

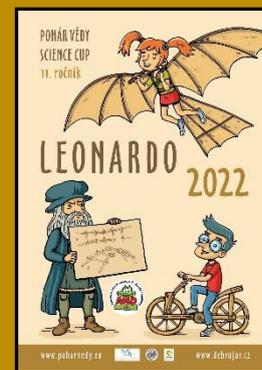
SCIENCE CUP – LEONARDO 2022



POHÁR VĚDY SCIENCE CUP

Category 4 – High School

1st round – January – deadline 31. 1. 2022 23:59



Introduction

Dear competitors, welcome in the first round of the 11th year of the **Science Cup – LEONARDO 2022**. Before you start working, please spend some time on this information on tasks, solutions, and evaluation.

Each month's assignment three main tasks - Creativity and Idea (assessed with 20%) Theory and Research (30%) and Practice and Project (50%). Write down the solving process of each task in your own words and document it with your own pictures and photographs.

Solutions must be submitted no later than 23:59 on the last day of the round, when the assignment is closed.

The solution must be uploaded to the Science Cup web interface in the given period as one file in PDF format, not exceeding 10 MB in size. All the content of the solution (texts, drawings, schemes, photos) cannot exceed 3 pages of A4 paper format, and should be easily readable (simple font, minimal font size 11 pt.).

We can imagine you can write and fill with pictures far more than only three pages. The judges, however, need to have the possibility to read and fairly evaluate all the solutions. Thus, all the solutions that would not meet the given criteria would get, unfortunately, -20 points as penalization.

On the contrary, if your solution gets full marks, you can get 20 points for creativity and idea, 30 points for theory and research, and 50 points for practice and project. In total, you can reach to 100 points in each of the four rounds of the corresponding part of the competition. Each evaluation consists also from a written feedback, so you know what your strong part was, and what you can improve for the next rounds. For the evaluation, the work of the team, not of the team leader, is crucial.

For your presentation during the final, your team would have ONLY a table or a school desk of approx. 100 x 150 cm in size (exact size will be given in the acceptance letter for the finalists) and the proximate surroundings of 10 cm around the table. You would not be able to use any additional space (walls, notice boards, floor behind the 10-cm radius), so keep this in mind when preparing your products.

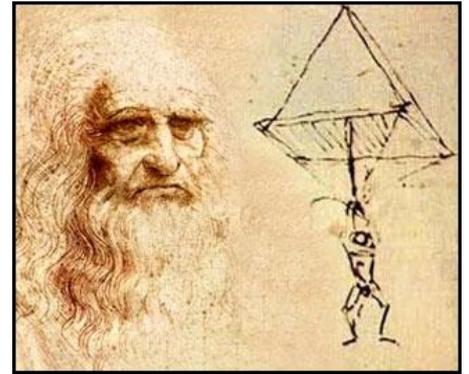
Now you can start working, good luck with the tasks and enjoy the exploring!

Yours LEONARDO 2022 Team – Jit'a H., Katka, Jit'a S., Nad'a, Andrea, Igor, and David

1. Creativity and idea (20 %)

Chinese were the first nation using something resembling a parachute. The first known depiction of a parachute was found in Leonardo da Vinci's sketchbook. The depiction suggests that a man could parachute from a tower or a building on fire. However, as far as it is known, this sketched parachute was not tested in reality.

In 2008, a Swiss skydiver dared to try this design and was successful. He jumped from a helicopter at an altitude of about 710 metres. The parachute was made of modern materials, but it was made exactly according to the drawings sketched by Leonardo da Vinci in 1485.



*Leonardo da Vinci and a parachute sketch
picture downloaded from: <https://www.ceskatelevize.cz/>*

You can have two plastic bags with a capacity of 30 - 40 liters, 2 m of a string, tape, 8 skewers, 8 straws, 3 party balloons, a plastic cup, scissors, and an egg, a weight or a figure weighing at least 50 g. Use the weight (egg, figure) as a "parachutist"; you do not need to use all the other tools, but you must not use anything extra.

Build a parachute for your parachutist, list the tools used and their quantities, the procedure for making the parachute, and experiment with height and flight time.

Describe briefly the conclusions of your experimentation.

2. Theory and research (30 %)

The creative part is focused on a parachute. Prepare for your experimentation with some theoretical knowledge and related tasks:

1. What parameters of an object and of the surrounding environment influence the magnitude of the drag force acting on a moving object?
2. Draw an aerodynamic shape of an object and give 2 examples of such an object - one where you can see it in nature and the other one from technology/industry.
3. A parachute has a diameter of 9 m and a drag force of 850 N. Find the drag coefficient and air density in tables or on the internet.

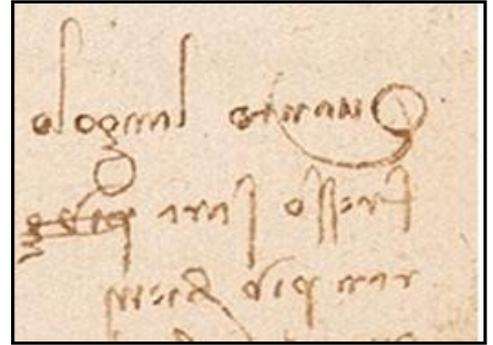


*Circular sport parachute
picture downloaded from: <https://cs.wikipedia.org>*

3. Practice and project (50 %)

Less known is the information that Leonardo da Vinci was also the author of short tales, stories, and puzzles.

He wrote about seven thousand pages of literary works on various topics, written in "mirror writing" or "mirrored font" (nowadays history is very skeptical that the purpose of the mirrored writing was encryption - "mirror" writing is easy to read and Leonardo, being left-handed, simply wrote backwards).



*Leonardo da Vinci's handwriting – mirrored font
picture downloaded from: <https://www.levactvi.cz>*

Explore with Leonardo da Vinci and a plane mirror.

1. Prepare one experiment or product or a physical toy in which a plane mirror plays a central role

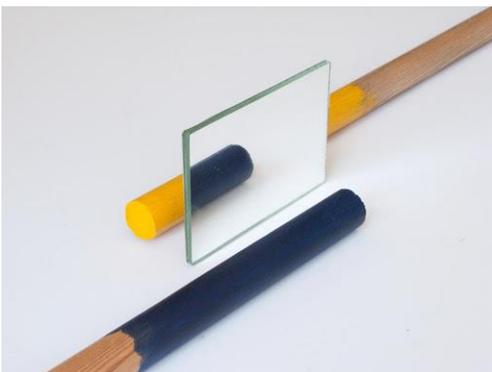
Describe the tools needed, procedure of making the **experiment/product/physical toy** along with the observations or measurements made.

Explain the principle of the experiment/product/toy and give the results of your observations or measurements, together with your own photographs or pictures.

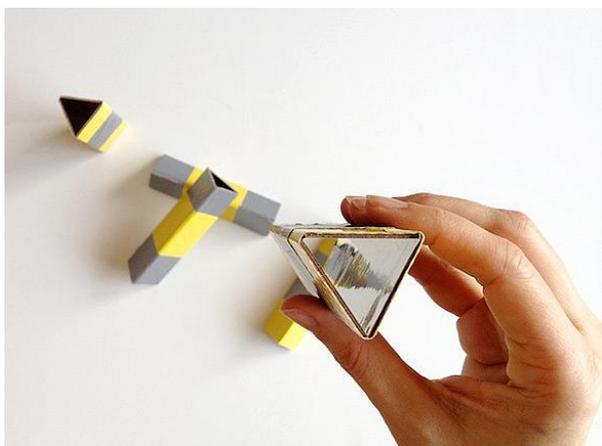
2. Be like Leonardo and write something in mirror writing and explore how it looks in a mirror.

We are interested in at least three conclusions from your observations while writing in mirror writing and while viewing the mirror writing in a plane mirror.

In the first round, we will give you a slight hint with a few photographs:



pictures downloaded from: <http://www.christophermadden.art/mirror-images/contemporary-art-mirror-reflection>



pictures downloaded from: <https://www.handmadecharlotte.com/make-cardboard-kaleidoscope/>

Describe the solution procedure of each task, the results of your team work, and any additional information, and document them with photos.

The solution can be handed in only before the deadline. Only the solutions fulfilling all the requisites given in the propositions will be judged without any point loss.

If you have any questions, you can ask a category consultant in your country:

Czech Republic and Slovakia: Jitka Soukupová – jitule.sk@seznam.cz and Nad'a Zíková – zikova@icpf.cas.cz

Turkey: Basriye Öngel – basriye.korkmaz@gmail.com