



SPACE[◉]

awareness

SOLAR SYSTEM

DIDACTIC COURSE FOR SECONDARY LEVEL

INVESTIGATION SHEET FOR THE TEACHER

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We are going to build a scale model of the Solar System.

1. Decide what objects from the Solar System must be included in your model and why.

(To begin, your model should include the Sun and the eight planets)

2. Investigate and decide the size of your scale model.

For your search, use the following:

http://www.exploratorium.edu/ronh/solar_system/

Note: It is advisable that you do not provide this link to your students unless they have completed their research plan and you are certain that they understand how to use scales. You may have them create the model of the Sun and then provide them with the link so as to obtain the measurements for the planets.

- Fill in the diameter of the Sun you want to scale your model by. You can fill in either the red-bordered inches box or the green-bordered millimetres box.

Important: Fill only one box. If both are filled in, you will get a dialogue box asking you to clear one of the boxes. Use the **Clear** button to clear the entire form.

- Click on the **Calculate** button.
- Notice that the distances and sizes of the planets will autopopulate.
- Let the students to experiment with different diameters of the Sun.
- Find the scale factor of your model. This will help you calculate the diameter of Saturn's rings in your model.
- Calculate the real distance represented by 1 meter of your model.

3. Collection of other data

Here are some other data that the students may choose to collect.

- History of the planet's name, date of discovery
- Internal structure
- Distance from the sun (model)
- Body diameter (model)
- Mass
- Movements (use 3D simulator)
- Density
- Gravity
- Atmosphere/atmospheric Composition



- Surface temperature
- Internal structure
- Geological structure (volcanoes, mountains, craters, etc.)
- Satellites
- Rings
- Planetary exploration

4. Model construction (Collaborate with the art teacher)

- 2D model

The Sun: Draw a circle in the playground so students understand the size (graffiti on a school wall will also work).

Spheres of the planets: Use construction paper

- 3D model

The Sun: Draw a circle in the playground so students understand the size.

The planets:

Mercury, Venus, Earth, and Mars. These planets have small diameters so you can use a lot of different materials to construct the planets' bodies.

Jupiter, Saturn, Neptune, and Uranus: Search in toyshops for balloons or balls that have similar dimensions to the model planets. Glue strips of newspaper on the spheres. Then paint the spheres using the instructions given below*.

(*Note: The 3D model is more expensive to construct but it needs to be built only once and can be used many times and in different classes.)

5. Colours

What are the true colours of each planet in our Solar System? I've seen the same planet coloured differently in different photos.

Here are the true colours of major planets to the best of my knowledge (spacecraft photos appearing in the media often have false coloration):

Mercury: grey. Mercury has practically no atmosphere, so we just see the rocky surface.

Venus: yellowish-white. We can only see the thick layer of colourless and featureless sulphuric acid clouds.

Earth: light blue with white clouds. Oceans and light scattered by the atmosphere make Earth prevalently blue. Depending on the area seen in an individual picture, brown, yellow, and green continents can be seen or parts of Earth can be covered by white clouds. Earth is by far the most dynamic planet when seen from space.

Mars: red-orange. This colour comes from rusty rocks on the surface since clouds are rare and thin.

Jupiter: has orange and white bands. The white bands are formed by ammonia clouds, while the orange comes from ammonium hydrosulphide clouds. None of the four *gas giant* planets (Jupiter, Saturn, Uranus, and Neptune) have a solid surface so all we see are clouds in the atmospheres.

Saturn: pale yellow. A white ammonia haze covers the whole planet and partially obscures redder clouds below. Currently, Saturn's northern hemisphere is blue. Scientists think that because the rings block the Sun in the north (it's winter in the north of Saturn right now), it is colder there, and the ammonia clouds are lower down than normal. This gives the rest of the atmosphere more of a chance to scatter light, just like the Earth's atmosphere does.

Uranus: light blue. The colour comes from methane clouds. In some photos released after the 1986 Voyager II fly-by, Uranus looked bright green, but that colour was artificial.

Neptune: light blue. Like in the case of Uranus, the colour is due to methane. The surface of Neptune appears darker than that of Uranus because of the dimmer illumination (greater distance from the Sun).

- https://www.nasa.gov/mission_pages/newhorizons/images/
- https://www.nasa.gov/mission_pages/newhorizons/main/index.html

Also, I would like to add that the assignment of colours is somewhat subjective. For example, one person's blue might look more like green to somebody else. Astronomers rarely care about that and use precise spectra when they need to obtain information about an object's colour.

In order to have an accurate view of your scale model, you must represent the relative distances between the planets.

Here you can use Google Earth.

On Google Earth, you set your scale line using two options:

- i. Along a road in your hometown (with this way, you can understand the relative distance between two planets).
- ii. In a straight line (with this way, you can understand the inner and outer Solar System).

Note that with Google Earth, you can set your model anywhere and help other students view your scale model and understand the Solar System.

In order to set your model in Google Earth, use the pin hole.

Change the pin hole to a sphere, use different colours for each planet, and write the name of the planet and its distance from the Sun.

First set the place of the Sun. Then use the ruler and set the last planet of your model. Each time, start from the Sun and use the ruler to set all the other planets of your model.

With Google Earth, you can save photos and videos and you can set your model in another town.

Example of model construction

Diameter of the Sun: 5 m





Sun



Mercury



Venus



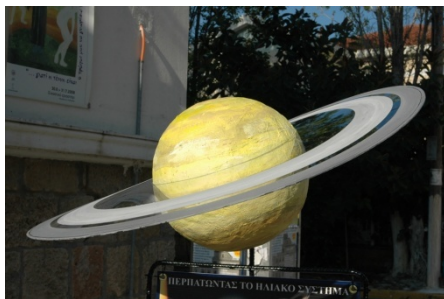
Earth



Mars



Jupiter



Saturn

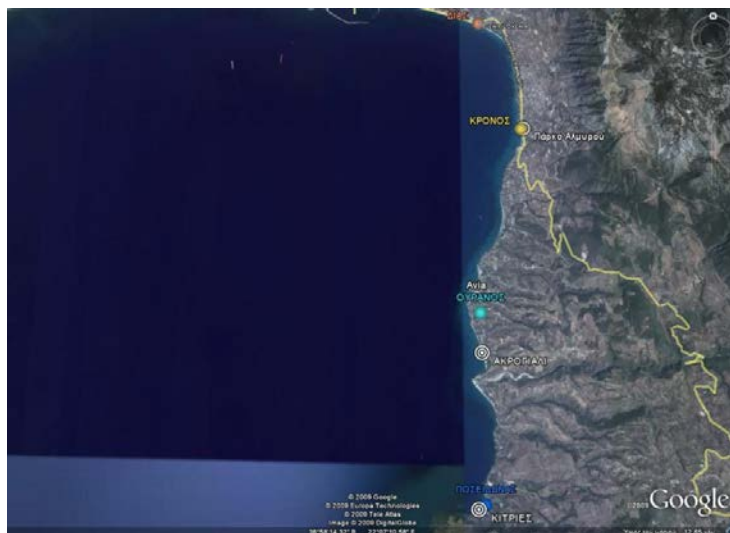
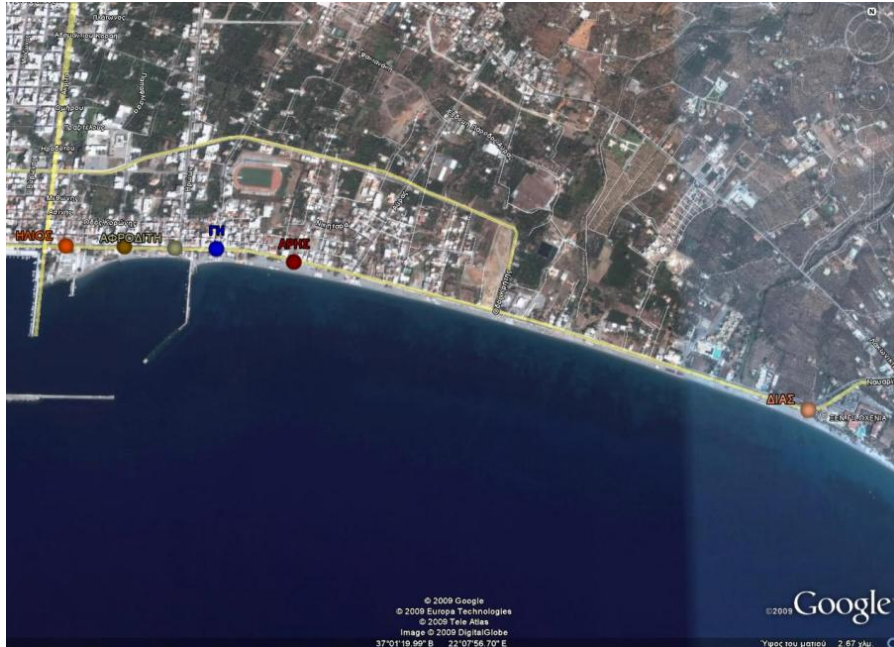


Uranus



Neptune

PLANETS ALONG THE ROAD



LINE MODEL

INNER SOLAR SYSTEM



OUTER SOLAR SYSTEM





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