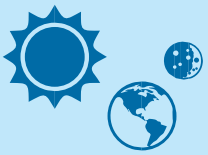
ACTIVITY 5

FROM THE EARTH TO THE MOON



Level:	Preparation:	Number of students:	Length:	Place:	Type of activity:
Grades 1-4	**intermediate**	**large group**	**15 min.**	**classroom, hall, outside**	**participation activity**

BRIEF DESCRIPTION

Students will discover the relative sizes of the Earth and Moon —and the distance between them—by making a scale model. They also learn about the concept of vast distance in space and the Earth's limited resources.

MATERIALS

- standard 30 cm-diametre globe
- approximately 8 cm-diametre ball
- measuring tape or 1-metre ruler
- small bottle for water
- measuring spoons
- satellite images to print and cut out

PREAMBLE

Students are likely already familiar with the Earth and Moon, having already seen images showing the two together —sometimes even showing the Moon orbiting the Earth. These images are rarely to scale, often giving the impression that the Moon is closer to the Earth than in reality. This activity helps us to better understand the distance between the two. We also include some interesting objects and distances in relation to the Earth, to make the concept of space clearer for students.

Finally, this activity will encourage reflection on the Earth and its resources. Although the Earth may seem quite big, especially for little ones, it's really a small planet in the scope of a vast universe. And our resources are limited, so taking care of our planet is important!

PREPARATION

Before undertaking this activity, be sure to find a correctly sized ball to represent the Moon. Some suggestions: a baseball or a Styrofoam ball for decoration, available in $1 stores. You can also use the image of the Moon provided with this activity.

In addition, it might be a good idea to put the amount of water on Earth (see Steps section) in a small bottle so that students can visualize the volume. The quantity, 19 ml, is roughly equivalent to one tablespoon plus one teaspoon.

Make sure you have a large enough room (9 metres long), or use a hallway or gymnasium.

STEPS

To begin, explain to the students that you will be making a scale model. To help them understand the concept of scale, you can use student's toys, such as small cars or animals. For example, you can hold up a small car or toy plane and discuss the fact that they are scale models, but (probably) not on the same scale as one another. You can then find two objects of the same scale to explain the difference.

EARTH-MOON

Show the students the globe and ball representing the Moon, and explain that these two objects are on the same scale. **The Moon is about 3.5 times smaller than the Earth**, which means it would be possible to fit 3.5 Moons into Earth's diameter. Are the students surprised that the Moon is so small next to the Earth?

Ask the students **how far from Earth would the Moon have to be to fit the model**. They may be surprised to learn that the Moon should be 9 metres away! You can use a one-metre ruler to measure this distance in the room, while a child holds the Moon at the other end. This model gives the correct impression of the distance between the Earth and the Moon. If they're surprised to see how far the Moon is from the Earth, you can add that on this scale, the Sun and planets would be kilometres from the globe! More precisely, you'd have to place the Sun 3.5 kms further away.

DID YOU KNOW ?

Did you know that travelling at 100 km/hr in space, it would take us more than four months to get to the Moon? Fortunately, space probes travel much faster than that!

AROUND THE EARTH

Let's take a closer look at the distance between the Earth and the Moon. Where, in between the two, are the astronauts on the International Space Station, or the satellites used for GPS? Where does space actually start as we climb to higher altitudes? Here's a table showing some of the distances that can be included in the model and discussed with students. These concepts are explained in greater detail in the *Information* section.

Object	Real distance from Earth	Distance from Earth in the model
Moon	385 000 km	9.06 m
Satellites for GPS	20 000 km	47 cm
International Space Station	400 km	0.9 cm
Limit of space	100 km	2.4 mm

ATMOSPHERE AND WATER

While there's plenty of air around and above us for us to breathe, our atmosphere is actually a very thin layer on a planetary scale. **If we want to see the atmosphere around the Earth to scale, it would be a sheet of paper!** So, it's easy to see how important it is not to pollute our air!

It's also possible to model the amount of water on Earth with our globe. **If we removed all the water from the oceans, rivers, lakes, and even glaciers from our model, the amount collected would be 19 millilitres.** Isn't that mindboggling? It's hard to imagine that this amount of water could fill all our oceans, but they are actually extremely shallow on the Earth's scale. On our globe, they would only be 0.2 mm deep.

Of all our water, only 0.007% is available freshwater. The other 99.993% is salt water from the oceans, ground and glacial freshwater. The amount of water available for supporting life on Earth is extremely limited: all the more reason to take care of our waters! To model this tiny quantity of water in our model, we'd have to take one drop of water and divide it fifty times.

The Earth and the Moon to scale, photographed by the Mars Odyssey space probe in 2001.
Credit: NASA / JPL / Arizona State University.

INFORMATION

It can be a challenge to understand the immense vastness of space. When we say that astronauts go into space, we imagine them far away from the Earth, when in reality they are typically so close to our planet that they can't see it as a complete sphere.

So, how do we define "space"? If we could climb a giant ladder up from the ground, when would we officially be in space? As a matter of fact, there is no obvious transition into space. The atmosphere doesn't suddenly end. It becomes thinner and thinner until we could no longer breathe. The sky would also get darker and darker the higher we climbed, since there is less air to diffuse the Sun's light. **With no clear delineation, scientists have created a definition: space begins at 100 km above the Earth.**

Beyond that, we can find satellites orbiting the Earth, including the International Space Station. These satellites have many functions: communications, weather forecasting, military use... In this activity, we talk about the International Space Station because as a home for astronauts, it's a particularly interesting satellite. We also mention GPS satellites, which are in a different orbit around the Earth. Most students are familiar with GPS, which is used for location. That signal comes from satellites located 20,000 km above the Earth. They are much further away than the International Space Station, at an altitude of 400 km.

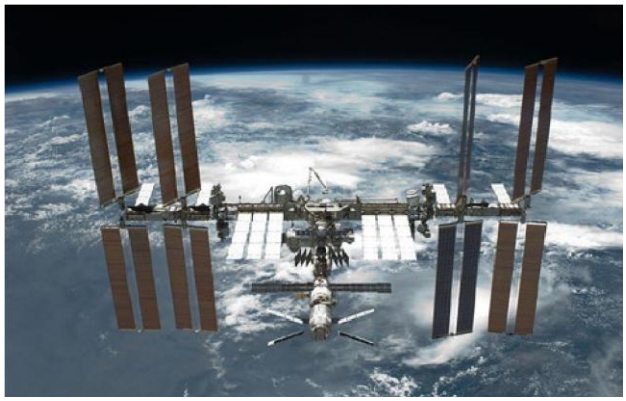
TO LEARN MORE:

- The Earth Moon System, from *Let's Talk Science*.

Moon to scale (8.2 cm).

To be printed at actual size, without scaling in the print options.
Photo Credit: NASA.

Satellite GPS
(image not to scale with activity)
Photo Credit: Government of the United-States.



International Space Station
(image not to scale with activity)
Photo Credit: NASA.