Instructions

Observing

# The distance between the Moon and the Earth.

**Materials**:

- a volleyball,
- a tennis ball,
- a string (7.5 meters long).

You can use any other objects that meet the following conditions: the object symbolizing the moon should have a diameter four times smaller than the object representing the earth, and the string should be 30 times longer than the diameter of the "earth"

**Course:**

Invite three to four students to demonstrate the proportions between the earth and the moon as well as the distance between them. The volleyball will symbolize the earth, whereas the tennis ball will represent the moon. The students stretch the string between the balls.

**Summary:**

You can ask your students the following questions:

How many times is the moon smaller than the earth?

How far is the moon from the earth?

Instructions

Movement game

# The rules of the Moon's movement.

**Materials**:

- round stickers in two colors:
- the "moon" color - one for each student,
- the "earth" color - one for each pair;
- a flashlight.

**Course of the play**:

1. Task 1 – rotational motion. The students stick the "moon" stickers to their clothes. Next, the students perform the rotational motion, that is they rotate around their own axes (these axes are their spines). They perform each rotation on one heel, without lifting their feet off the floor.

2. Task 2 – the orbital motion of the Moon. It consists in the Moon moving around the Earth along a track called an orbit. The students make pairs and assume the roles of the moon and the earth, respectively. One person in each pair changes his or her sticker to the "earth" color, whereas the other person remains the moon. The moons slowly orbit the earths, making small steps.

> Ask the moons to move around the earths without rotating around their own axes, that is they should constantly face one object, for example the chalkboard, during their entire orbital motion. Ask the children about the way in which the moons should orbit the earths so that they would illustrate the actual moon-earth system.

3. Now, only one earth/moon pair remains in the middle of the room. The teacher lights the pair using the flashlight (the sun), and simultaneously explains the relationship between all three objects – the Sun, the Earth, and the Moon.

Experiment

# Moon phases observed from the Earth.

Darken the room in which the lesson is taking place. Divide your students into teams, a few persons each (it would be best to work in groups of four).
The sheet on which the children will draw an orbit will also be an observation sheet on which they will mark particular moon phases.

**Materials for the group:**

- a sheet of paper (A4),
- a ping-pong ball,
- a pencil,
- a small flashlight (you can also use a smartphone with a built-in flashlight function).

**Course:**

1. Divide the following tasks within each group: the flashlight (the sun) operator, the ball (the moon) operator, the observer (who describes the shape of the moon as seen from the earth), and the person to fill out the worksheet.
2. Draw a circle representing the earth on a sheet of paper, and draw the moon's orbit around the earth.
3. Place the flashlight on the right-hand side of the sheet – this will be the shining sun, and its light will fall onto the orbit (in photo 1, the arrows representing the sunrays fall onto the earth and the moon).
4. Moving the moon-ball along the circle and lighting the ball with the flashlight, observe the moon phases.
5. Draw each of the phases you have observed in your observation sheet. (photos: 2, 3, 4, 5 and 6)

Allow your students to experiment and prepare their worksheets so that they contain possible errors – they will be able to correct them while discussing the results of the experiment.

Ask the children that they try to name particular Moon phases as they carry out the experiment.

The students closely examine each moon phase (Where does the light fall? Which side of the ball remains unlit?). Next, they name each moon phase and write a caption for it.

1. The observer tells the others how he or she sees the moon. When the moon is in its first position, the observer is unable to see the part of it that is lit by the sun. The moon phase being observed at the moment is the **New Moon.**
2. More or less, a week has now passed, and the moon changes its position. The students rearrange their balls on the sheet. The lines present the part of the moon which is seen by the observer. In the photo, only half of the moon's disk is lit. This is the **First Quarter.**
3. Another week of the moon's journey around the earth has passed, and the moon will soon come to another important point. The observer sees the moon's disk fully illuminated by sunrays (the lines suggest what the observer is able to see). This moon phase is called the **Full Moon.**
4. Another week has passed and the moon changes its position on the orbit again. It is yet another time that only part of the moon is visible, but this time it is the second part – this is confirmed in the photo; this moon phase is called the **Third Quarter.**

**What does the Moon look like between the four basic Moon phases?**
When another week passes, the moon returns to the place in which the experiment has begun. However, it is not so that the moon appears in the sky only four times during its movement around the earth – you can see it every day, after all.

This part of the experiment will be a challenge for your students.

1. The moon appears in the middle of the period between the New Moon and the First Quarter. The students try to tell what it will look like at that point. In the photo, the moon resembles a croissant, and this form of the moon's disk is called the Waxing Crescent.
2. Next, the moon moves to a position between the Full Moon and the Third Quarter. More than half

of the moon's disk is now visible. This is the Waxing Gibbous.

3. The moon between the First Quarter and the Full Moon is called the Waning Gibbous.
4. Between the Third Quarter and the New Moon, the Waning Crescent will appear.

**Summary:**

A Moon Phase determines the part of the Moon lit by the Sun, as seen from the Earth. Due to the fact that, except for eclipses, the sun always lights only half of the surface of the moon, its phases result from viewing that side at various angles, which are due to various positions of the sun, the earth and the moon relative to one another.

We can distinguish the following phases:
New Moon – the area facing the earth is not lit;
First Quarter – the entire western half of the moon's disk (that is, the right-hand half, as seen by an observer located in the northern hemisphere of the earth) is visible; since the New Moon phase, the moon has traveled a quarter of its orbit;
Full Moon – during this phase, the entire area facing the Earth is lit;
Third Quarter – the entire eastern half of the moon's disk (that is, the left-hand half, as seen by an observer located in the northern hemisphere of the earth) is visible; since the New Moon phase, the Moon has traveled three quarters of its orbit.