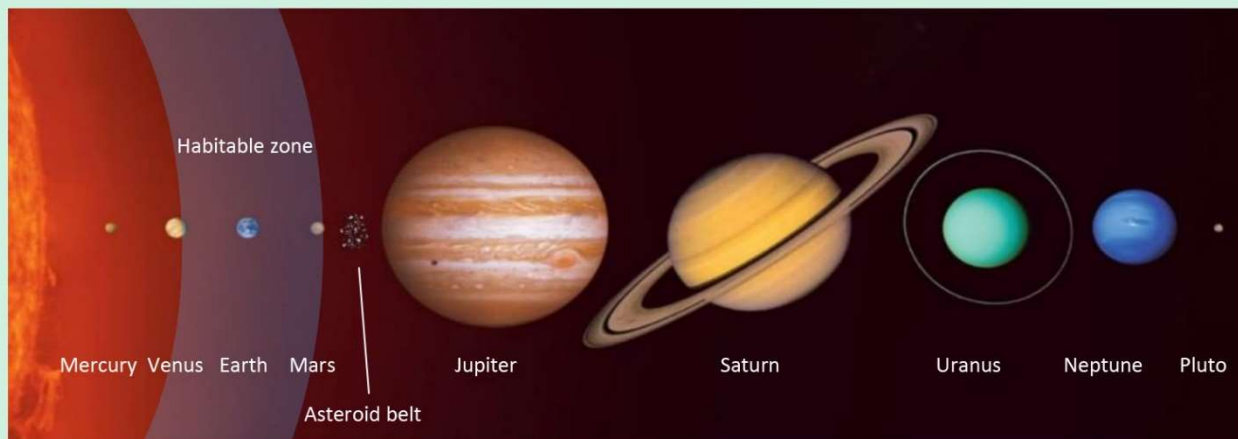


Activity 1 - The Earth in the Solar System

What makes our Earth a habitable planet?

Background:

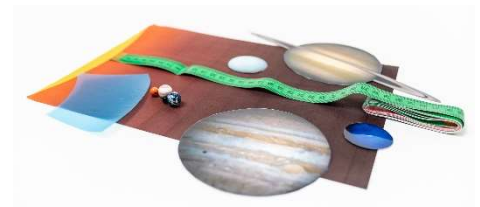
The Earth, like Mercury, Venus, and Mars, is one of the inner rocky planets of the Solar System. The inner rocky planets are followed by the asteroid belt (with about 650,000 asteroids) and the four gas giants Jupiter, Saturn, Neptune and Uranus as well as many dwarf planets such as Pluto. Around all stars, and thus also around our Sun, there is a so-called habitable zone - an area where water can exist in liquid form. The Earth and Mars are situated in the habitable zone, but only the Earth is habitable. Why?



The planets of our solar system in scale. The distances between the planets, however, are shown here clearly too small! (Credits: Scorza)

Materials:

- Background image with an outline of the Sun
- Planet models made of wood (rocky planets)
- Laminated gas planets, cut out individually
- Habitable zone (blue transparent film)
- Measuring tape



Materials for the activity

Implementation:

Part 1: Where is the Earth located in the Solar System?

The distance from the Sun to the Earth is about 150 million km (this distance is defined as the *Astronomical Unit (AU)*). In our model, we compress this distance to 10 cm. The radius of the bright yellow disc thus corresponds to 1 AU. The habitable zone in our Solar System model is represented by the 6 cm² blue transparent film.

Enter the distances of the planets to the Sun and the position of the habitable zone into the table.



Detail of the Sun (Credits: Scorza)

Planet	Distance from the Sun in AU	Distance in the model in cm
Mercury	0.4	
Venus	0.7	
Earth	1.0	10
Mars	1.5	
Jupiter	5.2	
Saturn	9.5	
Uranus	19.2	
Neptune	30.1	
Habitable zone (inner edge)	0.85	

Place the light-yellow disc on the floor and place the planetary spheres, the habitable zone, and the gas giants at the correct distance along a line on the floor.

Note: The planets are shown much too large compared to the distances in this model! However, the scale of the planets to each other is correct.

Part 2: What role does mass play in the habitability of the Earth?

Where is the Earth model located in relation to the habitable zone?

Now place Mars on the spot of the Earth. Discuss whether Mars would then be habitable. Compare the mass of Mars ($6.4 \cdot 10^{23} \text{ kg}$) with that of the Earth ($5.9 \cdot 10^{24} \text{ kg}$) and consider how the density of a planet's atmosphere is related to its mass (and gravity). Think of our Moon ($m = 7.35 \cdot 10^{22} \text{ kg}$). Is there an atmosphere there?



Comparing Earth and Mars (Credits: NASA)