

Lesson 3:

Motion of the Earth and planets in the Solar System

Aims:

1. To learn how different planets of the Solar System orbit the Sun
2. To learn how different planets of the Solar System spin around themselves
3. To learn how the tilt of the planet's axis affects the conditions on the planet

Age group: Y5-6, but might be easily adapted for Y4

Time: 60 minutes

Materials:

1. *Solar System in motion* video <https://www.youtube.com/watch?v=z8aBZZnv6y8>
2. *Planets and their orbital characteristics* table
3. *Orbits of the planets in the Solar System* image
https://usercontent1.hubstatic.com/12529558_f520.jpg
4. *Elliptical orbits* image <http://astro.wsu.edu/worthey/astro/html/im-planets/ellipse.gif>
5. Craft materials: cellotape, straws/sticks, colouring pencils
6. *Axial tilt and the seasons* video <https://www.youtube.com/watch?v=Pgg0LThW7QA>
7. Information sheet: Seasons on different planets in the Solar System
8. *Solar System in motion* activity

Introduction:

In this lesson, children learn that all the planets of the Solar System orbit the Sun and that the paths of the planets are ellipses, not circles, they discuss different characteristics of the orbital motion such as the time it takes for the planet to orbit and orbital speed, then they learn that at the same time as planets orbit, they also rotate on their axes and why the tilt of the axis in relation to the the orbital plane causes seasons. The children study the information about the tilts of the axes and seasons on different planets in the Solar System. At the end of the the lesson they make "live models" of the Solar System.

Procedure:

Tell the children, that everything moves in Space: Moon, Earth, planets, stars and even galaxies and that today they are going to look at the way the planets move around the Sun. This knowledge would be important for understanding how different objects interact in space, because there are the same kinds of motions on a smaller scale (moons move around their planets) and on a bigger scale (the Sun moves around the centre of our galaxy).

1. **Orbiting**
 - Show the children video (1). Pause halfway through the video (before/ at 1'40").
 - Ask the children to identify the planets on the video.
 - Ask the children what they notice about the motion of the Earth. (*The Earth goes around the Sun in a circle and spins around itself*) Do other planets also move the same way?

- Tell the children that the Sun is the heaviest body in the Solar System, therefore its gravity controls the motion of all the other objects in the Solar System.
- Ask the children to define what gravity is. Summarize and explain the concept.
- Tell the children, that gravity is a force that gets weaker with the distance (so the closer you are to the Sun, the stronger the gravitational pull). As a result, the objects that are closer to the Sun, move around the Sun faster, the objects that are further away, move around the Sun slower.
- Show table (2) to prove the last statement.
- Ask the children why the further the planet from the Sun the longer it takes for this planet to orbit the Sun once. (*1- the further the planet from the Sun, the slower it moves on its orbit 2 - the further the planet from the Sun, the longer its orbit*)
- Remind the children, that moving around the Sun is called orbiting. The paths of the planets around the Sun are called orbits.
- Show pic (3) to the children.
- Ask the children what shapes are the orbits of the planets.
- Tell the children, that
 - *The orbits of the planets are ellipses, though all (apart from Mercury) are nearly circular.
 - *The Sun is not in the centre but in the point called focus. Show image (4) to introduce the concept of focus.
 - *The orbits of the planets lie in approximately the same plane.
 - *All the planets orbit the Sun in the same direction, which is the same as the direction of the Sun's spinning on its axis (counterclockwise when looking from the Sun's North Pole)

2. **Spinning. Day and night.**

- Play the video (1) again from about 1'30" on.
- Remind the children that all the planets spin around themselves as they orbit the Sun. What is the result of the Earth's spinning around itself? (*Day/Night*). Ask the children to explain why we have days and nights on Earth and how long it takes for the Earth to spin around itself.
- Go back to the table (2). Tell the class to look carefully at the last two columns ("time to orbit the Sun" and "time to rotate"). Ask the children if they can tell any interesting facts about any of the planets by just comparing the two columns.
Give them an example:
 - (-gas giants spin faster than the rocky planets
 - a day on Venus lasts longer than a year
 - there is less than 2 days in a year on Mercury
 - a day on Mars lasts about as long as a day on Earth)
- Ask the children to imagine living on one of these strange planets. What would it be like?

3 **Axis of the planet. Seasons.**

- Tell the children that now they are going to demonstrate the spinning of the planet. Ask each child to choose their favourite planet, cut a circle out of a piece of paper (a quarter of A4 for rocky planets and a half of A4 for gas planets), colour their circle to make it look like a planet and finally attach the straw/ stick/ pencil to the middle of the planet using cellotape (in a way that the middle of the straw sits in the middle of the circle). Allow 5 minutes to complete the task and don't forget to make a spinning planet yourself.
- Tell the children, that an imaginary line about which the planet rotates is called an axis. (so the straw in a model is an axis!) Ask the children to show you how their planet spins on its axis. Would it be straight? At an angle? Left to right? Right to left?
- Tell the children, that the Earth is tilted towards the plane of its orbit at an angle of 23.4 degrees. Ask the children if they think they can feel this tilt and whether it has any effect on our planet.
- Tell the children, that the tilt of the Earth causes seasons.
- Watch video (6).
- Tell the children, that other planets are also tilted, but at a different angles, with some spinning in the same direction as the Earth, and some in the opposite.
- Give information sheet (7) to your class to study. You can either arrange children in groups and let them read and discuss the information in their groups or give the information sheets individually and ask the children to take a few minutes to read it quietly. Ask the class a few questions about what they just have learned.

4. **Solar System in motion activity**

- Divide the class into 3 groups and do the "Solar System demonstration" using instructions (8)
- Praise the children for their hard work and enthusiasm.

5. **End of the lesson**