

SPACE EDUCATION WORKBOOK

No Planet B



QUEEN'S
UNIVERSITY
BELFAST



ARMAGH
OBSERVATORY &
PLANETARIUM

EXPLORING THE COSMOS SINCE 1790

Our Home Planet

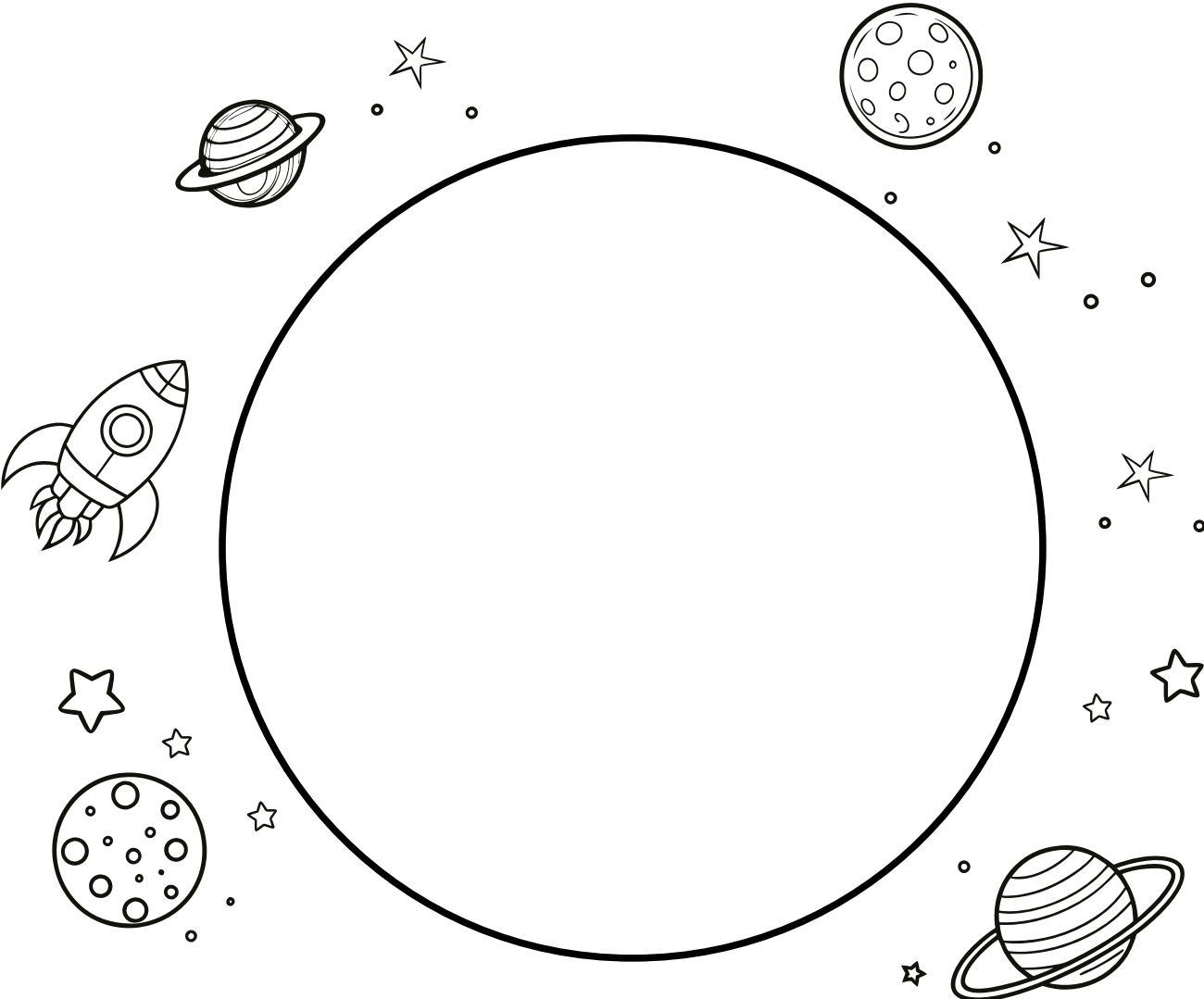
The Earth is the only place in the Universe that we know has life.

Are there other potential places humans could live?

**Or is there really
NO PLANET B?**



Create your own planet



My planet is called:	
The weather on my planet is:	My planet is _____ miles from the Sun
The best thing about my planet is:	
You would need these things to survive on my planet:	

Planet B Criteria

Using the Planet B criteria, can you determine whether humans could survive on any other planets in our Solar System?



1. Habitable Zone

Not too close and not too far away from the Sun!
The goldilocks zone... just right.



2. Circular Orbit

Supports a stable climate all year long.



3. Similar Gravity

Humans have adapted to gravity on Earth.
Different places in space have different gravity.



4. Magnetic Field

This is our invisible forcefield protecting us
from cosmic radiation.



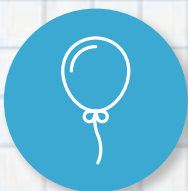
5. Water

Water is essential for life to exist.



6. Stable Axis

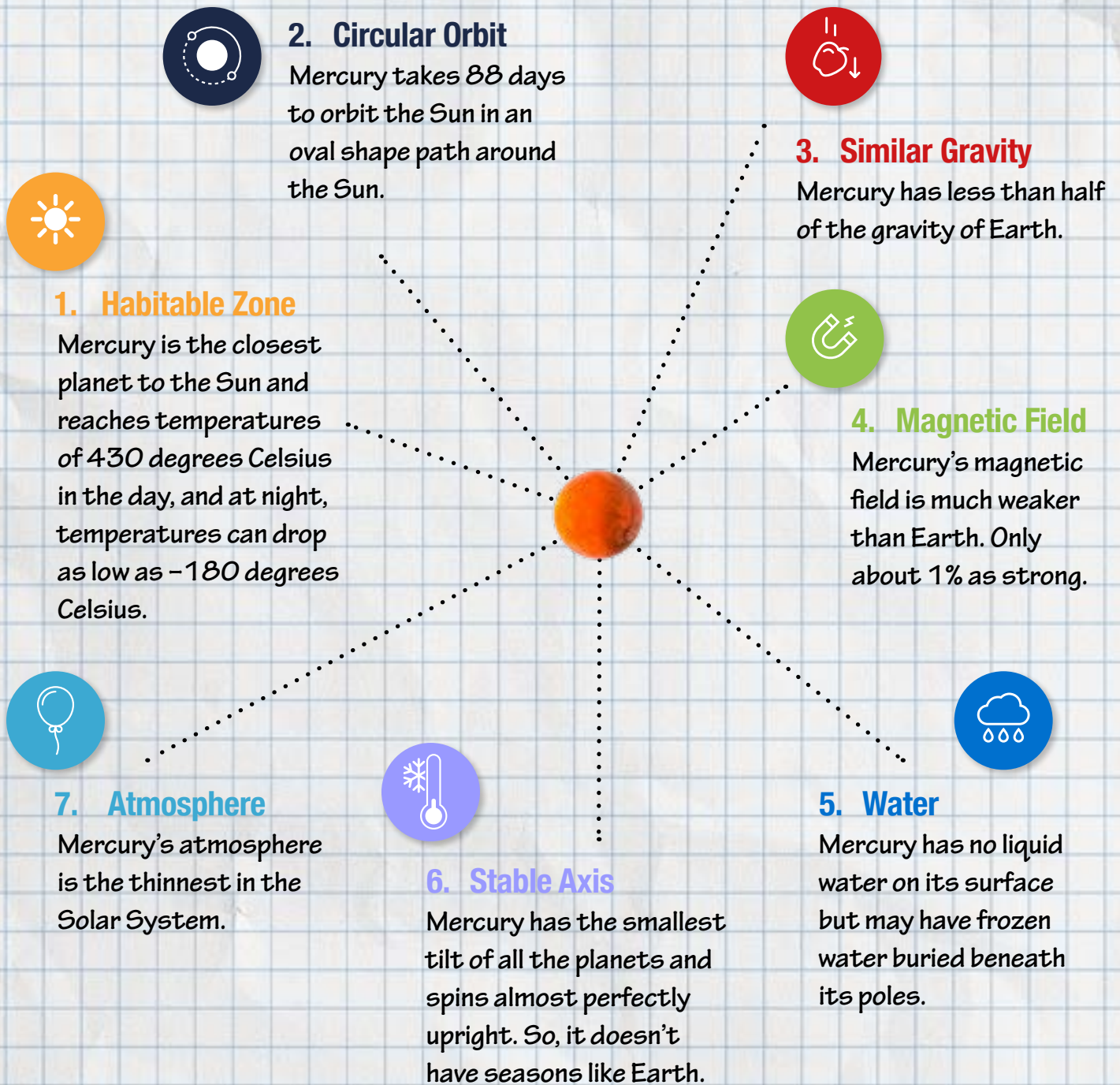
This keeps planet temperature stable
and avoids extreme changes.



7. Atmosphere

Our atmosphere provides oxygen to breathe
and protects us from harmful radiation.

Mercury

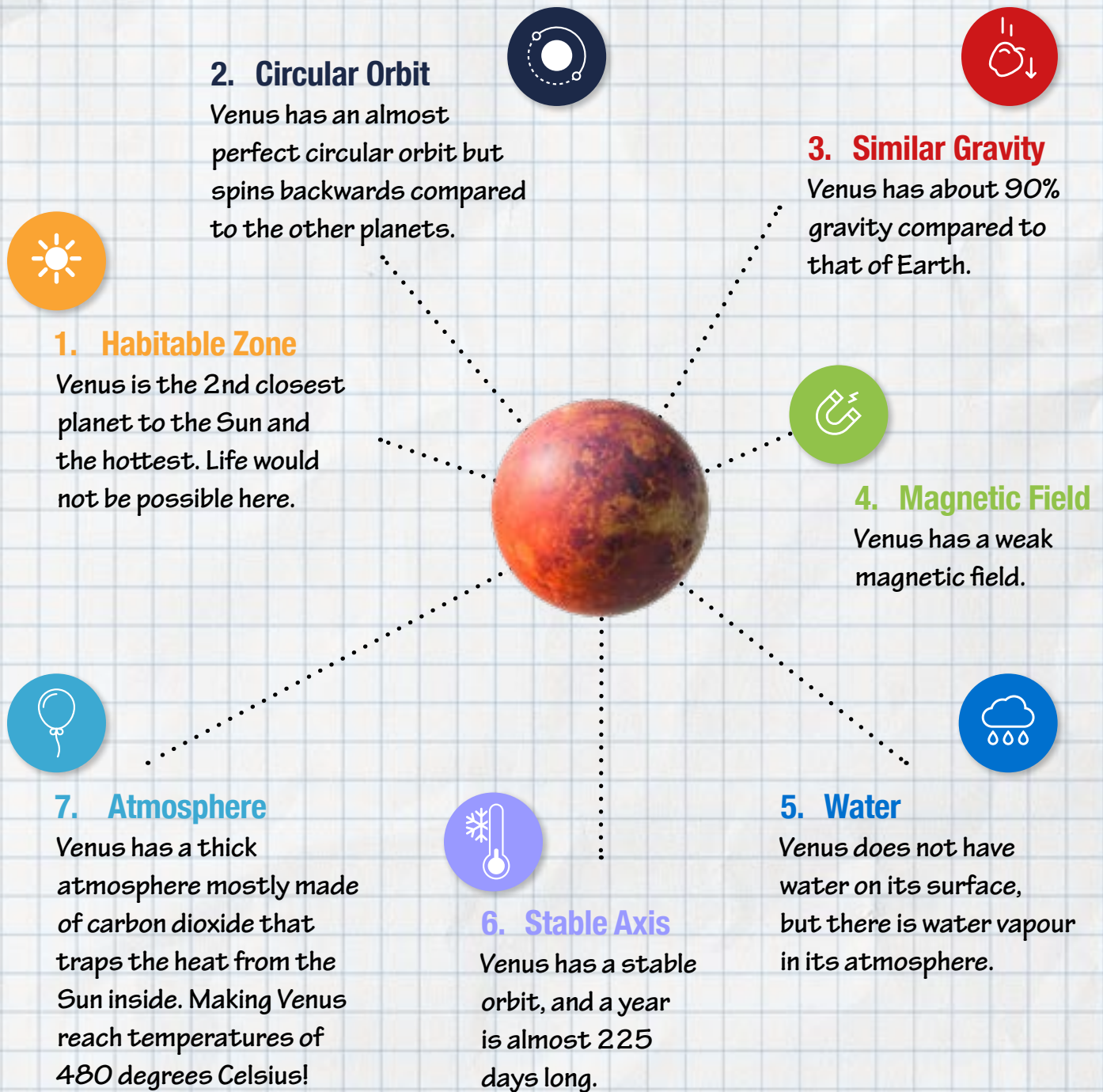


Amazing Fact:

Mercury is even smaller than some moons in our Solar System, such as Jupiter's moon Ganymede.



Venus



Amazing Fact:

A day (243 days) on Venus is longer than a year (225 days)!



Make your own Volcano

DID YOU KNOW?

The largest volcano in our Solar System is Olympus Mons on Mars. It's over 21,000 metres tall which is almost two and a half Mount Everests on top of one another. Olympus Mons is so large for many reasons, the main one being that Mars is smaller than the Earth, which means its gravity is weaker, so mountains can rise taller. There is also less erosion than on Earth.

The Science Behind

Baking soda and vinegar combine with one another in a chemical reaction! Baking soda is a base and vinegar is an acid. Together they produce sodium acetate (we call that a salt, but it's not the same as table salt!), water, and carbon dioxide. Carbon dioxide (CO_2) is what makes the mixture bubble and foam, just like it does in fizzy drinks. CO_2 is also what is captured by the balloon in 'try this'. Unlike lava in a volcano, the mixture will be cool, not hot.



You will need:

- Baking soda
- Vinegar
- Red food colouring
- Small plastic bottle, beaker or glass
(a small opening works best!)
- Tray
- Jug



Steps:

1. Place a bottle on a tray as things can get messy!
2. Add 3-4 tablespoons of baking soda to the bottle. You might need to use a funnel.
3. Pour 300ml of vinegar into a jug and add a few drops of red food colouring.
4. Pour the vinegar into the bottle and watch the volcano erupt!

1



2



3



Try this!

Pour vinegar into an empty bottle and add a few tablespoons of baking soda into a balloon. Place the balloon over the bottle neck and the baking soda will fall in.

What happens to the balloon?



Earth



3. Similar Gravity

The gravity on Earth is perfect for life to exist.



4. Magnetic Field

The magnetic field on Earth is our invisible forcefield called the Magnetosphere protecting us from the harmful rays from the Sun and the Universe.



5. Water

All living things on Earth need water.



6. Stable Axis

The Earth sometimes has little wobbles on its axis, it does not sit perfectly straight, its tilted at 23°. It takes 24 hours for the Earth to spin once. This is a day.



2. Circular Orbit

Earth's orbit around the Sun is not perfectly circular, but it's stable over long periods of time. It takes 365 ¼ days to complete one orbit around the Sun. This is a year.



1. Habitable Zone

Earth is the perfect distance from the Sun, in the habitable zone, where the temperature is not too hot or too cold but just right. Sometimes it's also called the goldilocks zone!

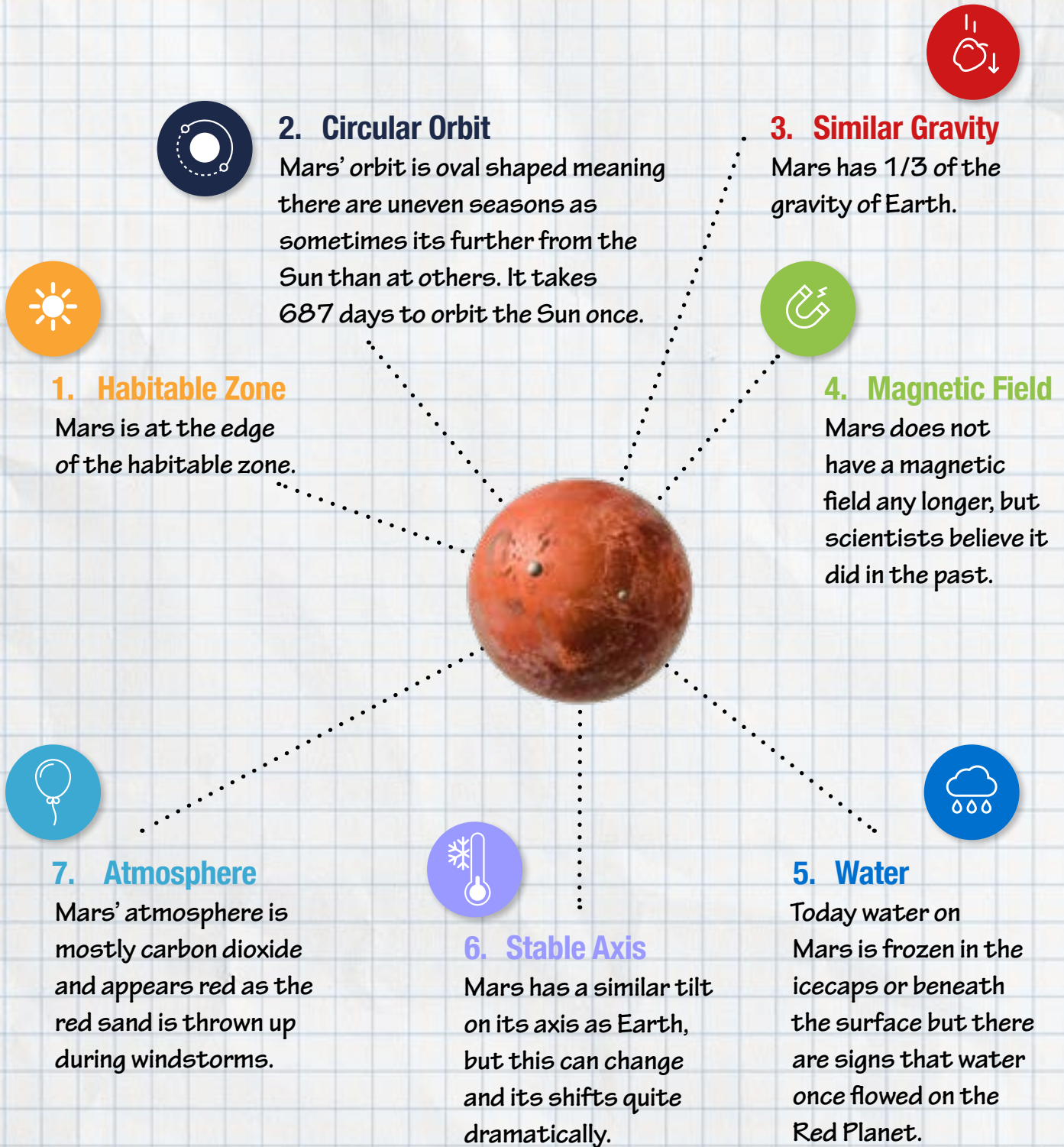


7. Atmosphere

Earth's atmosphere gives us oxygen to breathe, protects us from radiation from the Sun, and keeps the Earth at a constant temperature.



Mars



Amazing Fact:

Mars is red because the iron in the soil has gone rusty. A sign that water must have existed on the planet at some stage!



Jupiter



1. Habitable Zone

Jupiter is not in the habitable zone in our Solar System but some of its moons might be the correct distance away from their home planet.



2. Circular Orbit

Jupiter's orbit is almost circular and takes 12 Earth years to complete one path around the Sun.



3. Similar Gravity

Jupiter's gravity is more than double here on Earth, but it's mostly made of gases.



4. Magnetic Field

Jupiter is the largest planet and has the strongest Magnetosphere in the Solar System. 20,000 times stronger than Earth!



7. Atmosphere

Jupiter's atmosphere is mostly hydrogen and helium and if it was 80 times bigger it would be a star.



6. Stable Axis

Jupiter is almost totally upright meaning it does not have change in seasons like other planets. It takes 10.5 hours to spin once.



5. Water

Jupiter doesn't have any oceans but does have water vapour in the different levels of atmosphere.

Amazing Fact:

Jupiter is so big that all the other planets could fit inside!



Saturn



2. Circular Orbit

Saturn's orbit is circular and takes 29.5 years to orbit the Sun.

3. Similar Gravity

Saturn has much more gravity than Earth but because the planet is so big, (Saturn is the second largest planet), seems to be a little more than on Earth.



1. Habitable Zone

Saturn is outside the habitable zone, but it could have some moons the correct distance from their home planet.



4. Magnetic Field

Saturn has a magnetic field about 600 times that of Earth's.



7. Atmosphere

Saturn has a thick atmosphere like Jupiter's. It's mostly made of gases hydrogen and helium and is so light that it would float in water.



6. Stable Axis

Saturn is tilted the same as Earth and has seasons. It takes 10 hours to spin once.



5. Water

There are some traces of water vapour on Saturn, but Saturn's rings are almost totally made up of water ice.

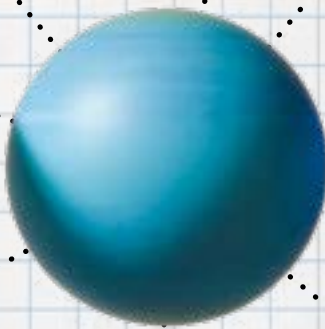


Amazing Fact:

Saturn has more moons than any other planet in our Solar System!



Uranus



1. Habitable Zone

Uranus is classified as an ice giant, and it is not in the habitable zone.



7. Atmosphere

The atmosphere of Uranus is primarily made up of hydrogen, helium and methane gases and it holds the title for the planet with the coldest atmosphere with temperatures dropping to a chilly -224 degrees Celsius!



2. Circular Orbit

Uranus' has a long orbital period of 84 Earth years and follows a slightly elliptical orbit. It takes 17 hours and 14 minutes to rotate once on its axis.



6. Stable Axis

Uranus is unique as it is the only planet in the Solar System that rolls on its side as it orbits the Sun. This unusual tilt results in extreme seasonal variations. Each pole experiences 42 years of continuous sunlight followed by 42 years of darkness. It takes 17 hours and 14 minutes to rotate once on its axis.



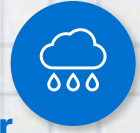
3. Similar Gravity

Uranus' gravity is approximately 89% of Earth's gravity. This means a person weighing 100kg on Earth would weigh around 89kg on Uranus.



4. Magnetic Field

Uranus has an unusual magnetic field in comparison to the other planets in the Solar System as it's tilted at a strange angle, but Uranus' magnetic field is a similar strength to Earth's.



5. Water

Uranus does have water like we have on Earth in the form of oceans, rather water exists here deep inside the planet within dense fluids of icy material.

Amazing Fact:

Uranus has 13 faint rings, which are much fainter and less prominent than Saturn's.



Neptune



2. Circular Orbit

Neptune has the longest orbit of all the planets in the Solar System and takes 165 years to complete one orbit around the Sun. Neptunes orbits is slightly elliptical.

3. Similar Gravity

Neptune's gravity is stronger than Earth's by around 14%.



4. Magnetic Field

Neptune has a magnetic field about 27 times stronger than Earth's.



1. Habitable Zone

Like Uranus, Neptune is classified as an ice giant and is not in the habitable Zone.



7. Atmosphere

The atmosphere of Neptune is made up of mostly hydrogen, followed by helium and a small amount of methane, which gives Neptune its deep blue colour and on average is the coldest planet in the Solar System.



6. Stable Axis

Neptune has a relatively stable axis, like Earth's.



5. Water

Like Uranus, there is water on Neptune but not in the way we find it on Earth. Rather water exists deep inside the planet within dense fluids of icy material.

Amazing Fact:

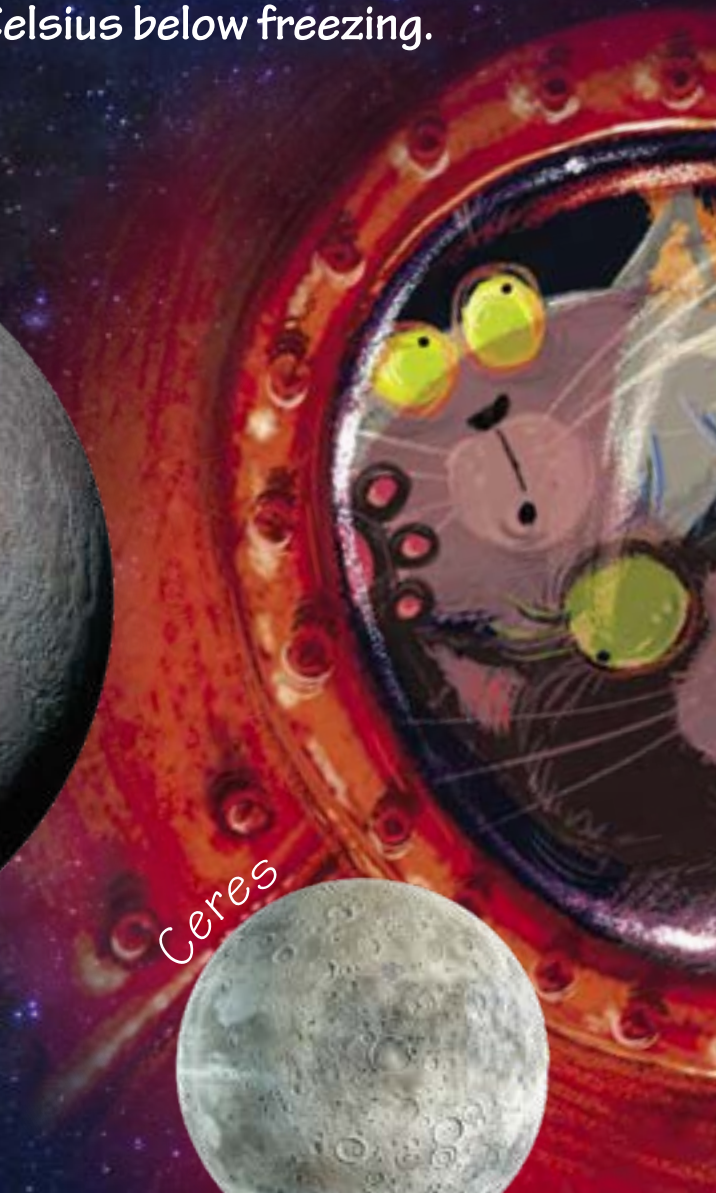
Of all the planets in the Solar System Neptune has the fastest winds, reaching speeds of up to 2,100 kilometres per hour.



Dwarf Planets

Pluto, Ceres, Makemake, Haumea and Eris

The dwarf planets are very small and do not have a thick atmosphere like Earth. Most dwarf planets, except for Ceres, are found far beyond Neptune's orbit, where temperatures can plunge to 250 degrees Celsius below freezing.



Makemake



Haumea



Eris



Exploring Space



Moon landing

The first successful moon landing was in 1969 and was called the Apollo 11 mission. The first person to walk on the Moon was Neil Armstrong followed by Buzz Aldrin. In total 12 people have walked on the Moon over 6 separate missions from 1969 to 1972.

The furthest humans have travelled in space was 400,171 kilometres away and it was during the Apollo 13 mission.

The Artemis mission will take humans back to the Moon before 2030.

Why do we want to send humans back to the Moon?

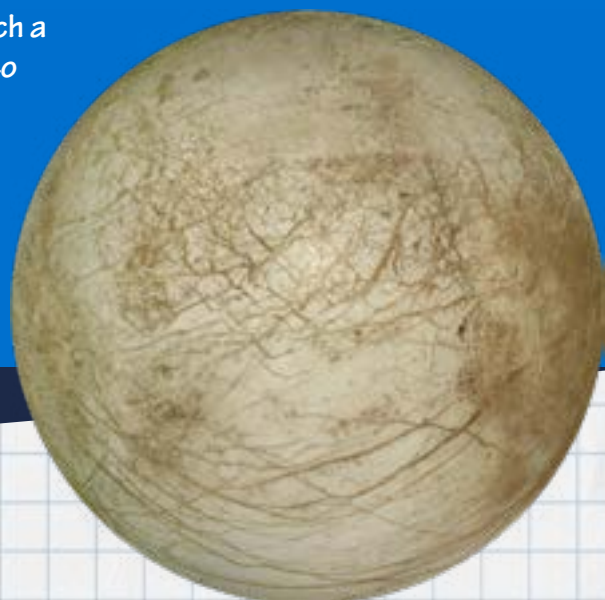
The goal is to discover more about the Moon, build a permanent base there and to use it as a launchpad for exploring deeper into space, such as travelling to learn more about Mars!



Potential for life on Jupiter's moon Europa?

Europa is one of the most fascinating moons in our Solar System. It is the second largest moon of Jupiter and is covered in a thick layer of ice, scientists believe there are oceans of liquid water beneath the ice! This makes Europa one of the best places to search for extraterrestrial life, because where there is water there is life! Although not suitable for human life!

In the 2020s, NASA plans to launch a spacecraft named Europa Clipper to closely study Europa. The mission will investigate the moon's ice, ocean, and atmosphere to better understand its potential for supporting life.



Make Moon Craters



Try this!

Why not try dropping objects from different heights?

What about throwing them from the side?

Was there a difference?

You will need:

- Flour
- Cocoa powder
- Container or tray
- Spherical objects (Ping-pong ball, Maltesers, marbles, pebbles)

Steps:

1. Fill a tray 2cms deep with flour and spread it about, this will act as the Moon surface.
2. Sprinkle cocoa powder over the flour. Drop spherical objects of different sizes and mass.
3. Watch as impact craters form.

Do you notice a difference in the craters depending on the weight of the object?

The Science Behind

The craters on the Moon were made by asteroids and meteoroids hitting its surface at high speeds, creating craters, and spreading the lunar material around. With cocoa powder acting as the thin surface layer, you can see very similar effects from the comfort of your home or indeed classroom! Higher speeds and heavier objects will create deeper craters and throw more material around. Newer craters might overlap or partly destroy older craters. All these things can be seen on the Moon as well.



DID YOU KNOW?

One of the most prominent craters on the Moon is Tycho Crater in the southern hemisphere (the part with fewer dark areas). It is named after **Tycho Brahe**, a 16th century Danish astronomer who made measurements of the positions of stars, planets, comets, and other celestial objects.

1



2



3



How can we look after our Planet Earth?





Reduce, Reuse, Recycle

We can minimise waste by reusing items and recycling materials such as paper, plastic, and metal, which helps reduce landfill overflow and pollution.



Conserve water

Water is a valuable resource and essential for life therefore it is important that we use water responsibly, by fixing leaks, choose water-saving appliances, and avoid unnecessary waste.



Save Energy

Save energy by turning off lights and electronics when not in use or by switching to energy-efficient LED bulbs and appliances.



Environmental Education

Help children and others understand why it's important to take care of the environment and how climate change can affect the planet.



Use public transport if possible

If you can, take public transport because it reduces traffic, lowers pollution, and saves energy by letting many people travel together.

Plant Trees

Planting trees helps keep the air clean, gives animals a home, and makes the Earth a better place to live.

**We need to take care of planet Earth,
because it takes care of us.**

There is no PLANET B!



Word Search

Find the following words in the puzzle.

Words are hidden → ↓ and ↘.

Words can share letters as they cross over each other.

H	K	S	V	E	N	U	S	W	C	O	R	B	I	T	K	K	X
A	T	M	O	S	P	H	E	R	E	O	X	G	J	S	A	M	I
G	D	W	A	T	E	R	R	Y	Z	I	Y	G	N	D	Y	T	G
R	N	M	A	R	S	F	G	W	T	M	E	R	C	U	R	Y	N
A	L	N	P	L	A	N	E	T	B	V	M	P	J	O	X	L	H
V	L	E	A	A	S	A	T	U	R	N	W	P	U	D	B	J	A
I	M	P	Z	A	O	R	L	E	A	R	T	H	P	L	G	W	P
T	E	T	Q	M	A	G	N	E	T	I	C	F	I	E	L	D	A
Y	U	U	F	E	A	U	R	A	N	U	S	R	T	V	X	W	Q
A	P	N	P	H	A	B	I	T	A	B	L	E	E	U	O	O	A
F	V	E	J	S	G	G	W	O	A	U	D	O	R	B	Y	J	C
D	T	A	X	I	S	Z	P	R	X	K	O	P	Z	H	V	G	G

Words:

MAGNETIC FIELD	JUPITER	WATER
ATMOSPHERE	NEPTUNE	VENUS
HABITABLE	SATURN	ORBIT
PLANET B	URANUS	AXIS
GRAVITY	EARTH	MARS
MERCURY		



Caring for our Planet

What can we do to look after the Earth? Read each statement carefully and tick the box if it's a good way to help our planet.

Saving Water

Tick the right choices!

- Turn off the tap while brushing your teeth.
- Leave the tap running when you're not using it.
- Take quick showers instead of long baths.
- Pour rubbish into rivers or lakes.
- Fix leaky taps to stop wasting water.

Bonus Question:

What else can you do to save water?

.....

.....

Keeping the Air Clean

Tick the right choices!

- Plant trees in your garden or neighbourhood.
- Walk, cycle, or use public transport when possible.
- Let factories pump out lots of smoke.
- Play outside where the air is fresh and clean.
- Use too much electricity at home.

Reducing Pollution

Tick the right choices!

- Throw rubbish in a bin.
- Recycle paper, plastic, and cans.
- Drop litter on the ground.
- Use a reusable water bottle.
- Burn rubbish in a park or field.

Protecting Animals and Nature

Tick the right choices!

- Leave food wrappers in forests or parks.
- Clean up after a picnic.
- Help animals by protecting their homes.
- Waste food and throw it in the bin.
- Learn about animals and how to keep them safe.

Bonus Question:

What's your favourite animal, and how can you help protect it?

.....

.....

My Earth Pledge

Write one thing you will do to help the Earth:

.....

.....

.....

My Promise!

Great job! You're now a Planet Protector!

Name

What is your superhero called?

Group members

Mission

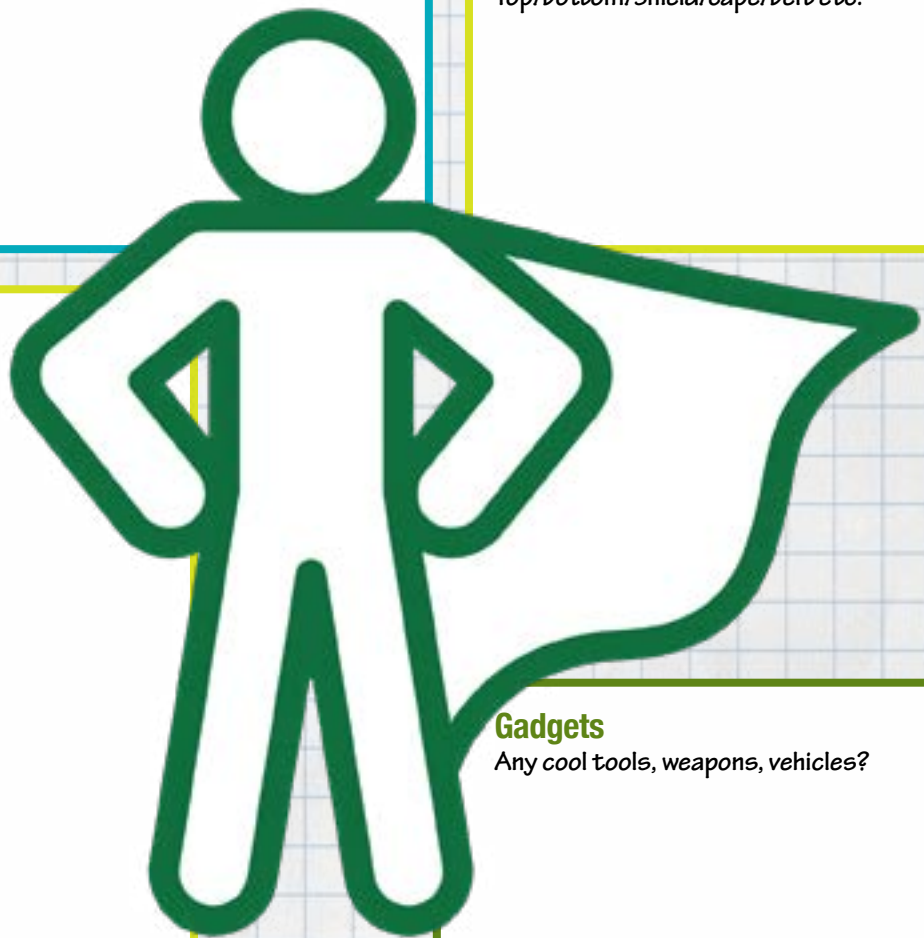
Protect green spaces from... (e.g., litter, pollution, destruction, deforestation). Make green spaces better by... (e.g. planting trees, cleaning, making them open/available to everyone) etc.

Suit design (colour/pattern/shape)

Top/bottom/shield/cape/belt etc.

Special skills

What superpowers?
Space/time travel?
Can they fly? Superspeed



Gadgets

Any cool tools, weapons, vehicles?

Anything else

Glossary

Axis

An axis is an imaginary line that runs through the centre of a planet and around which it rotates.

Day

The period during which the Earth completes one full rotation on its axis.

This results in a cycle of light and darkness, which we experience as day and night. One day on Earth is 24 hours.

Gravity

An invisible force that pulls objects toward each other. Earth's gravity is what keeps you on the ground and what makes things fall.

Habitable Zone

The habitable zone is the area around a star where the temperature is just right for liquid water to exist on a planet's surface. It's also known as the Goldilocks zone.

Magnetic Field

Is an invisible force that surrounds charged particles and astronomical objects, such as stars, planets, and galaxies.

Moon

A moon is an object similar to a small planet that travels around a planet.



Orbit

An orbit is a regular, repeating path that one object in space takes around another one. The Moon orbits the Earth.

Planet

An extremely large, round mass of rock and metal, such as Earth, or of gas, such as Jupiter, that moves in a circular path around the Sun or another star.

Solar System

The collection of planets and their moons that orbit round a star.

Year

The time taken by the Earth to make one revolution around the Sun.





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Healthy Ageing Challenge
Social, Behavioural and
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