SPACE awareness

KNOW YOUR PLANETS

Learn about the properties of the Sun and planets in this card game.

Unawe, UNAWE



Temat z programu nauczania
the Solar System

Ważna koncepcja nauki
Earth is a very small part of the universe.

Słowa kluczowe
Solar System, Planets, Sun

Wiek
4 - 10

Poziom kształcenia
Pre-school, Primary School, Middle School

Czas trwania
1h

Rozmiar grupy
Group

Nadzór ze względów bezpieczeństwa
Supervised

Koszt
Low (< ~5 EUR)

Lokalizacja
Indoors (small, e.g. classroom)

Umiejętności kluczowe
Asking questions, Analysing and interpreting data, Communicating information

Rodzaj zajęć edukacyjnych
Partial enquiry

KRÓTKI OPIS

Play a question and answer card game on the Solar System and learn about the properties of the Sun and its planets.

CELE OGÓLNE

During this activity, students play a game and learn the properties of different planets and their relative position in the Solar System.

CELE OPERACYJNE

- Students will be able to describe what the Solar System is.
- Students will be able to describe the properties of different planets and classify them into rocky and gassy.
- Students will be able to name the planets in order of distance from the Sun.

EWALUACJA

- The teacher discusses with the students what colour they used for the planets.
- Students have to explain how the colour chosen relates to the planets' properties that students have learnt during the activity. For example, Venus is very hot so it could be coloured red.
- Ask the students to name the planets in the solar system in order from the Sun.

MATERIAŁ

- Card game PDF (one set per group)
- Planets and Sun model – Universe in a Box or other material

- Coloured pencils (one set per group)
- Scissors (one per student)
- Photos of the Solar System PDF (one set per group)

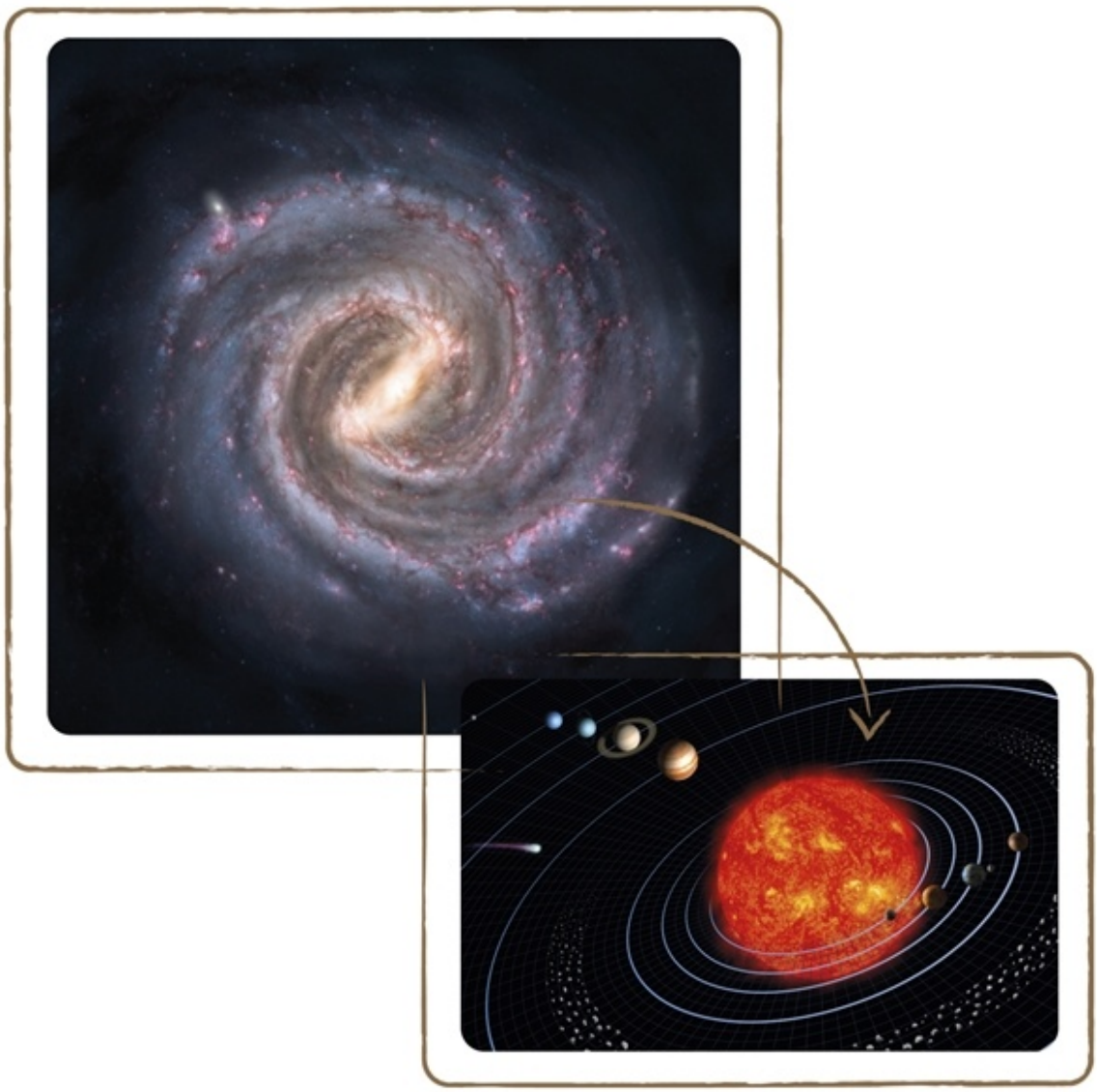
PODSTAWOWE INFORMACJE

Introduction

The Solar System, in which we live, consists of the Sun as its central star, eight planets with their moons and several dwarf planets. Together with hundreds of thousands of asteroids (boulders from the size of small pebbles to the size of a dwarf planet) and comets, these celestial bodies orbit the Sun.

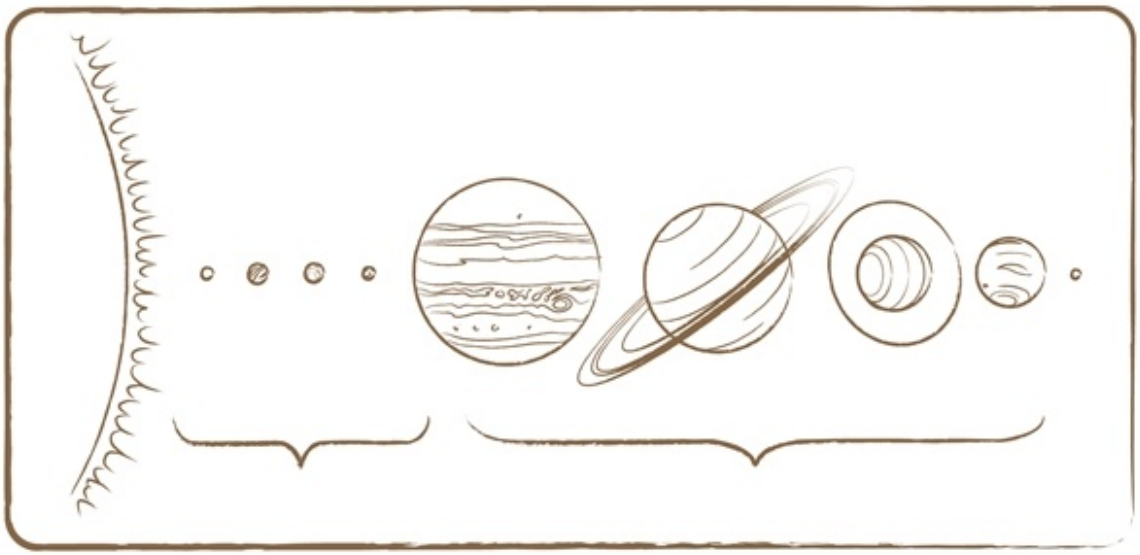
The Earth is a very special planet among these celestial bodies. It is our home! In order to understand its uniqueness, students need to compare the Earth to the other planets in the Solar System. The Earth is located about 150 million kilometres from the Sun, giving a temperature that is exactly right for liquid water to be present on the surface, unlike on other planets. This proved crucial for the development of life!

The Solar System as a whole is part of the Milky Way galaxy, a collection of about 200 billion stars that are arranged in a spiral, along with gas and dust. Billions of these stars have planets and these, in turn, have moons. This suggests that we are probably not alone in the Milky Way, but the distances between the stars are so big that a visit to another world would be very difficult.



Credit: Wikimedia Common / Nick Risinger / NASA / JPL

Even the star nearest to us, Proxima Centauri, is 4.22 light years (i.e., over 40 trillion kilometres) away from us. This is so distant that a journey there would take generations of human lives.



Credit: UNAWE / C.Provot

Planets that orbit stars other than our Sun are called extrasolar planets or exoplanets for short. Astronomers have already discovered thousands of these exoplanets and regularly discover more. We can categorise the planets of our Solar System into two types: rocky planets, which are nearest to the Sun and have a solid surface, and gas giants, which are farther from the Sun and are more massive and mainly composed of gas. Mercury, Venus, Earth and Mars appear in the former category, and Jupiter, Saturn, Uranus and Neptune make up the latter. Pluto, our formerly outermost planet, has been considered a dwarf planet since 2006. Between Mars and Jupiter is a so-called asteroid belt, which circles the Sun like a ring. It consists of thousands of smaller and larger boulders. The largest of these have their own names, just like the planets. One of them, Ceres, is so large that it is considered a dwarf planet.

The planets

Planets are spherical bodies orbiting a star. They have sufficient mass to have purged their orbits of all larger and smaller boulders thanks to their gravitational pull. Dwarf planets are also spherical and orbit a star, but they have small masses and therefore such weak gravity that they are not capable of attracting smaller boulders in their vicinity. Currently (in 2016) five dwarf planets have been identified: Ceres, Pluto, Haumea, Makemake and Eris. Moons are often spherical as well, depending on their size, but they orbit planets.

Each of the planets in our Solar System has very specific features. We have summarised them in the fact files below. The following rule of thumb is valid in the Solar System: small planets lie close to the Sun and are made of solid material, while large planets are farther away from the

Sun and are mainly composed of gas. This is not necessarily true for planets around other stars, some of which have planets like Jupiter much closer to their star than Mercury is to the Sun in our Solar System.

Rocky Planets

The four rocky planets (Mercury, Venus, Earth and Mars) are very dense (solid) and comparatively small. Their atmospheres are very thin or non-existent (Mercury), with the exception of that of Venus.

Mercury

Mercury is the planet nearest to the Sun. It has no atmosphere and its solid surface, like that of our Moon, is covered with many craters. Mercury orbits the Sun once in just 88 days and has no moons. There are severe temperature differences on its surface: 380° C on the side facing the Sun, and -180° C on the night side! This is because day and night shift very slowly on Mercury, because of its slow spin. Also, there is no atmosphere to trap the heat at night.



Credit: NASA

Venus

Venus is about as large as the Earth. Carbon dioxide (a greenhouse gas) makes up 99% of its atmosphere, which causes sunlight to get trapped in this mega greenhouse. Whether it is day or night, it is always very hot on Venus: almost 500° C! While the other Solar System planets rotate in the same direction, anticlockwise, Venus rotates backwards, clockwise.



Credit: NASA

Earth

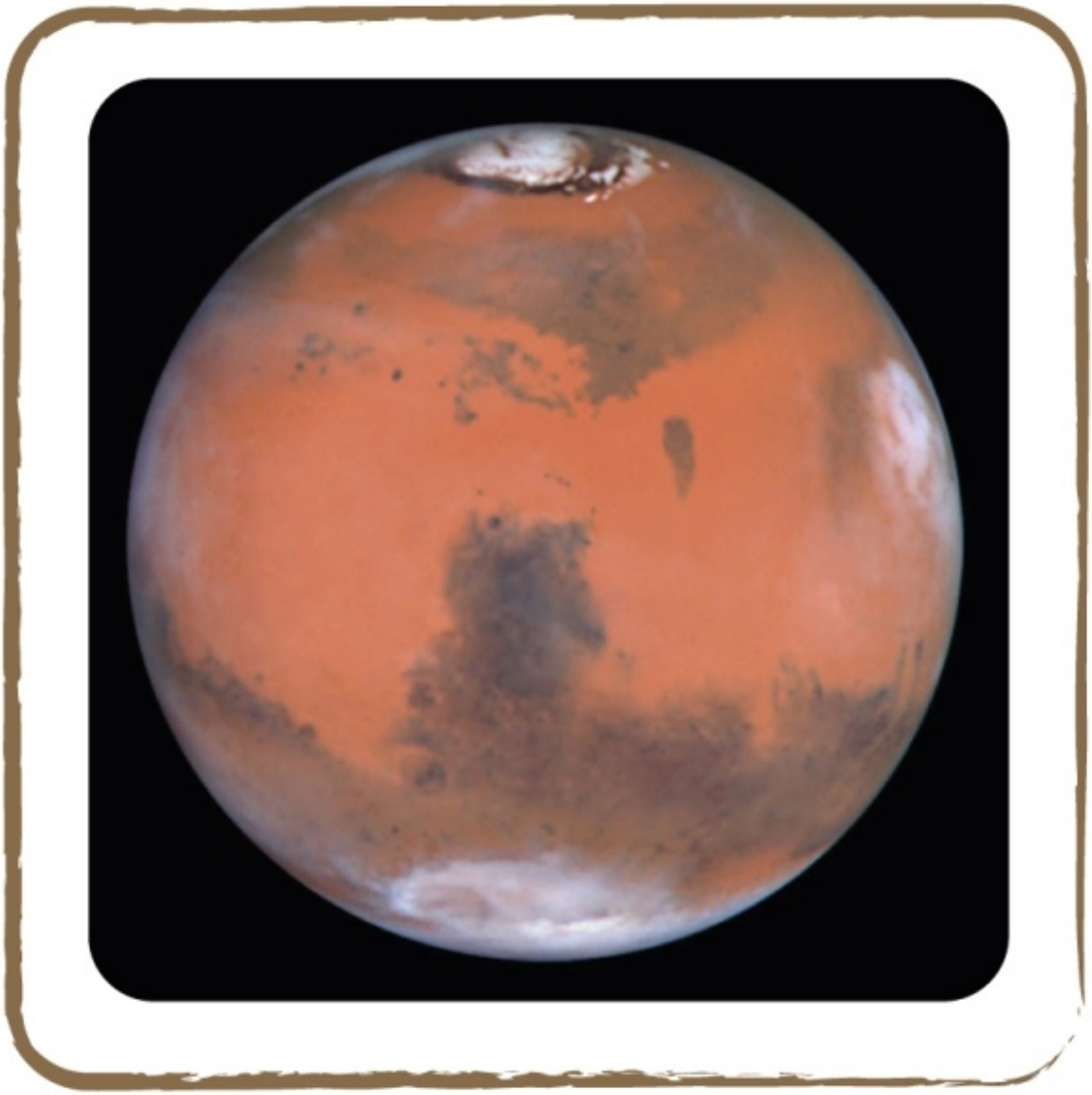
Earth is the only planet in the Solar System that has liquid water on its surface, significant amounts of oxygen in the air and moderate temperatures. It orbits the Sun once a year. Its stable axis (inclined 23 degrees) results in seasons. Furthermore, it is the only celestial body on which we have found life so far.



Credit: NASA

Mars

Mars is half the size of the Earth. Its reddish colour is caused by iron oxide (rust). It has a very thin atmosphere, which mainly consists of carbon dioxide. One of its special features is its many extinct volcanoes, which reach heights of up to 22,000 metres! Mars has two very small moons and needs about twice as much time as the Earth to orbit the Sun. Like Earth, it also has seasons, as its rotation axis is inclined.



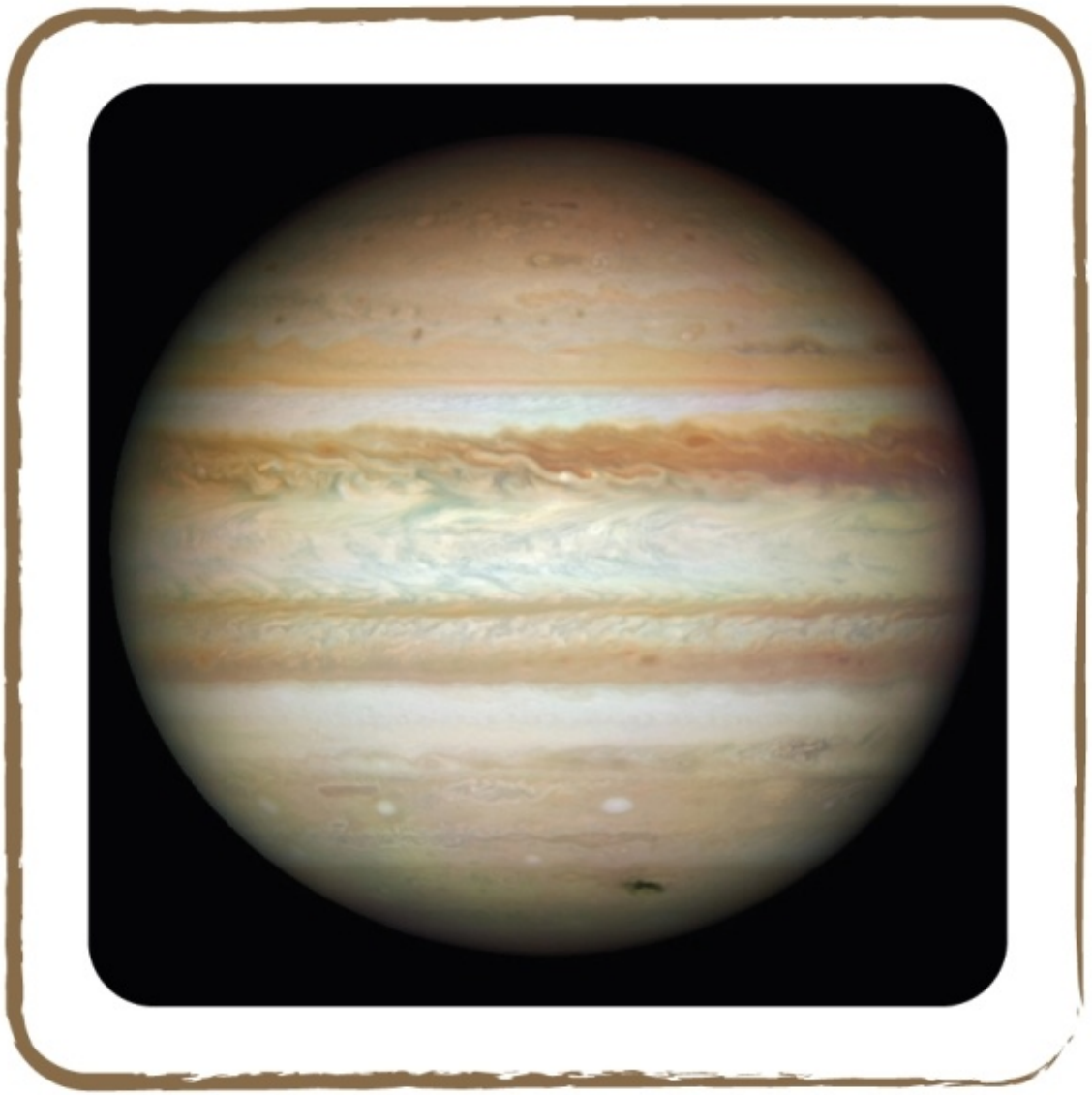
Credit: NASA

Gas Giants

The ‘gas giants’ are so-called because they are large compared to other planets and they are composed mostly of gas. They consist of a thick atmosphere and a relatively small solid core.

Jupiter

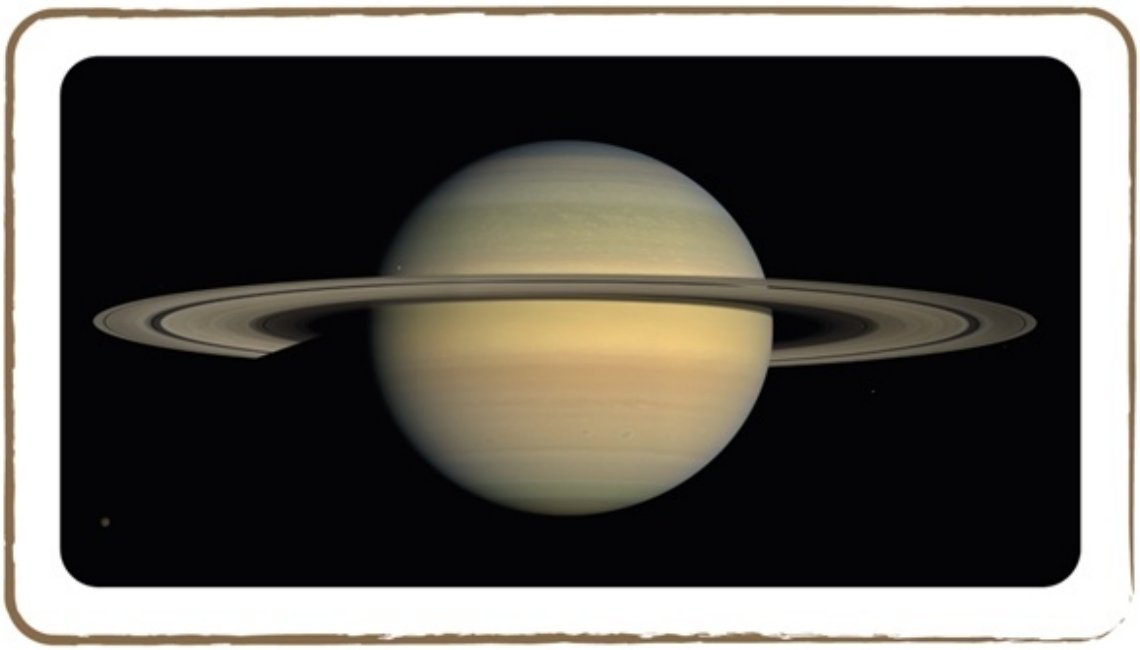
Jupiter is the largest planet in our Solar System. Like all giant planets, it mainly consists of gas and has a small solid core and a thin ring system. It has a remarkable red spot on its surface that is twice the size of the Earth! This spot is a huge storm (a cyclone) that has been raging for more than 400 years. It has at least 67 moons (in 2016) and is composed mainly of hydrogen and helium.



Credit: NASA

Saturn

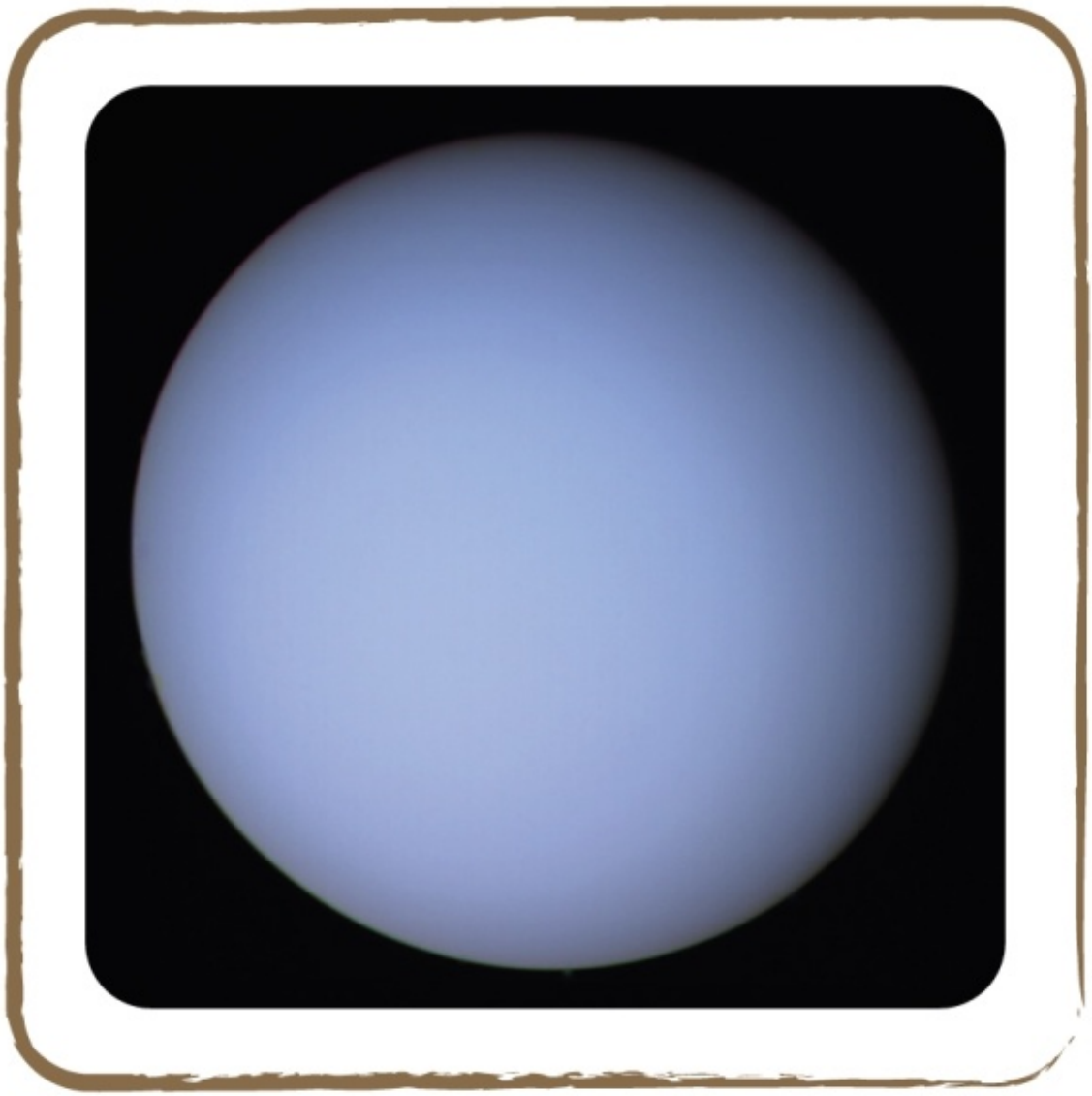
Saturn is surrounded by large rings and therefore earns its nickname ‘Lord of the rings’. These rings consist of numerous small ice grains. Saturn’s atmosphere has a fairly low density: Saturn is the only planet in the Solar System that could float on water. It has many moons: more than 60 (62 in 2016) and many more unnamed ‘moonlets’.



Credit: NASA

Uranus

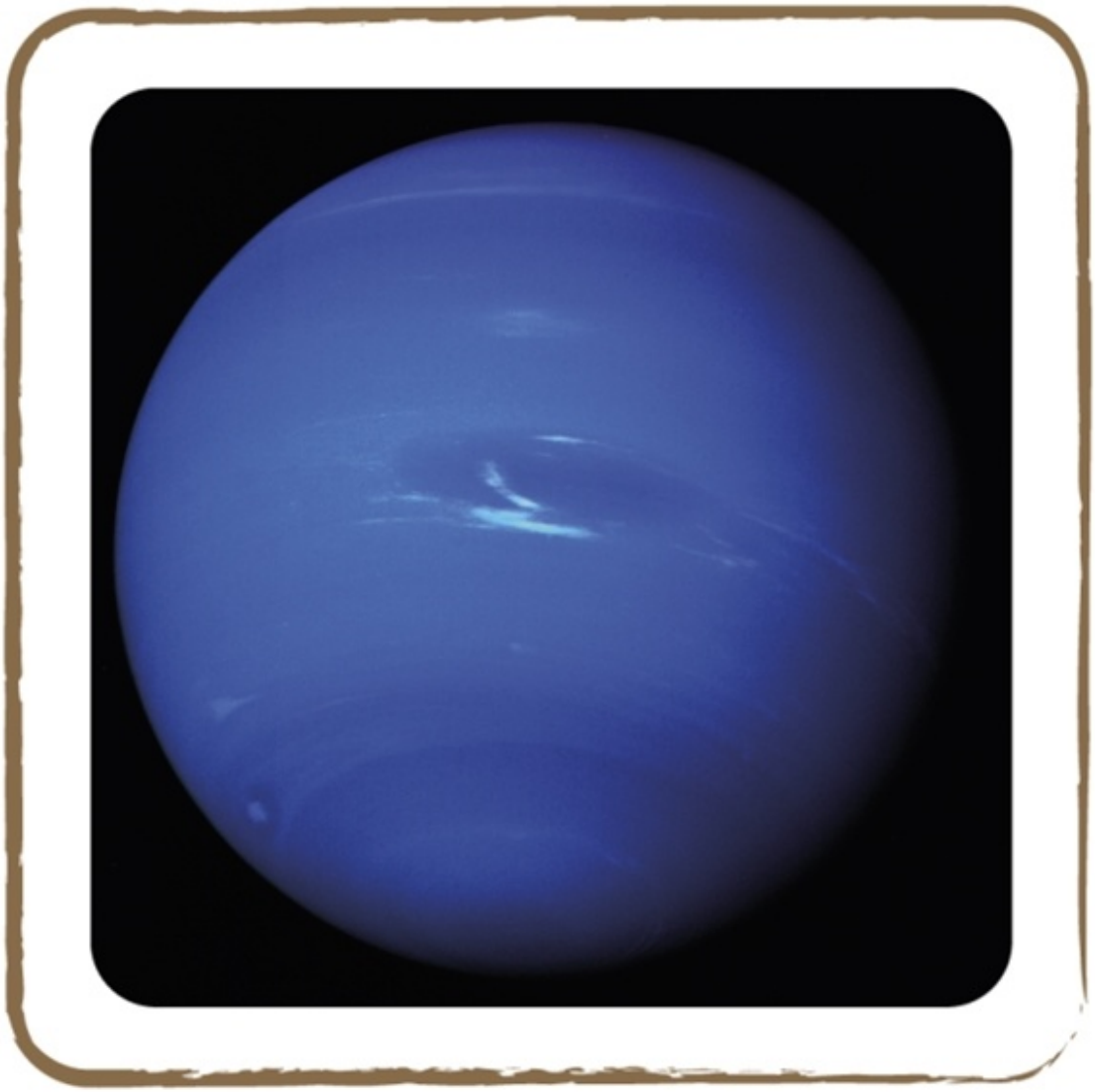
Uranus has a few thin rings. Its surface looks very smooth and barely shows any structure. It has 27 known moons (2016).



Credit: NASA

Neptune

Neptune's surface has a blue colour, like that of Uranus. White clouds fly over its surface at speeds of over 1000 km/hr. Neptune's path sometimes crosses the orbit of dwarf planet Pluto. The planet has a thin ring system and 14 known moons (2016).



Credit: NASA

Dwarf Planet: Pluto

Pluto is composed of ice and rock. In 2006, astronomers decided that Pluto should no longer be classed as a planet but only a dwarf planet, although it is spherical. Due to its low mass, it cannot attract smaller boulders in its vicinity, as the ‘real’ planets do. Pluto has one larger and

two smaller moons. Currently, in 2016, there are 4 other planets considered as dwarf planets that could be added to the game on an equal standing with Pluto: Ceres, Haumea, Makemake, and Eris.

Our knowledge of the Solar System

Astronomy research and tools evolve and improve very quickly. Our knowledge about space including our Solar System is extensive but not complete and it is constantly growing. Therefore, data given in the present resource might become incomplete or inaccurate over time. This might be illustrated with Pluto, considered for many years as the ninth planet of the Solar System and today identified as a dwarf planet.

PEŁNY OPIS ZAJĘĆ

Preparation

- Print out the card game PDF, one set per group. Print out either double sided or stick the front and back together. Cut out the cards along the lines.
- Print out the photos of the solar system, one set per group. Cut them separately.
- Ideally ten students per group.

Activity

Step 1: Identifying planets

- First, ask the students to identify the pictures of the planets: which planet is seen in which photo?
- Let them arrange the photographs of the Sun and its planets in the ‘right’ order. Show students the correct order at the end.

Step 2: Colouring planets

Next, the students colour the pictures of the card game. Ask each student to pick one card and colour it. Which peculiarities have to be taken into account?

Step 3: Playing the card game

- On the back of each card, there is a summary of the most important features of the individual planets and the Sun. At the bottom, there is a question, whose answer indicates another celestial body in the Solar System.
- Shuffle the cards and hand every student one card.
- Ask the students to read and understand the exact properties of ‘their’ celestial body.
- The student with the Sun card reads out loud the question on the bottom of the back of its card. The answer should be called out only by that student whose celestial body was sought. Then, this student can read out loud the question on his/her card.

- The game ends when the round goes back to the student holding the Sun card.

Step 4: Planet order and size

- In order to better memorise the order of the eight planets in our Solar System, use the following mnemonic: My Very Eager Mother Just Served Us Nachos or invent a new one with the students in your home language.
- If available, use the model of the planets and the Sun to give students a feeling of the different sizes of the planets.
- Give a quantitative feel for the comparative distances of the planets from the Sun and size by showing this video: 'How big is the Solar System' https://www.youtube.com/watch?v=MK5E_7hOi-k For older students: 'To Scale: The Solar System' https://www.youtube.com/watch?v=zR3Igc3Rhfg

PROGRAM NAUCZANIA

Space Awareness curricula topics (EU and South Africa)

Our wonderful Universe, the Solar System

National Curricula UK

KS2: Year 5, Science: Earth and Space: Describe the movement of the Earth, and other planets, relative to the Sun in the solar system. Pupils should learn that the Sun is a star at the centre of our solar system and that it has eight planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune (Pluto was reclassified as a 'dwarf planet' in 2006).

KS1, Art and Design: To use drawing, painting and sculpture to develop and share their ideas, experiences and imagination.

ZAKOŃCZENIE

Students use cards to become familiar with the planets of the Solar System. They play and learn that all planets go around the Sun. They also learn some properties about these planets, the names of the planets and their order in the Solar System.

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