



Barbie™

YOU CAN BE ANYTHING

LIFE IN SPACE



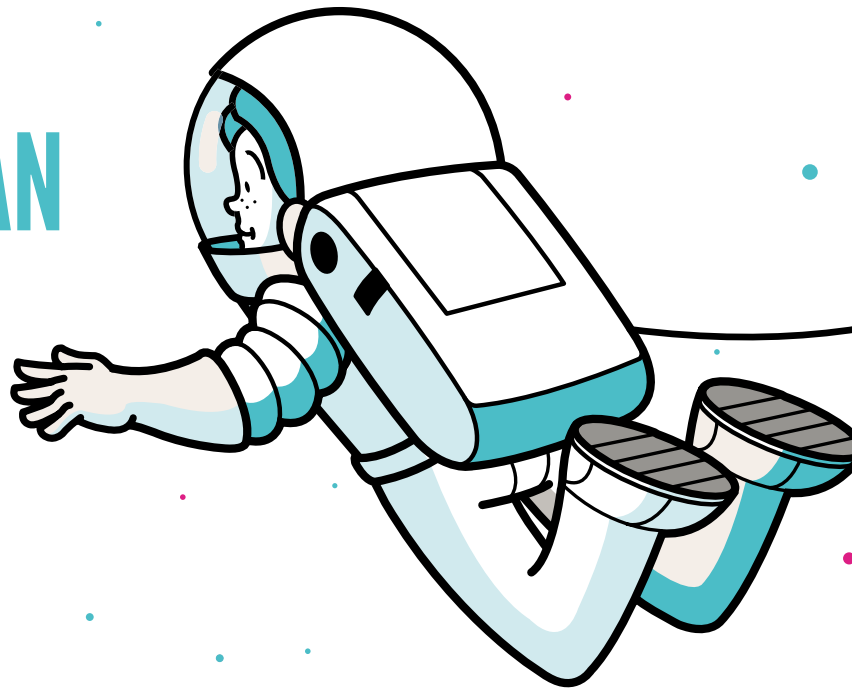
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Barbie™



esa

IMAGINE BEING AN ASTRONAUT!



There are few more adventurous or more exciting things you can do than travel in space; very few people get the opportunity to be an astronaut!



But, although life in space is very different to life on Earth, astronauts still need to do all the usual things we do on Earth – keep clean, eat and drink, keep themselves fit and healthy and visit the bathroom.

Weightlessness makes all the things we regard as normal, much more challenging.

We wanted to see just how Barbie would enjoy her experience of life in space and her experience of weightlessness!

We're sure she'd be as brilliant as ever because there's a Barbie for every imagination so, why shouldn't she be just as confident, experiencing weightlessness or travelling in space?

LET'S FIND OUT about what it would be like

FLYING IN ZERO-G

Experimenting With Weightlessness

To give Barbie an inspiring and exciting new challenge we decided to send her on a 'Zero-G' flight.

What's a Zero-G flight?

Here's everything you need to know. DLR (the German Space Agency), CNES (the French space agency) and the European Space Agency (ESA) all got together to create a special jet plane in which astronauts practice being weightless before travelling to the International Space Station.

The plane is called the A310 Zero-G. When in the air, the Zero-G pilot performs an amazing manoeuvre by pulling up sharply, then suddenly reducing power. This makes the Zero-G follow a large arc in the air, just as if it had been fired by a catapult. As the Zero-G plane



Barbie experiencing 'Zero-G'

goes over the top of the arc, all the people on board are in free-fall, which is the same as being weightless, for about 20 seconds. Then, as the plane starts to fall downwards, the effect of gravity returns. The pilot must pull up again and the manoeuvre is repeated.

While this is happening, different experiments are used to discover the effect of weightlessness on our brains. They also experiment on the effect of weightlessness on plants.

These experiments are important because they help us plan for future space expeditions such as sending astronauts to the Moon and even to Mars. We need to know if humans can live and work in fully weightless conditions for long periods of time or whether some gravity is needed to keep us healthy. And we need to know about the effect of gravity on plants because plants will be essential to our survival on other planets.

Barbie loved the Zero-G flight!

She enjoyed the feeling of freedom that being weightless brought and she soon found herself able to carry out the tasks that are so much more challenging under weightless conditions.

We're sure you'd love a Zero-G flight, too!





A MISSION TO EXPLORE SPACE

We asked the European Space Agency (ESA) to tell us about space travel, gravity and weightlessness.

— ✨ —

ESA is Europe's space agency, the equivalent of NASA in the USA. ESA has a mission; to explore space and by doing so, help the citizens of Europe and the world.

Here's some of the situations and challenges that ESA told us about...

EATING AND DRINKING

Mealtimes in space are important not just to provide the energy that astronauts need and to keep them healthy but also, because they provide an important social occasion because they're so far away from family and friends.

They eat food which is specially prepared to last a long time. The astronauts eat a wide variety of foods some of which are favourites from their own countries.

To help them identify their food options, their red food trays contain food from Russia whilst the blue trays contain American/European food.



TYPES OF FOOD

Astronauts have their food packaged differently to us because it has to last a long time and must also be easier to store on board the spacecraft or space station. Here's some of the different ways they have their meals:

- **Freeze-Dried Food:** This is food with the water removed to make it easier to store such as tea, coffee, orange juice and cereals.
- **Thermo-stabilised Food:** this is heat-processed food which can be stored at room temperature, such as tuna and fruits. It's stored in easy-pull cans.
- **Irradiated Foods:** Beef products are cooked on Earth and then packaged in foil pouches and then sterilised by radiation so they can be kept at room temperature.
- **Fresh foods:** apples and bananas are brought to the space station by newly visiting crews.
- **Natural form foods:** these include nuts and cookies.



Crumbs = disaster!

When they're having their meals, the astronauts use the trays as plates and everything has to be either squeezed out of a tube or bag. If crumbs or drink escape and float around the capsule, they could easily interfere with the masses of electrical equipment - which would be disastrous.

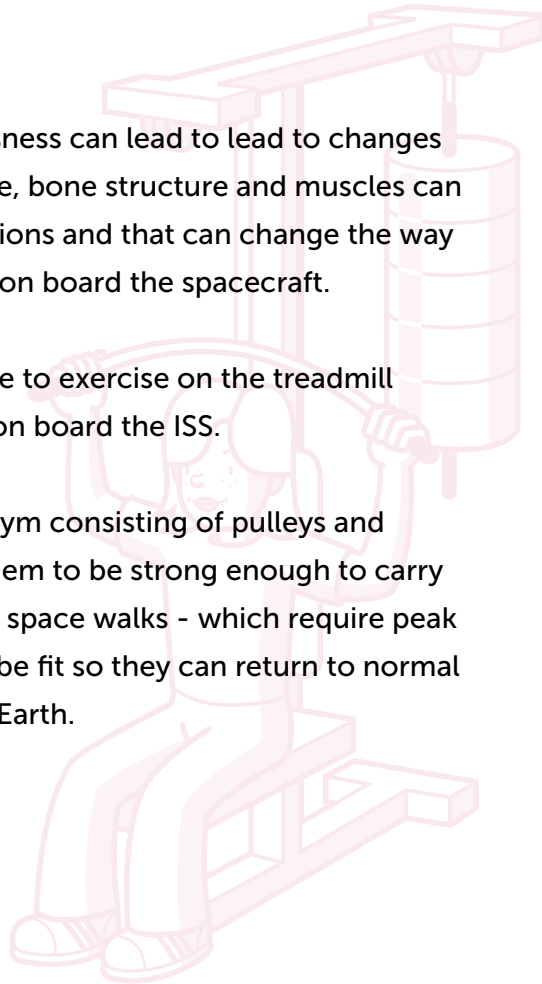
Barbie has been a chef, so we know for sure she'd enjoy experimenting with these unusual forms of food! **Imagine Barbie's just arrived at the International Space Station (ISS); what meal would you create for Barbie using some or all of these food types?**

EXERCISE AND FITNESS

Long periods of weightlessness can lead to changes in their bodies. For example, bone structure and muscles can alter under the new conditions and that can change the way everyday tasks are tackled on board the spacecraft.

So, the astronauts take time to exercise on the treadmill and exercise bike that are on board the ISS.

They also have their own gym consisting of pulleys and ropes – all of this allows them to be strong enough to carry out their daily tasks as well space walks - which require peak fitness. They also need to be fit so they can return to normal life when they get back to Earth.



PERSONAL HYGIENE

Astronauts have to brush their teeth just the same as we do but the toothpaste, water (and the toothbrush) are all weightless which makes even a routine task like this, awkward. So, they use toothpaste which can be swallowed after use and they clean their mouth with a wet wipe. And when they're brushing their teeth, they have to keep their mouth closed otherwise the toothpaste floats out!

Using The Bathroom

That's different too! On the ISS, the astronauts strap themselves in and the waste fluids and solids are collected and disposed later. Astronauts soon adapt to these different conditions; it becomes a way of life for them.

Barbie showed how she was inspired by her Zero-G weightlessness testing flight to enjoy a journey into outer space.

THE FORCE OF GRAVITY



Have you ever seen a fruit, like an apple, falling from a tree, or watched an object falling from a height? Have you ever thrown a stone into the air and watched it as it fell to the ground?

It's All Down to Gravity!

Barbie understands that the force which governs every aspect of our lives on Earth – gravity – exists in space, but its effect disappears in orbit because spacecraft and astronauts are in 'free-fall'. Here's some information about what gravity is and how it affects life on Earth:

- Gravitational Force is why we always keep our feet on the ground. We don't need to be in direct contact with Earth to be pulled towards it by gravity. Not being too far away is just enough for the same forces to act.
- That's why our planet, Earth, orbits around the Sun and why the Moon orbits around the Earth.
- That's why it's all down to GRAVITY!

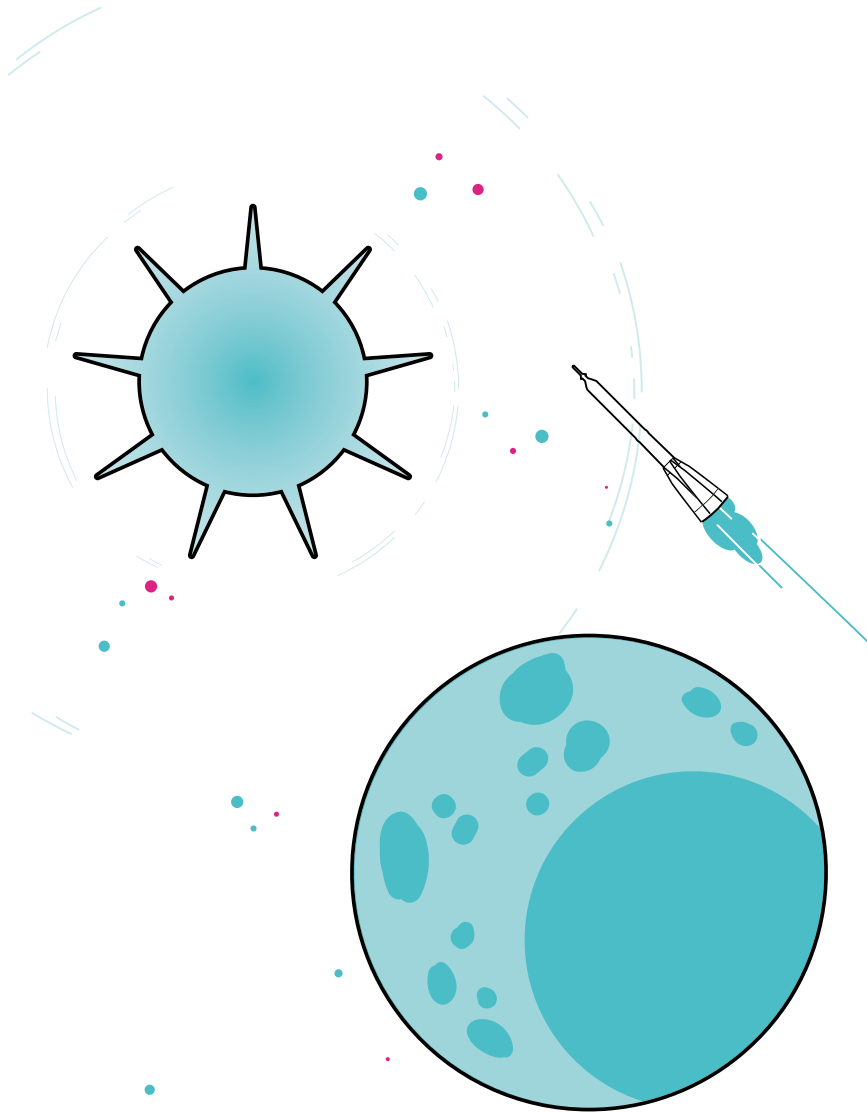
ISAAC NEWTON AND THE APPLE

A British scientist, Isaac Newton, discovered gravity over 350 years ago; it's said that it was an apple falling on his head that got him thinking about the concept of gravity.

The Mass Of An Object

- Gravitational Force is determined by the mass of an object – by how big and how solid it is.
- The gravitational force among two objects is proportional to the mass of the objects.
- If we separate the two objects, the gravitational force decreases very quickly.
- We (humans) also attract objects with 'our' force of gravity, but we can't see the effects because we are too light.

THE SUN AND THE MOON



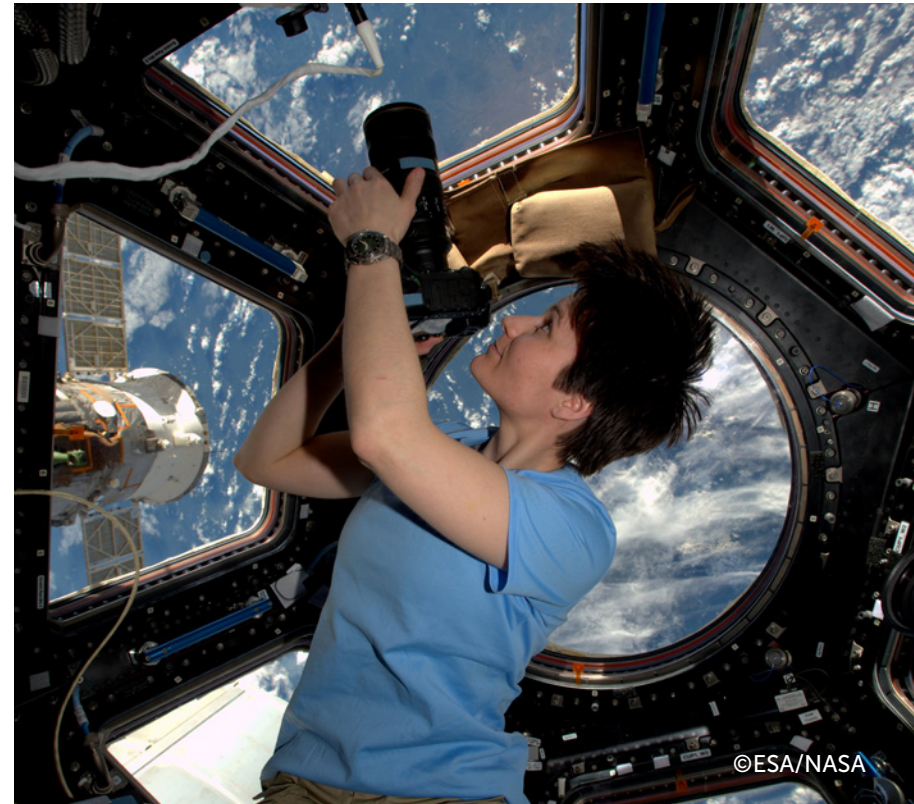
- The Sun is so massive that it's able to hold us close even when it's so far away – because it has such a huge gravitational force.
- The Moon also exerts a force of gravity and because the Moon is smaller than the Earth and lighter too.
- If we could weigh ourselves on the moon, we'd find we were lighter than we are on Earth – in fact, we'd weigh about 1/6 of our weight on Earth.
- The pull of the Sun and the Moon also causes Earth's ocean tides.

Why doesn't the Moon fall down?

- Some people might ask 'Why doesn't the Moon fall on Earth – just like an apple falls from a tree?'
- It's because the Moon is never completely still.
- It's always moving around us and without the force of gravity from Earth, it would just float away into space.
- It travels at exactly the right speed; if it went any quicker it would escape into space and if it travelled any slower, it would fall to Earth.

LONDON TO NEW YORK IN 10 MINUTES!

- When we go into orbit around Earth, we can escape the effects of gravity.
- That's what we try to do with satellites and spacecraft.
- If a spacecraft can reach 11.2 km per second, called 'escape velocity', then we can balance the effect of gravity (that's very fast – at that speed, we would be able to get from London to New York in 10 minutes!)
- If a spacecraft goes beyond that speed it can leave Earth and travel in the Solar System. Amazing!



MICROGRAVITY

- Microgravity means more or less the same 'weightlessness', but refers to the fact that there are always tiny forces acting on a spacecraft so not perfectly 'zero-g'.
- The most commonly known microgravity environment can be found on the International Space Station.

BEING IN SPACE IS GREAT!

It means astronauts can no longer sit, walk, lie in bed or pick up anything from the ground! As soon as the rocket engines are turned off in space, they astronauts feel weightless. They are only held down by their seatbelts.

However:

- Their blood begins to flow towards their head.
- Their muscles change because there is no weight to support.
- So, they must exercise for several hours each day.
- It's odd in space because there's no difference between the floor and the ceiling and that takes time to get used to.

A SPACE CHALLENGE FOR YOU

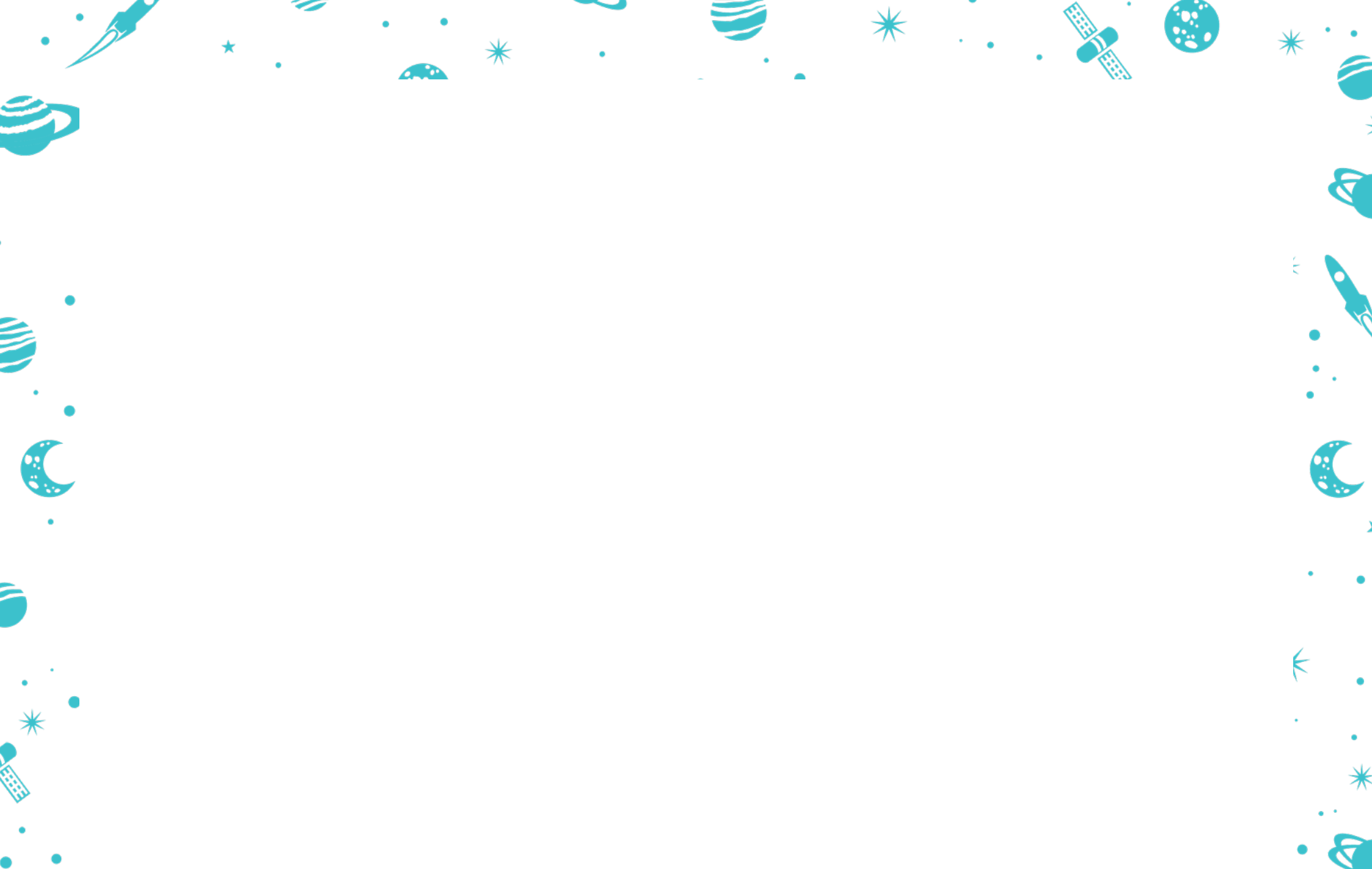
Here's something for you to consider...

YOU have been selected to set out on a mission into outer space! Imagine you are just about to set off. Countdown to the launch will begin soon. What are the thoughts that go through your head? What do you think would fascinate YOU most about being in space? What excites you about the mission that lies ahead!

Write a short piece about this and/or draw a picture which conveys all your feelings about the inspiring journey you're about to take!.

This product is developed in collaboration with the European Space Agency (ESA) for the purpose of fostering children's interest in space science. ESA is not involved in the manufacturing and commercialisation of this product. Neither ESA nor the astronaut receive any royalties from the sale of this product.

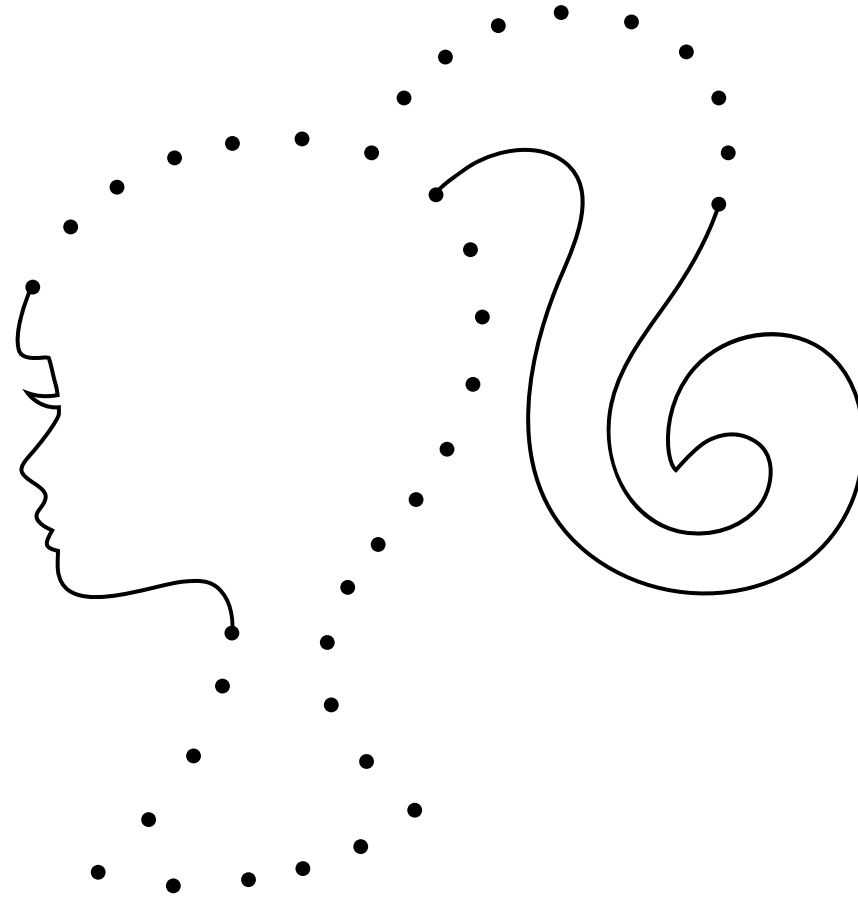
Sources: www.esa.int/kids/en/home | www.esa.int/Education | www.esa.int/Education/Teachers_Corner/Primary_classroom_resources





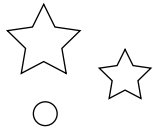


HELP BARBIE FIND THE CONSTELLATION!

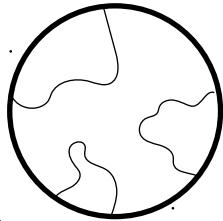


Connect the dots to complete the constellation.

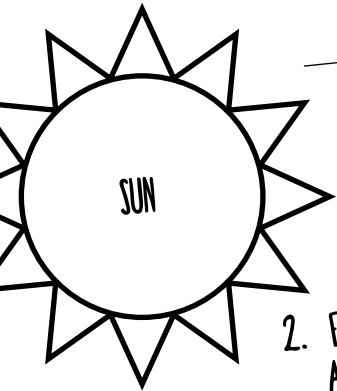
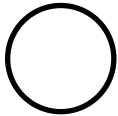
CAN YOU NAME EACH PLANET?



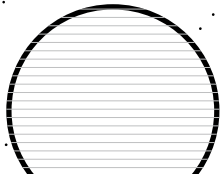
3. THE PLACE WE CALL "HOME"



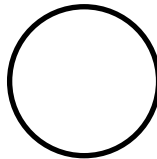
1. THE CLOSEST PLANET TO THE SUN



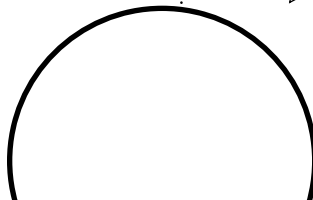
2. EARTH'S TWIN PLANET THEY ARE ALMOST THE SAME SIZE!



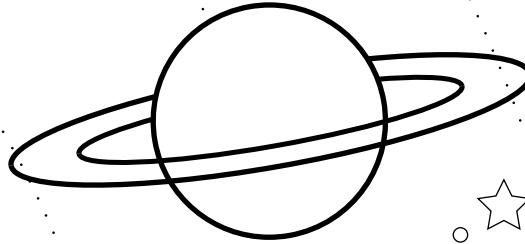
4. NICKNAMED THE "RED" PLANET



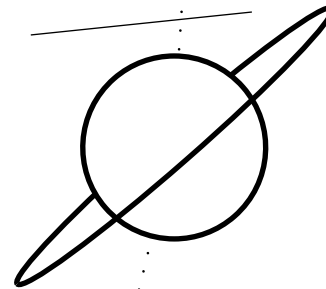
5. THE BIGGEST PLANET



6. HAS RINGS AROUND THE PLANET



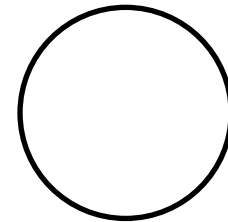
7. THE PLANET THAT SPINS ON ITS SIDE



9. A SMALLEST PLANET



8. HAS THE STRONGEST WINDS OF ANY PLANET



Barbie® 1st became an Astronaut in 1965!



ANSWER KEY: 1. MERCURY 2. VENUS 3. EARTH 4. MARS 5. JUPITER 6. SATURN 7. URANUS 8. NEPTUNE 9. PLUTO