has by using a *scale*. In this experiment, you will choose five different objects, weigh them, and record the results you get on this sheet!

YOU'LL NEED

- A digital scale
- Five different objects! They could include an apple, a banana, a cup, a book and a piece of paper.

A **Write down your five objects below.** Which one do you think is the lightest? Put that one first. Then put the put the one you think is second-lightest, and so on.

1. _____ weighs _____ g.
2. _____ weighs _____ g.
3. _____ weighs _____ g.
4. _____ weighs _____ g.
5. _____ weighs _____ g.

B **Weigh each object and record its weight above.**

C **Did you get the objects in the right order? Was there one that was heavier or lighter than you expected?**

D **What is the difference in weight between the lightest object and the heaviest object? To find out, subtract the weight of the lightest object from the weight of the heaviest object.**

_____ g - _____ g = _____ g.

MASS OR WEIGHT?

Mass is the amount of 'stuff' in an object. We measure the mass of an object in *grams* and *kilograms*. *Weight* is how much gravity pulls on an object. A scale (like the one you used) actually measures the *weight* of an object, not the mass. On the surface of the Earth, gravity makes an object with 1kg of mass weigh... 1kg! But on the surface of the Moon, gravity isn't as strong. There, the scale would show about 200g, but the *mass* of the object would be unchanged!

NAME _____ CLASS _____

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WHAT IS PHYSICS?

Physics is the study of how the universe works! To understand physics, you need to know about two things: *matter* and *energy*.

What is Matter?

Matter is 'stuff'. Your body is made of matter. The air we breathe is made of matter. The planet Earth and all the stars in the universe are made of matter, too! All matter has *mass*. The more stuff something is made of, the more mass it has! An ant has a tiny amount of mass. A molecule of oxygen has an itsy-bitsy bit of mass. A planet has an *incredible* amount of mass.

What is Energy?

In physics, **energy is what you need to change stuff**. Energy takes lots of different forms! For example, light, sound, magnetism, heat and electricity are all kinds of energy!

WHEN MATTER MEETS ENERGY, EXCITING THINGS CAN HAPPEN!

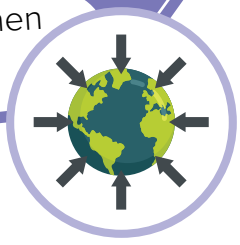
Physics uses maths to work out what happens when matter and energy interact with each other!

WHAT ENERGY DOES TO MATTER

- **Energy can be used to move matter!** When you push, pull or throw something, you are using energy on it! This 'movement energy' is called *kinetic energy*.
- Adding energy to something **can heat it up**. This is how a kettle boils water! If you take heat energy *out of* something, it cools down.
- **It can change the form that matter takes!** If you heat up water, it turns into a gas (called steam). If you cool water down, it turns into ice.
- **You can store energy** in matter! Chocolate has energy that you can unlock by eating it, and a battery can hold electrical energy.

What about gravity?

Gravity is a universal force that attracts objects with mass towards each other. In particular, it attracts objects with a little bit of mass (like you!) towards objects with a lot of mass (like the planet Earth)! Gravity is something that physicists must pay attention to when doing calculations!



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WHO DOES WHAT?

Physics is only one form of science! Can you match the experts below with a description of their job?

1. **Physicist** ☐
2. **Biologist** ☐
3. **Chemist** ☐
4. **Geologist** ☐
5. **Mathematician** ☐
6. **Astronomer** ☐
7. **Engineer** ☐

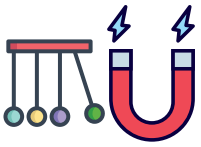
A. Studies planets, stars and the secrets of outer space!



B. Studies chemicals and how they interact with each other!



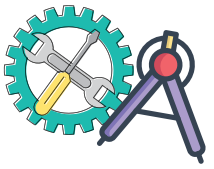
C. Studies energy, gravity and the forces of the universe!



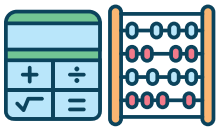
D. Studies living things, like plants, animals and other organisms!



E. Creates machines, engines and other devices!



F. Uses numbers to solve complicated problems!



G. Studies the Earth!



ANSWERS: 1. C, 2. D, 3. B, 4. G, 5. F, 6. A, 7. E.

NAME _____ CLASS _____

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THE MANY FORMS OF ENERGY

Energy is all around us, and it comes in lots of forms. Can you work out what energy we use when we do different things?

1. **KINETIC ENERGY** is energy that moves things. The faster things move, the more kinetic energy it has! When you throw a ball, you give it kinetic energy. When you run, you have kinetic energy as well!

2. **LIGHT ENERGY** is energy in the form of tiny particles called *photons*. Sunlight is light energy, and so is the light from a candle or torch. Lasers are also a kind of light, and they can be powerful enough to cut metal!

3. **SOUND ENERGY** is created when things vibrate... like the air and solid objects. Our ears pick up the vibrations!

4. **HEAT ENERGY** makes things warm. If you warm things up enough, they can become liquids... or gases!

5. **MAGNETIC ENERGY** is a kind of energy found in magnets or generated by electrical fields.

6. **ELECTRICAL ENERGY** is created by a flow of tiny particles called *electrons* through metal or another conductive material.

7. **CHEMICAL ENERGY** is energy stored in matter. The food we eat and the firewood we burn release chemical energy.

WHAT KIND OF ENERGY ARE WE USING WHEN WE DO THESE THINGS?

- ☐ **Light a fire**
- ☐ **Listen to music**
- ☐ **Charge an electronic device**
- ☐ **Boil water in a saucepan**
- ☐ **Stick a magnet to the fridge**
- ☐ **Throw a ball**
- ☐ **Shine a light at something**

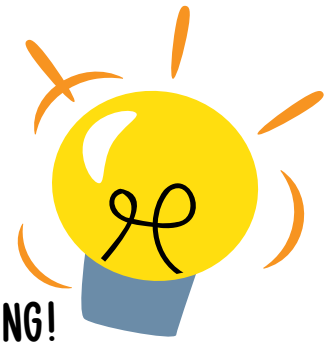
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ANSWERS: Light a fire: 7, Listen to music: 3, Charge an electronic device: 6, Boil water in a saucepan: 4, Stick a magnet to a fridge: 5, Throw a ball: 1, Shine a light at something: 2.

NAME _____ CLASS _____

ROLL IT!

Try this fun gravity experiment! By rolling balls down a slope, you will see gravity in action.



YOU'LL NEED:

- Three different balls. You could use a tennis ball, a rubber ball, a ping pong ball or a marble.
- A stack of books about 20cm high
- A ruler, or another long flat object that can be propped up on the stack of books to make a ramp.
- Bits of carpet, cloth, felt, or other materials to put in the ball's path as obstacles
- A measuring tape
- A pen or pencil and a printout of this sheet

GET ROLLING!

Set up your ramp so there is a clear area in front of it for the ball to roll across.

Which ball do you think will roll the furthest? Why?

Now, roll the balls down the ramp and record the results!

	Ball 1: _____	Ball 2: _____	Ball 3: _____
Distance rolled:			
Distance rolled with one obstacle in the way:			
Distance rolled with a second obstacle in the way:			

Conclusion:

Which ball do you think has the most mass? **Ball** ☐

Which ball rolled the furthest? **Ball** ☐

Why do you think this is? _____

Which ball was slowed down the most by the extra objects? **Ball** ☐

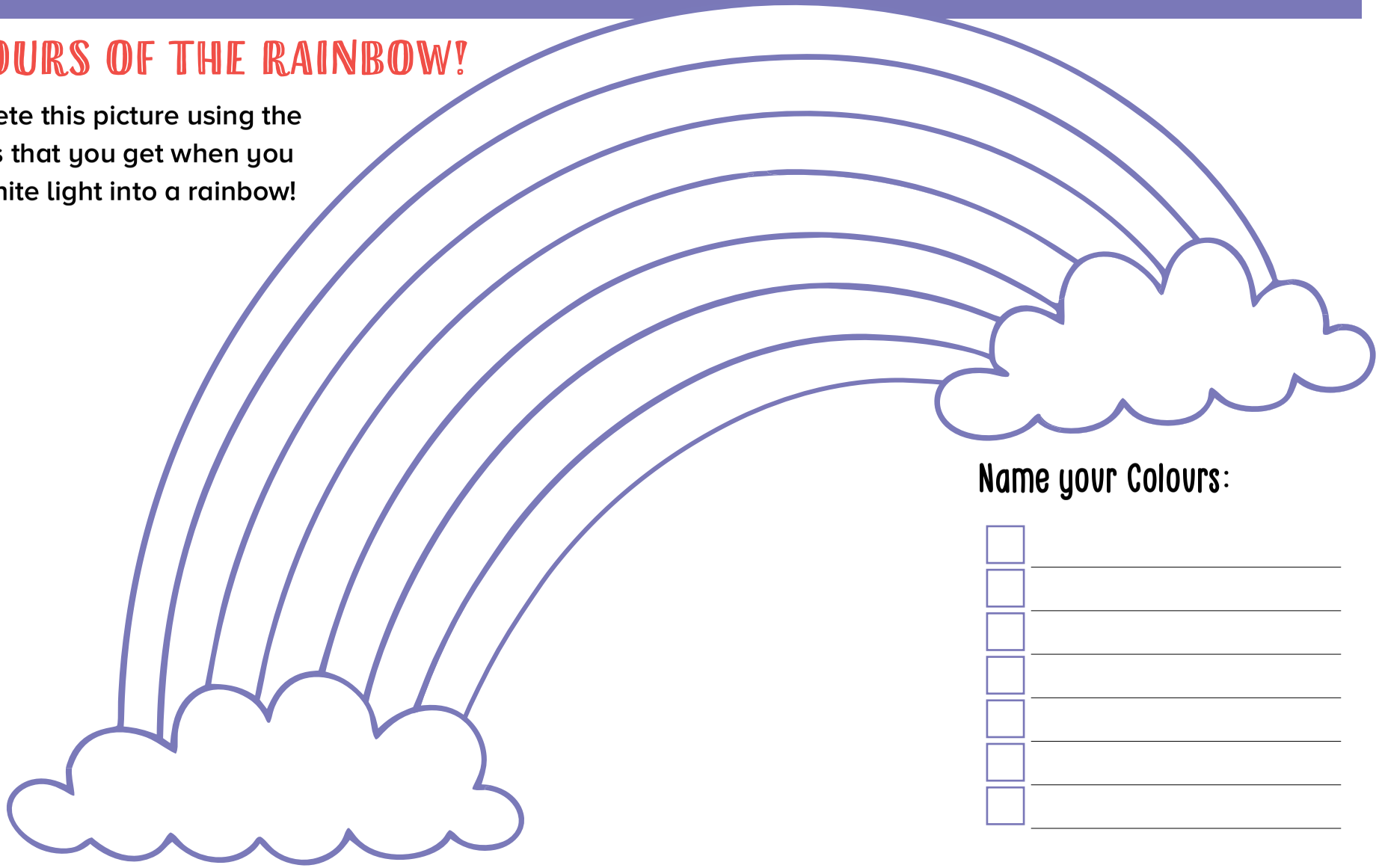
Which ball was slowed down the least by the extra objects? **Ball** ☐

NAME _____ CLASS _____

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COLOURS OF THE RAINBOW!

Complete this picture using the colours that you get when you split white light into a rainbow!



Name your Colours:

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

NAME _____ CLASS _____

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