

STEM Education LLC

National STEM Competition 2025
Open STEM Category
(First - Fourth grades of Primary School)

Robots On Space Rules and Scoring

1st Edition (August 2024)



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Description of the subject

Mars, often referred to as the "Red Planet," is the fourth planet from the Sun in our solar system. It's named after the Roman god of war due to its reddish appearance, which is caused by iron oxide, or rust, on its surface. Mars is about half the size of Earth and has a thin atmosphere composed mainly of carbon dioxide. Its landscape is diverse, featuring the largest volcano in the solar system, Olympus Mons, and a canyon system, Valles Marineris. Mars also has polar ice caps made of water and carbon dioxide, which change with the seasons, further indicating its dynamic environment.

The exploration of Mars is of paramount importance for several reasons. First, it offers a unique opportunity to understand the history of our solar system. Mars has many similarities to Earth, such as its day length and the presence of polar ice caps, which make it a valuable comparison for studying planetary evolution and climate change. By analyzing Mars' geology and atmosphere, scientists hope to uncover clues about the planet's past, including whether it once had conditions suitable for life.

Moreover, Mars exploration is crucial for the future of human space exploration. As the closest planet that could potentially support human life, Mars is seen as the next frontier for human colonization. Establishing a human presence on Mars could serve as a stepping stone for further exploration of the solar system, providing valuable experience in long-term space travel and habitation in a hostile environment. This could pave the way for human exploration of more distant celestial bodies, such as the moons of Jupiter or even other star systems.

Additionally, Mars holds the potential for economic benefits. The planet may contain resources such as water, minerals, and possibly even elements that are rare on Earth. These resources could be used to support human colonies on Mars or be transported back to Earth, opening up new avenues for space-based economies. The technological advancements required for Mars exploration could also drive innovation in various fields, from robotics to renewable energy, with benefits that extend beyond space exploration.

Sources:

- [The European Space Agency: https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Exploration/Why_go_to_Mars](https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Exploration/Why_go_to_Mars)
- [National Geographic: https://www.nationalgeographic.com/magazine/article/spacex-elon-musk-exploring-mars-planets-space-science](https://www.nationalgeographic.com/magazine/article/spacex-elon-musk-exploring-mars-planets-space-science)
- <https://www.scienceinschool.org/el/article/2008/terraforming-el/>

Team formation

Your team consists of:

- the coach (**over 20 years old**)
- **2-6 students** who are in grades A' - D' Primary **School during the current school year**

Objective - Thematic

Your team needs to work on a project with at least 3 mechanisms that use simple machines and an electric motor connected to the battery holder described in the equipment materials.

General Rules

- The coach is over 20 years old, constantly accompanies the children, takes care of their safety and needs, cooperating with the organization. It has a responsibility to be a role model and promote fair play among students, parents and other participants. He is responsible for the behavior and attitude of his team.
- 2-6 students who are in grades A' - D' Primary School during the current school year.
- The equipment is recommended below in a special paragraph in the regulations.
- **Mechanism** is considered a construction with moving parts, which achieves some clear result for the purpose, for which it was designed using simple machines
- These **3 mechanisms** must
 - contain at least 2 simple machines (in addition to the shaft).
 - all or parts thereof manually or motor-driven
 - One of them must have a motor with a switch for its operation.
 - you can make more than 3 mechanisms, **CAUTION** the rating is total for everyone
- **ATTENTION:** Projects that **are not relevant to the theme** of the competition or **use automation** will not be evaluated.

Types and Examples of Simple Machines

Simple machines are parts of the mechanisms you aim to build. The most fundamental of these are the following 7:

Gear	Pulley	Lever
Wheel with Axle	Screw	Ramp

We find them in many objects that children use, such as: at home as an educational STEM game and at school as educational material.

Gear



Pulley



Lever



Wheel and Axle



Screw



Inclined plane/Wedge



And of course in many more constructions that helped us in the past and but at the same time, we use them in present as well!



Figure 6 Manual drilling (Lever, shafts)

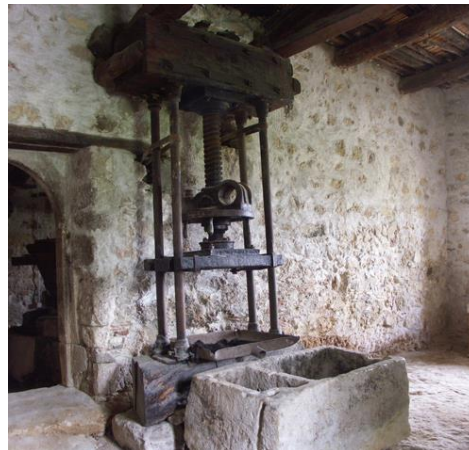


Figure 7 Olive press (Lever, screw, and shafts)

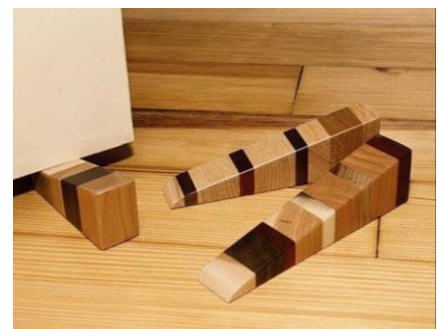


Figure 8 Door Stop (Wedge)



Figure 9 Scissor lift
(Lever, screw, toothed bar)

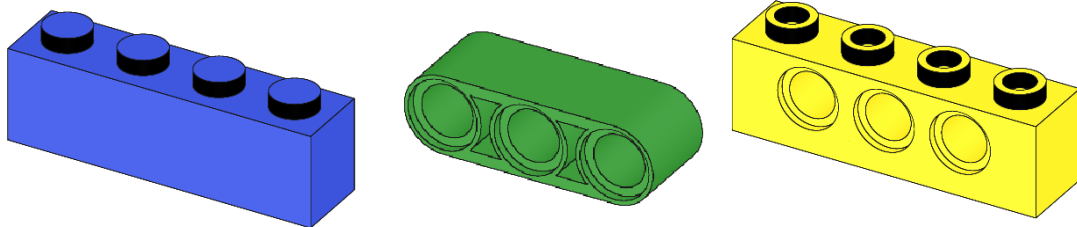


Figure 10 Manual winch with wire rope
(Gears, ratchets, shafts, screws and lever)

Equipment materials

The building materials of the mechanisms and motors must be Lego Classic, Technic or hybrids. Lego pieces from students' toys can also be used.




The following 3 pieces belong to the corresponding Lego Classic, Technic and hybrid systems.
















Depending on what you are missing, see the following suggestions.

Recommended packages and individual components (click on the blue letters to view them)

1.Engineering Packages (if you don't have equipment)

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">PROPOSAL A</p>	<p style="text-align: center;"><u>Simple Machines</u></p> 	<p style="text-align: center;"><u>Battery SET and 3 Sizes of Motors and Accessories</u></p> 
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">PROPOSAL B</p>	<p style="text-align: center;"><u>Composite Electrical Machines</u></p> 	

2. Individual mechanism components (to complement your existing equipment)

Engines and accessories	<u>Battery Box</u> 	<u>M-Motor</u> 
	<u>L-Motor</u> 	<u>XL Motor</u> 
	<u>Extension Wire 8"</u> 	<u>Extension Wire 20"</u> 
	<u>Control Switch</u> 	<u>Servo Moto</u> 
	<u>Rechargeable Battery for the models</u> 	<u>IR Receive</u> 
	<u>Electric Compressor Pneumatic Set</u> 	<u>Remote Control Kit for Constructions</u> 
Spare Parts	<u>Spare Parts</u> 	

Especially for pulleys it is allowed to use rubber band, thread for their operation.

Evaluation

For the judging of projects, a limited amount of time will be allocated to each team - indicatively seven minutes

- Of which part (e.g. five minutes) will be for the presentation by the team and the rest for questions by the judges.

- The students will present the project they have created and indicate how it relates to the theme of the competition
- The team report and engine tables contain important information for the judges, which the team should present.
- There will be a demonstration of the operation of the project, with emphasis on the presentation of simple machines.
- The sketch will be presented through the digital or printed poster, with reference to the operation and solution of the problem it solves.
- The students will answer any questions the judges may have related to the project.

During the evaluation no kind of help or involvement from the coaches to the teams is allowed.

Evaluation Process

There will be only one round of evaluation of the students' projects, after a meeting the jury will give special prizes to all teams based on the points that their project stood out!

Scoring Criteria

Categories	#	Criteria	Points
Concept & Innovation	A	Category 60 total points	
	1	Idea and creativity	15
	2	Research and development of the concept	15
	3	Workable and qualitative solution to the challenge	15
	4	Originality of the idea	15
Educational Engineering	B	Category 60 total points	
	1	Structural stability, Elegance	15
	2	Mechanical performance	15
	3	Correct indication and nomenclature of simple machines	15
	4	Functionality of the mechanism	15
Sketches of structures	C	Total category 30 points	
	1	Accuracy in depicting the skeleton of structures	10
	2	Accuracy in the depiction of construction mechanisms	20
Presentation & team spirit	D	Category 50 total points	
	1	Presentation Evaluation	15
	2	Communication skills, Collaboration	20
	3	Stand decoration, videos, posters	15
MAXIMUM RATING:			200

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Can We Live On Mars?

TEAM REPORT

Group Name:		
Coach Name:		
Member Names:	1.	2.
	3.	4.
	5.	6.
Topic or themes we focus on		
What are we trying to do? Invent or improve?		
Where did we look for information?	Internet Libraries Museum Professionals	
	Other:	
What solutions did you agree to attempt to build?		
How many mechanisms will you present?		
What difficulties and challenges did you encounter?		

TEAM REPORT

Mechanism Table No

Mechanism Name:	
Problem	Solution
Photo of the construction	Sketch of the mechanism
Simple machines used	
1 Wheel with Axle 2 Gears 3 Pulley 4 Lever 5 Screw 6 Inclined plane / Wedge	