Activity 1 - The Earth in the Solar System

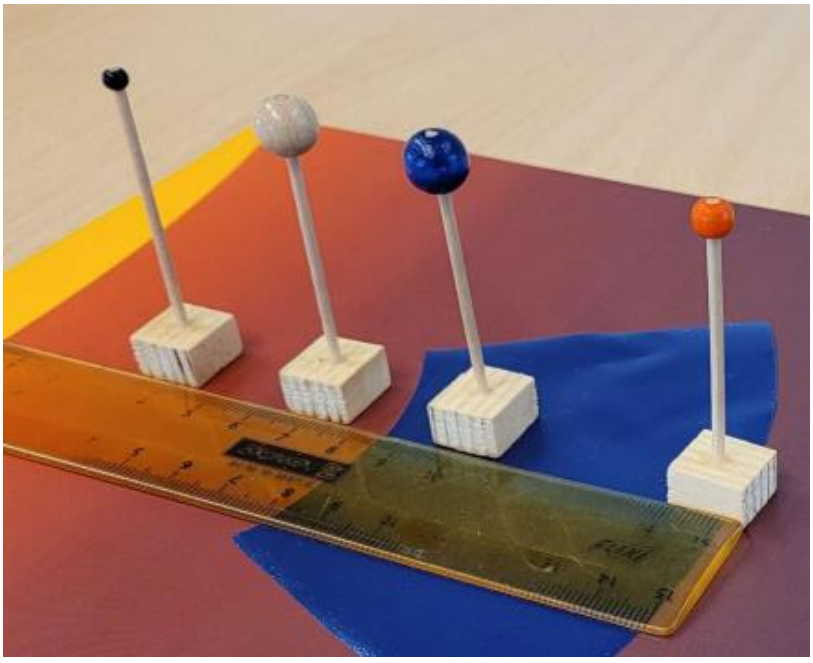
What makes our Earth a habitable planet?

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

➞ Enter the distances of the planets to the Sun and the position of the habi-table zone into the table.

Planet	Distance from the Sun in AU	Distance in the model in cm
Mercury	0,4	4
Venus	0,7	7
Earth	1,0	10
Mars	1,5	15
Jupiter	5,2	52
Saturn	9,5	95
Uranus	19,2	192
Neptune	30,1	301
Habitable zone (inner edge)	0,85	8,5

➞ 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.



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?

Planet	Distance from the Sun in AU	Distance in the model in cm
Mercury	0,4	4
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Earth	1,0	10
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Habitable zone (inner edge)	0,85	8,5

Earth and Mars are the only planets in the habitable zone!

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

Air density is proportional to mass, i.e. the density of a planet's atmosphere increases or decreases with its mass.
Because of the higher mass of the Earth, compared to Mars, the atmosphere of the Earth has a higher density than the atmosphere of Mars. The atmosphere of Mars is very thin!
Also because of the composition of its atmosphere, Mars is unfriendly to life, since only 0.3% consists of oxygen.
The moon has no atmosphere because of its small mass!

Earth: 1,225 kg/m^3 Mars: 1,2 % der Dichte der Erdatmosphäre Moon: –

Calculation of air density: $\rho = \frac{pM}{RT}$

p*: (Air) pressure*
M*: Molar mass*
R*: Gas constant*
T*: Temperature*

Theoretical pressure difference by altitude → *Barometric formula*