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BRIEFING

Lesson objective

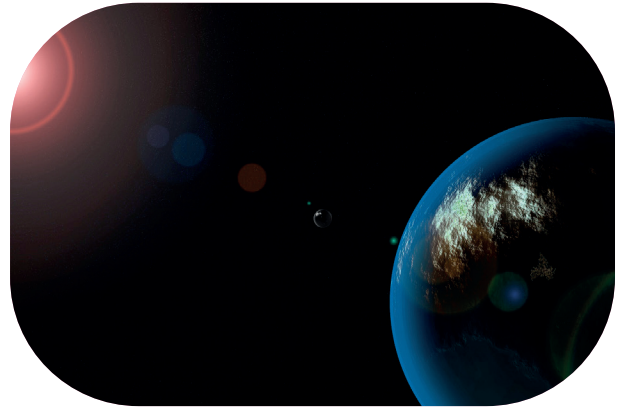
- To learn about the planets in the Solar System.
- To learn about planetary distances.

Lesson fact

- The Solar System includes the Sun and the objects orbiting it, such as planets, dwarf planets, moons, meteoroids, and asteroids.

Discussion: What planets do you know? Is Earth a planet?

- The stars you see in the night sky are not a part of our Solar System but belong to other galaxies.

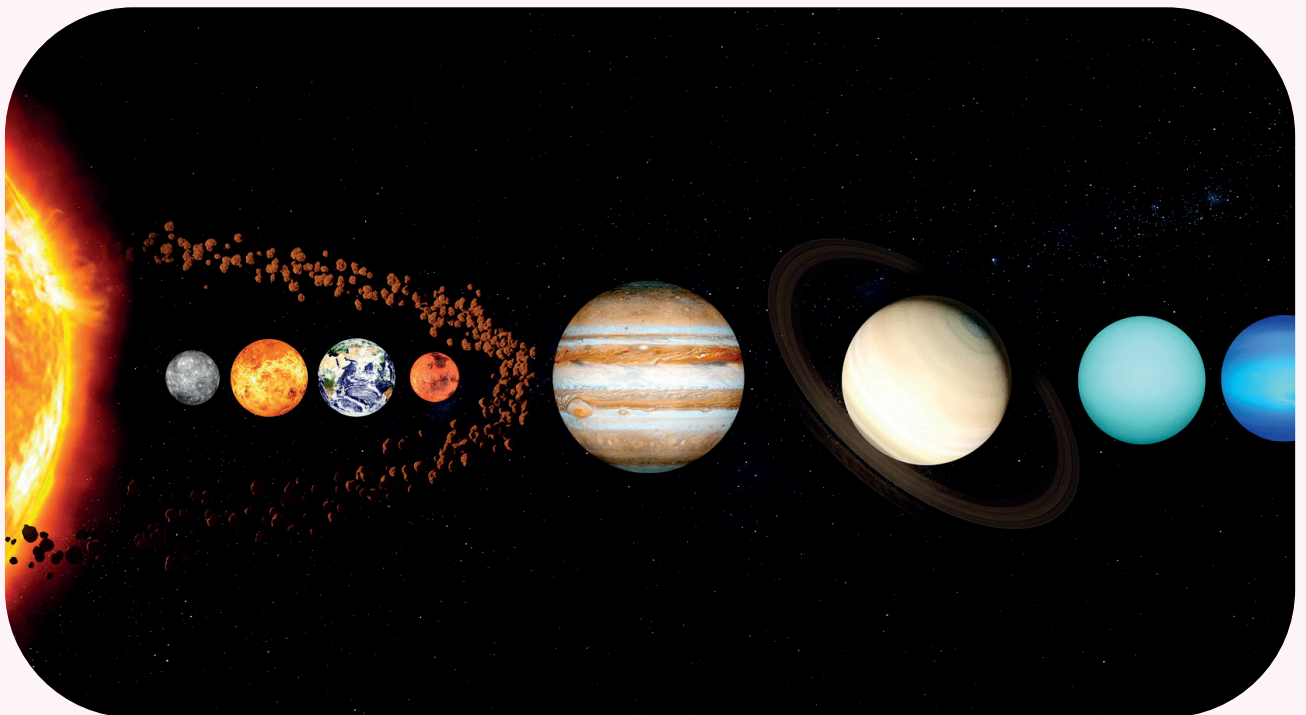


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Briefing: Solar System

Lesson fact

- The Solar System consists of eight planets, and one plutoid that was previously classified as a planet.
- Each planet has its orbit. Each planet stays on an individual orbit because the Sun creates a gravitational force which keeps the planets in the right place.
- Each planet also has an individual rotation speed and day length.
- The planets have very different circumstances, for example, some planets are very hot and others very dry. These circumstances depend on the composition and movement of the planets, and their distance to the Sun.
- Planets' gravitational forces pull objects towards them, such as moons, gas (atmosphere) and rocks (rings).

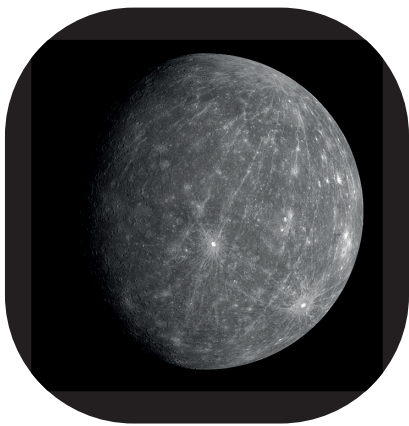


Lesson exercise: The planets of our Solar System

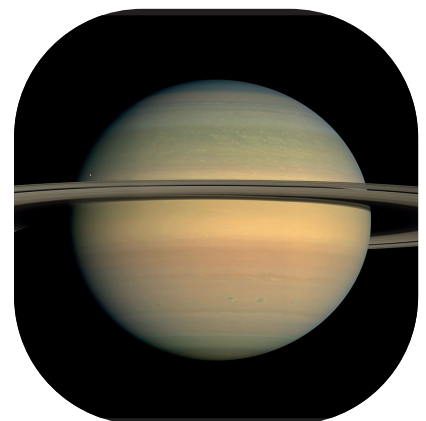
Execution

The teacher tells about planets and then asks the kids to combine a picture of a planet with the right information.

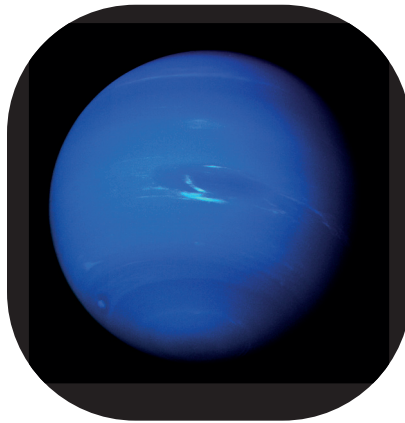
1. Mercury: A clear rocky planet with no atmosphere. The smallest planet in the Solar System. For Mercury, it takes about 88 days to complete a single orbit around the Sun. It rotates on its axis very slowly, one rotation takes 59 days.
2. Venus: A clear rocky planet with a heavy atmosphere of gases. It is almost the same size as Earth. It takes about 244 days for Venus to orbit around the Sun and one rotation around its axis takes 243 days.
3. Tellus (lat.) also known as Earth: A rocky planet with an atmosphere. The planet seems blue because it consists mostly (approx. $\frac{2}{3}$) of water. Water enables life on planet Earth. Earth goes around the Sun in 365 days and it rotates around its axis in 24 hours. Earth rotates on its axis at a 23-degree angle, which causes our four seasons.



4. Mars: A rocky planet with a thin atmosphere of gas. A long time ago, the nowadays red and dry Mars used to be hotter and a more humid planet. A large salty ocean may have covered the north side of the planet. The average temperature on Mars is -55° , while the Earth's average temperature is about 15° . Mars goes around the Sun in 687 days and rotates around its axis in 25 hours.
5. Jupiter: A gas giant that is composed of hydrogen and helium. Jupiter's atmosphere is very large, it is about the size of the rest of the planets combined. Because of the fast rotation of the planet, its clouds formulate light bands, called zones, and dark bands, called belts. There are 79 known moons of Jupiter. It takes 11 years and 315 days for Jupiter to orbit around the Sun and 10 hours to rotate around its axis.
6. Saturn: The second-largest planet in the Solar System. Saturn is surrounded by an atmosphere and it has a similar liquid core that Jupiter has. Saturn is known for its ring system that is about half a million kilometres wide and about half a kilometre thick. Saturn orbits around the Sun in 29,5 years and rotates around its axis in 10,5 hours.



7. Uranus: Has a gaseous atmosphere that gradually transitions into the liquid layers of the planet. Uranus is a blue/turquoise simplified circle with 27 known moons. It goes around the Sun in 84 years and rotates around its axis in 17 hours.
8. Neptune: Neptune is probably composed of ice and rock, and has a thin layer of gas on its surface. Neptune is known for its blue colour and its large dark spot. Neptune orbits around the Sun in 164 years and 288 days, and it orbits around its axis in 16 hours.
9. Pluto: The surface of this reddish plutoid is believed to be coated with methane ice and a thin layer of gas on top of it. Pluto was long believed to be the ninth planet in the Solar System, but due to its size and location, it is defined as a plutoid and a dwarf planet. A plutoid is a celestial body that is too small to be a planet and orbits the Sun farther than Neptune.



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Lesson exercise: Planets' movement

Supplies

- round bowl or plate
- ball
- playdough

Execution

1. Attach a piece of playdough to the centre of the dish.
2. Place a ball of playdough at the edge of the dish.
3. Rotate the dish so that the ball spins along the edge around the sun.
4. Try slowing down and speeding up the rotation.

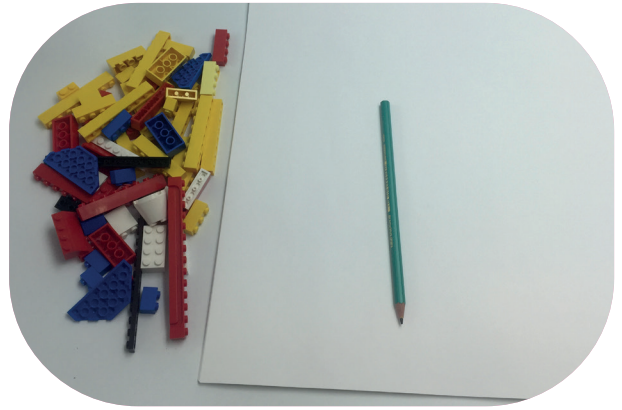


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Lesson exercise: Planetary motion

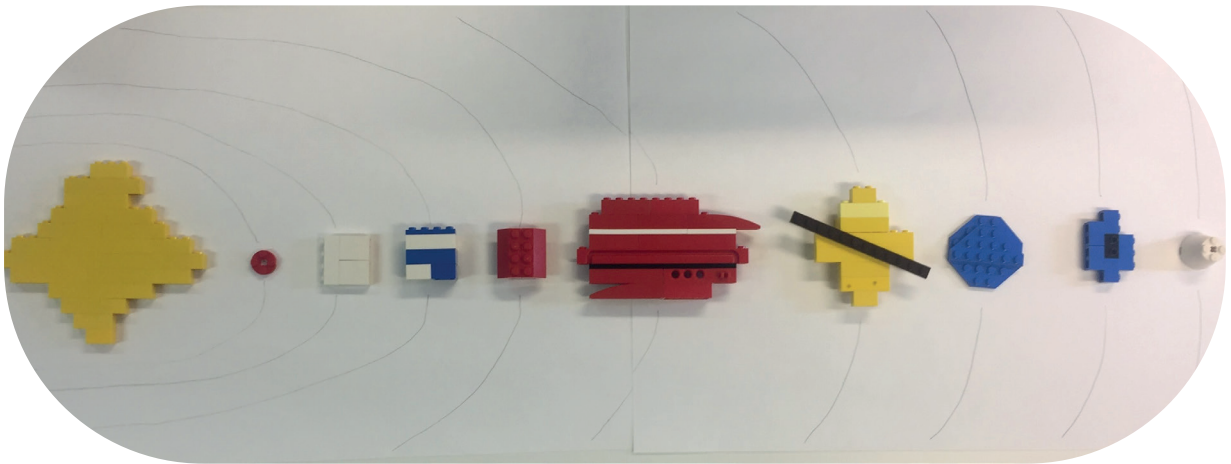
Supplies

- large white paper
- Legos
- pencil



Execution

1. Build Lego planets. Planets do not need to be round but try to use information about the actual colours, sizes, etc. of the planets.
2. Place the Lego sun in the centre of the paper.
3. Draw planetary orbits around the sun.
4. Add the rest of the planets to their correct orbits and try moving them correctly.



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Lesson exercise: Planetary movement

Supplies

- toilet paper
- Lego planets from Exercise 3, or you may use beads etc. instead



Execution

1. This exercise requires a large space.
2. Pick a wall of the room that represents the sun.
3. Take as many sheets of toilet paper as shown in the table on the next page.
4. Place the sheets straight on the floor and place the correct planet at the other end of the string.

Planet	Distance from the Sun (km)	Number of sheets of toilet paper on the planet's orbit
Mercury	57 910 000	1
Venus	108 200 000	2
Earth	149 600 000	3
Mars	227 940 000	4
Jupiter	778 330 000	13
Saturn	1 429 400 000	24
Uranus	2 870 990 000	49
Neptune	4 504 000 000	76
Pluto	5 913 520 000	100

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Lesson exercise: Moon phases

Lesson objective

- To learn how the Moon orbits Earth and how its movement affects Earth.
- To learn the four main Moon phases.

Lesson fact

- The Moon is the only celestial body orbiting the Earth.
- It is the fifth largest moon in our Solar System.
- The Moon does not have a light, but half of it is always lit by the Sun.
- The Moon reflects sunlight to the Earth, but the size of the lighted area varies within the month. During the New Moon, the Moon does not reflect light at all. During the Full Moon, the entire side facing Earth is lit. The size of the illuminated area depends on how the Sun, Moon and Earth are positioned.
- The moon eclipse turns the Moon red. The lunar eclipse is caused by the Earth being between the Moon and the Sun.

Supplies

- 2 clear plastic cups (disposable)
- black marker
- yellow paper
- black paper
- glue
- tape
- ruler



Execution

1. Measure the height of the disposable cup with a ruler. Cut an equally high rectangular piece of black paper. The paper strip is used to cover the inside of the cup.
2. Cut a round moon out of yellow paper and glue it to the other side of the black paper, in the middle.
3. Glue or tape the black paper into the cup with the yellow moon facing outwards.
4. Place the cup inside another cup, so that the black paper is in between.
5. The teacher has written the Moon phases in small notes: Full Moon, New Moon, 2 x Half Moon, and 2 x Crescent.
6. The moon that is already in the cup is the full moon, and the "Full Moon" tag is glued under it. Glue a yellow arrow pointing to the right above the moon. The arrow is on the watch face at 12 o'clock. Glue the next three labels at three, six and nine. Divide the cup into four blocks to accommodate all lunar phases.
7. Turn the top cup so that the yellow moon is at three o'clock. Glue the "Half Moon" tag to this point and colour the left side of the moon with a black marker.
8. Turn the top cup over to six o'clock and glue the "New Moon" tag on it. Hide the yellow moon inside the cup by completely blackening it with the marker.
9. Turn the top cup at 9 o'clock and stick another "Half Moon" tag on it. Colour the right half of the yellow moon with the black marker (i.e. draw a semicircle to the right side of the moon).
10. These are the four main phases of the Moon: First Quarter (Half Moon), New Moon, Third Quarter (Half Moon), and Full Moon.
11. You can also add the phases of the crescent to the moon cup with the older students. Glue the name tags between New Moon and Half Moon. Colour the moon at 1.30 o'clock so that only a crescent curving to the right remains. At 10.30 o'clock, colour a crescent curving to the left.

