ACTIVITY DOSE '22-

Author: Marijke Lippens
School: Sint-Idesbald, Roeselare, Belgium

Title Activity	
Age group	☐ **1st grade primary school (6-8 yo)** ☐ **2nd grade primary school (8- 10 yo)** **X 3th grade primary school (10-12 yo) / first grade secondary school**
Number of hours	180'
Goals/skills summary (most obvious, related to context)	(The pupils can ...) - search on the Internet. - Look up and name the different planets of our solar system. - Explain why some planets are habitable and others are not - Find/explain factors influencing life on Earth - Explaining the concept of transport - Designing/building a self-made means of transport - Look up factors affecting plant life - design an ecosystem similar to Earth's - Working together as a team - Can divide their tasks among themselves - Taking responsibility - Working safely with the materials provided -
Brief description of the activity: (max 4 sentences)	
Introduction to our solar system. Research of life on other planets. Building a rocket Researching the viability of plants and creating a suitable habitat.	

<table>
<tr><th colspan="2">CONTEXT</th></tr>
<tr><td>Motivation</td><td>Science: Research:
Are there other planets similar to our Earth? (Which one is the most accessible?)
How can we reach these other planets? Concept: pre-motion/transport
How can we make plants grow on this planet? Concept: Creating a liveable environment for plants (and animals).

Research method
Compare published data / research sources (search via internet)

Technology
Of homemade means of transport to reach the found planet (here the pupils have to understand the functioning of a rocket / concept of a propulsion device to try to build one themselves)
(Eco)System to grow edible plants. This requires students to understand what plants need to grow and how we can adapt the environment to meet these needs.

Mathematics
Scale calculation / area calculation is needed to compare the planets optimally.

You have to calculate how much force to use, speed taking into account gravity, etc. To make your propulsion device work. (How fast is your rocket?,...)

The freedom to the design, colour, design, aerodynamics,... of their own designed products to be filled in by yourself.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><th colspan="2">Methodology and materials needed</th></tr>
<tr><td>Materials</td><td>By class:
In general:
Workbook, writing materials, laptop/pc or smartphone/tablet with internet (and stellarium app)
For the means of transportation:
Balloons, PET bottles, bicycle tire/football (for valve) bicycle pump, cork, hose or intestine, stable surface (beer can/cola container) mentos, cola, clay, adhesive tape, glue, paper/cardboard, scissors, saw or carving knife</td></tr>
</table>

<table>
<tr><td></td><td>For an experiment on the viability of plants:
Garden cress, small flower pots, cardboard box, soil, water
For the ecosystem: (plexi) glass, soil, water, seeds, large PET bottles, warm lamp, glass bottle with cork,...</td></tr>
<tr><td>Organisation</td><td>Use of ICT (when relevant):
PC for research, group work, watching films, etc.
Stellarium app integration
Possibly integration mBot (as Mars rover) learning to program (Computational Thinking - 21st century skills)
Divide or open classroom (when relevant):
Yes, we need a lot of space (at least two classrooms) and we will have to go outside (to fire the rocket, etc.).
8 islands of 4</td></tr>
<tr><td colspan="2">Coaching & methodology

Based on learning by doing (with different levels: from imitation to creation)</td></tr>
<tr><td>e.g. Useful coaching questions:
Problem definition:
The life span of our earth has almost been reached.
Research question:
How can you live on another planet?
Part 1 of methodology

What factors determine human habitability (temperature, oxygen concentration in the air, etc.)?</td><td>Preface:

Part 1: (discovering planets)

Introduction:
A general introduction is given by means of a short film (Top 10 ways to end the world).
https://www.youtube.com/watch?v=iJCytgKsPwU
After the film, we arrive at our problem statement:
"The life span of our earth has almost been reached."
As true STEM scientists, we must of course be able to find a solution to this.
Pupils are divided into groups by cards. We provide 8 different cards (our eight planets, see appendix 1). Pupils randomly draw a card from the stack and thus form a group with the people who have drawn the same card.
We have about 8 groups of 4 students, which can be adjusted depending on the number of students.</td></tr>
</table>

- How can we make sure that you can breathe on another planet? - How can you warm yourself on another planet? o Which planet is the easiest to reach? (concept distance/proximity/time) Venus and Mars (which planet has the most habitable environment). o On which planets can you stand? (We need to know this because there are also gas planets and we cannot walk on gas) Part 2 of methodology **Problem:** How can we reach another planet? **Research question:** Which means of transport is best suited for bridging long distances? o Explain why you have chosen this means of transport o Explain how your means of transport works	Pupils receive a workbook in which they learn about our solar system. Each group starts by investigating its own planet and filling in the corresponding questions in the booklet. Then they make a presentation of their own planet and introduce their planet to the other pupils/groups. The other pupils take notes and complete the booklet where necessary. The order of presentation is the order of the planets as they appear in our solar system. Some pupils do not make the link yet, but this can be referred to later when the pupils explore our solar system more deeply. Through targeted questions in the bundle, they discover all our planets and their characteristics such as: Surface, distance from us (Earth), temperature, composition of the atmosphere, etc. Through the bundle and the coaching questions, the pupils finally come to the conclusion that Mars could offer a possible alternative for us to live on. Mars is the closest planet (so most feasible to reach). Venus is not habitable as it is much too hot there. **Part 2: (transport)** Introduction: As we found out from our research in part 1, we now know that Mars would be the most suitable planet to live on. But we come to another problem: "How can we reach another planet?" Pupils are introduced to the concept of transport (by means of a bundle). The students are given the following design task: "Design a system (in miniature) to enable us to travel to another planet". Step 1 Design On the table are all kinds of objects. The students are asked to use these objects to assemble a means of transport with the following requirements: - Make a sketch of your design - Your sketch is recognisable - The parts are named, and it is also clear to see how the rocket can be launched from the launch platform. - You mention all the necessary tools and equipment. - You mention numbers.

 ○ How can you make the chosen means of transport move by itself? ○ What factors influence the movement of the means of transport (speed, distance, time, friction, gravity, etc.)? ○ How can we give our rocket/carrier more thrust (use of water) ○ How can you improve your design? **Design:** Design a system (in miniature) to enable us to travel to another planet.	- Your means of transport moves over at least 1.5 metres - as high as possible - Is as stable as possible - Is cheap: use at least 4 different kinds of materials - Your means of transport is sustainable - is attractive (integration of doctor needs to be decorated, etc.) - You used different kinds of tools Pupils may look for inspiration on the Internet. Step 2: Making a design (with the material provided) step 3: test the design Step 4: Analyse the results: What is happening? What do you see? step 5: search for explanations How did it come about? Can you explain what you have observed? Step 6: Can you adjust the design to get a better result? (higher, further, safer, more controlled,...) Which variables can be adjusted or adapted and investigated further? e.g. amount of water, big/small bottle, tension of the cork on the bottle, with or without fins, is aerodynamic,... **With redesign, a few more criteria are added: such as safety requirements, aerodynamics,... see step 6 at the top.** Make a launchable rocket with the following conditions - as high as possible - as stable as possible **And who can land back slowly, safely and softly** step 1: (re)design Make another design drawing of their rocket that also clearly shows how the rocket can be launched from the launching pad step 2: (re)design step 3: (re)design testing Step 4: Re-analysing the results

	What is happening? What do you see?
	Step 5: Searching for explanations
	How did it come about? Can you explain what you have observed?
	What led to your improvement? e.g. parachute size, landing gear strength, contact surface size, adhesion...
	Part 3: (Ecosystem)
Part 3 of methodology	Introduction: We have found our suitable planet and thanks to your great means of transport we have been able to reach it. But...
Problem definition:	How are we going to get food there?
Mars' atmosphere is not suitable for growing plants.	Students brainstorm about how to get food on another planet. We come to the conclusion that our food supply is finite and that we will have to grow our own food. But...
Research question:	We have another problem! Mars' atmosphere is not suitable for growing plants.
How can we simulate an earthly atmosphere? So that the plants can grow (in the most ideal environment)	So we have a new research question: "How can we mimic an earthly atmosphere? So that plants can grow (in the most ideal environment)".
	To do this, we first need to know what plants need to survive. We investigate this by carrying out an experiment with cress.
○ What factors influence the viability of a plant?	
	We need different pots with seeds:
○ What is the influence of sunlight on a plant?	● A pot of seeds that gets water and light and a pot with seeds that gets water and no light
○ What is the influence of water on a plant?	Question: How can we make the pot with seeds and water not light? Put it in a closed box, for example.
○ What is the influence of heat on a plant's growth?	● We also have a jar with seeds that gets water, light but no air Question: How can we keep the jar with seeds and water from oxygenating? For example, put it in a sealed plastic bag or glass bottle with a cork.
○ How can we keep the heat, sunlight and water in a closed system?	

(with the aim of developing a greenhouse) ○ Explain how your ecosystem works? **Design:** Design your own ecosystem so you can grow plants on another planet. Is there attention for Stimulation of self-management: *(concrete opportunities/remarks adapted to the project)* Stimulation of cooperation: *(concrete opportunities/remarks adapted to the project)* Stimulation of Formative Assessment:	● We also have a jar of seeds that gets water, light, air but no heat Question: How can we ensure that the pot of seeds with water, light and air, cannot get any heat? ⍰ By putting it in the fridge, for example. ● There is also a pot with seeds that gets water, air, light and warmth but no soil. Compare the different plants with each other, what do you observe? How can you explain this? What can you conclude from this test? From our test, we conclude that: - Our plants need heat, light, water and oxygen. (Plants produce oxygen themselves, so we do not necessarily need to provide it). (7 days after our experiment with the cress, the next lesson follows). As an introduction to the new lesson, we watch the film from Agrotopia, in which a greenhouse is built. https://www.youtube.com/watch?v=O153eBPLIE0 This is followed by the design brief: "Design your own ecosystem so you can grow plants on another planet." Students read the following article for inspiration: https://www.tuinenbalkon.nl/plant-leeft-al-40-jaar-in-een-afgesloten-bol On the table are all kinds of objects. The students are asked to use these objects to put together an ecosystem/serre with the following requirements: - Ensure that all factors that influence the viability of the plant are present - Consult with your teammates on how best to go about this - Explain how your ecosystem works - How could you make your system even better?

<table>
<tr><td></td><td>

Part 4: EXTRA- Programming with mBlock (mBot)

Pupils learn how to programme with the mBlock programme via an accompanying bundle. With this you can control the mBot. The mBot then acts as a "Mars rover".

The bundle contains Mars-related assignments that have a link to our project. In this way, we can also integrate further ICT goals through the STEM Project.

Reflection (on both teamwork and assessment):

What went well with this prohect, what did you find difficult? If you encountered problems, how did you solve them? How would you rate your teammate? (peer evaluation).

</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">

Possible adaptations:

- General ideas: Adding water in the rocket for more thrust, automatic water system for the greenhouse.
- Ideas for younger/older pupils (3-6 <-> 6-9 / 9-12 <-> 12-15)

</td></tr>
<tr><td colspan="2">

Tips & tricks

(only mention when relevant, e.g. background information)

</td></tr>
<tr><td colspan="2">

Contact: Kristof.vandekeere@vives.be / geert.neyrynck@vives.be

</td></tr>
</table>