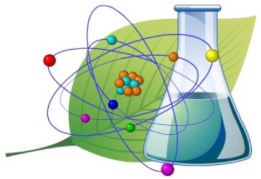

IX International Natural Sciences Tournament

MEL Science

Tallinn, Estonia
February 1-6, 2019

Welcome to the
IX International Natural Sciences Tournament!

Dear participants and guests,

You are very welcome to the IX International Natural Sciences Tournament!

Nowadays science runs pretty fast through new horizons and new possibilities. Every day we discover one more little piece of the Universe puzzle. However, the path, all the students should overcome since they got fundamental knowledge till they could apply them, is too long for many of us. That is why a long time ago a small group of students, who felt the same fillings “what is this knowledge for? and why am I studying for 6 years all this strange stuff?” decided to break this wall between university education and real life. That is how our lovely Tournament was born.

Two years ago Tournament started its first trip to amazing Russian scientific and cultural center – Novosibirsk. Then INST moved to the wonderful country of spices and colors – India. This year the Tournament takes place in the ancient city of Tallinn. And who knows… Maybe in 100 years our descendants will play the INST on Mars, because every year brilliant solutions of Tournament participants prove us: nothing is impossible.

So, let’s live these days together and wish each other good luck! Do not forget that we can help you to organize National round of INST in your country. Together we can give an opportunity to more and more students to join our mutual INST journey!

International Organizing Committee of IX INST

Official Program

Dear participants, please, note the provided information is subject to slightly changes.

January 31 (Thursday): Full-day Arrival

2 p.m. till evening	Full-day Arrival

February 1, 2019 (Friday): Full-day Arrival

6 a.m. till evening	Full-day Arrival

February 2, 2019 (Saturday): Opening Ceremony, Qualifying Games. Day 1

10.30 a.m. – 11.00 a.m.	Registration of Participants
11.00 a.m.– 11.30 a.m.	Opening Ceremony
11.30 a.m. – 12.30 p.m.	Teams' Briefing, Teams' draw/ Experts' Briefing
12.30 p.m. – 2.00 p.m.	Lunch Break
2.00 p.m. – 5.00 p.m.	Cycle 1

February 3, 2019 (Sunday): Day-off

12.00 p.m. till evening	Excursion

February 4, 2019 (Monday): Qualifying Games. Day 2

10.00 a.m. – 10.30 a.m.	Registration of Participants; Coffee Break
10.30 a.m. – 1.30 p.m.	Cycle 2
1.30 p.m. – 3.00 p.m.	Lunch Break
3.00 p.m. – 6.00 p.m.	Cycle 3
6.00 p.m. – 7.00 p.m.	Workshop
7.00 p.m. – 8.00 p.m.	Results of Qualifying Games

February 5, 2019 (Tuesday): Grand Final

10.00 a.m. – 10.30 a.m.	Registration of Participants; Coffee Break
10.30 p.m. – 11.00 a.m.	Grand Final Opening Ceremony
11.00 p.m. – 2.00 p.m.	Final Games
2.00 p.m. – 4.00 p.m.	Lunch Break
4.00 p.m. – 5.00 p.m.	INST 2019 Closing Ceremony. Awards Ceremony.

February 6, 2019 (Wednesday): Full-day Departure

6 a.m. till evening	Full-day Departure

List of the Intramural Round Problems
Unit X*

1. T-1000

In nature, there are insects, the color of which is not based on pigments, but on the surface morphology. Recently, scientists were able to apply a similar approach to metals, as a result of which the surface acquired superhydrophobic properties and became almost completely black. Suggest your own methods for creating different solid colors of metals only by modifying the surface structure of the metal or alloy itself. Assess the thermal, chemical and mechanical stability of such a surface, depending on what color is created. Suggest applications for the metal products with such a surface.

2. Char Ecosystem

The StarCraft series of computer games features the planet Char – a volcanic world with a high temperature, due to which the lava does not freeze even on the surface, and a complete lack of vegetation. However, it is inhabited by a huge number of alien creatures – zergs. Judging by their appearance, all zergs, even the weakest and most numerous of them, are predators. How could the Char ecosystem be arranged then? What serves as food for so many predators if there are no traces of autotrophs on the surface of the planet? Your solution should not contradict to the known laws of biology and ecology. You can find more information about this fictional planet here.

3. The Chinese study

In the summer of 2018, some batches of the drug valsartan, for which the active substance was produced by the Chinese company Zhejiang Huahai Pharmaceuticals, were recalled from the pharmaceutical market. The reason of the recall was the presence of a dangerous impurity *N*-nitrosodimethylamine (NDMA) in the active pharmaceutical substance. NDMA is highly hepatotoxic and is classified as a proven carcinogen. Its presence in valsartan is believed to be caused by the changes in the production method of the active substance. What do you suppose was the source of *N*-nitrosodimethylamine in the active pharmaceutical substance? How should the way it is produced be modified to avoid the appearance of this impurity? Is it possible to effectively purify the supplied substance from NDMA? If this is possible, suggest an alternative production scheme, which excludes the appearance of *N*-nitrosodimethylamine in the substance.

4. Shaken, not stirred (MelScience)

Watch this video. If you look at Scotch tape through a polarizing filter under polarized light, it appears colored. Furthermore, its color depends on the number of layers of tape and the rotation angle of the polarizing filter. Investigate this phenomenon:

- outline a theoretical prediction model of the spectral line shape of such 'colored' light, and
- measure the spectrum of such light – what form does it have, and how close is it to your prediction model?

5. Breakthrough Starshot

"Breakthrough Starshot", announced in 2016, is a program that aims to send micro probes to the Alpha-Centauri star system. This will be the first interstellar flight of an object developed by man.

The probe used in the program is a set of measuring instruments weighing 1 gram equipped with a solar sail. An array of lasers is supposed to be used to accelerate the entire structure to 20% of the speed of light. One of the unsolved problems of the project is the material of the solar sail: since it is accelerated to high speed, the sail can suffer from star dust or overheat by reflected light. Suggest a physical model of the solar sail and your material options, which would have a high light reflection factor, be heat-resistant, lightweight, and durable.

Unit Y*

6. The Olive

According to various estimates, more than half of all sold olive oil is more or less counterfeit. One of the main methods of adulteration is adding cheaper low-quality oil. This threatens to cause great economic damage to stores and large oil producers, and also cases of serious health problems and even the death of consumers have been recorded. To date, the control of quality and authenticity of olive oil requires a series of analyzes, which is too labor consuming, since each batch of oil must be analyzed. Suggest a method, or the minimum possible number of analyzes that could be easily applied to numerous samples, and allowed one to detect the addition of other oils to olive oil in an amount of more than 1% by weight.

7. Smartdryer

When traveling, a person may need various heating devices – a hair dryer, a kettle, a shoe dryer, a heater, etc. All of them have a similar operating principle, however, they differ greatly in power and efficiency. Offer the concept of a compact universal heating device that performs the functions of the above devices in reasonable time for each case.

8. Vitamin sea

With the development of aviation, moving around the world has become very simple and affordable, and within a day you can get to anywhere in the world for work or vacation. Evolutionarily, the human body is not adapted to such a drastic change in external conditions, which leads to significant discomfort and possible health problems. Explain the mechanisms that occur in the body during the adaptation to new environmental conditions when traveling to different climatic zones, and suggest a way to accelerate acclimatization based on the described mechanisms.

9. WALL-E 2.0

In 2009, the commercial communication satellite Iridium 33 came into collision with the decommissioned communication satellite "Kosmos-2251". This collision created a large amount of debris, and yet again increased the mass of industrial waste on the orbit of the Earth.

Space debris is a severe problem for launching and operating spacecrafts, yet still there are no reliable ways of cleaning up our planet's orbit.

Propose your own technology for removing space debris, as well as assess and justify its recyclability.

10. Green worms

There is a belief among fishers that fish bite at green worms that glow underwater better. Is there any physiological prove of this assumption? Propose your own way of increasing the appeal of

worms to the fish, taking into account the fish's physiological and behavioral characteristics. Your alteration should be available to the ordinary fisher.

Please, be careful to work through every problem. Remember that you may refuse to solve any one problem in each unit.

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* Please, be careful to work through each problem. Remember, that you may refuse to solve any one problem in each block.

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Rules & Recommendations

1.General Information

1.1 The event aims to give students an idea of real industrial problems, and also to establish "student – company" communications for further cooperation. Participation in the Tournament provides a unique opportunity to apply your fundamental knowledge to solving problems of a practical nature.

1.2. The organizer of the IX International Student Natural Sciences Tournament (hereinafter – the Tournament) is an initiative group of students, postgraduate students, graduates and professors from Universities all around the world.

1.3. The organizing committee reserves the right to change the rules of this regulation in the case of changes in the number of participating teams or the conditions of the Tournament.

1.4. The Tournament is held in two rounds: an Extramural and an Intramural round.

1.5. During the Extramural round teams must solve at least two of the three qualifying tasks proposed by the organizers.

1.6. The Intramural round of the Tournament is held in three days: two qualifying days and the Final. For the first qualifying day teams are assigned to auditoriums according to the results of the Captain's Competition. 3 or 4 reports are made in each section (auditorium) during 1 cycle, depending on the number of teams in the section. In each cycle teams play each of the 3 roles: the Speaker, the Opponent, and the Reviewer once.

1.7. At the Tournament teams are given 10 tasks, at least 8 of which they have to solve (4 out of 5 tasks in each of the two units). Teams may turn down one problem in each block without losing points. To register a reject, the Captain of the team must report the number of the rejected problem to the Organizing committee during registration prior to the Tournament.

1.8. During the two qualifying days each team member can only act once as Speaker, once as Opponent, and no more than twice as Reviewer. In case of the participation of a team of 3 people only one of the team members can act twice as a Speaker, another member of the team – twice as an Opponent during the two qualifying stages.

1.9. In the Final each team member can only act once as Speaker, once as Opponent, and no more than twice as Reviewer.

1.10. Winners of the team competition are determined as follows:
For teams that qualified for the Final, the score (the place that the team took) is determined only by the total points scored in the Final. For teams not qualified for the Final ranking is determined by the sum of scores from the two qualifying days. By the results of the Tournament the 3 highest ranking teams are determined. They receive gold, silver and bronze medals, respectively.

1.11 During the challenge, use of literature, as well as any other information sources (laptops, tablets, e-readers, mobile phones, etc.) is prohibited.

2.Key terms

A team, participating in the Tournament, should consist of 3–5 people. The team members should choose a captain and a vice captain amongst themselves. The captain is the leader of the team during the Tournament and is responsible for interacting with the Organizing committee and the Jury.

> **ATTENTION!** In every single moment of the challenge the captain can take a **1-minute** break for his/her team. The Captain should ask Master of the section about this **captain's minute.** The captain may use this opportunity one time for the qualifying games and one time for Final cycle.

A challenge is a sequence of actions of discussing a single problem. Three teams take part in a challenge: the reporting team, the opposing team and the reviewing team. If there is a fourth team in the section, they do not take part in the challenge. During the challenge participants are prohibited from using any information sources (literature, laptops, tablets, e-books, mobile phones, etc.).

A section is a room where the Tournament takes place. A **section Master**, **Jury members** (4–8 people), **the counting board** and 2–4 teams are always present during the game in each section. The number of sections in the Tournament is determined according to the total number of participating teams.

A cycle is a complete set of 2–4 challenges in one section depending on number of teams in the section. In one cycle, each team acts once as a Speaker, once as an Opponent, and once as a Reviewer. In case of **two team section** in the first challenge one team acts as the Speaker, and the second team is divided into two independent sub-teams that take the role of Opponent and Reviewer. In the second challenge, the teams change their roles.

The counting board is made up of members of the organizing committee, whose responsibilities include counting the points that participants earn during the Tournament.

The section Master is a member of the organizing committee, who perform the Cycle and creates all conditions in which the rules of the Tournament can be fully carried out during the gameplay in their section. If any of the participants notices a violation of the rules of the Tournament, the team captain should report the violation to the Master as soon as possible (but without interrupting the Speaker).

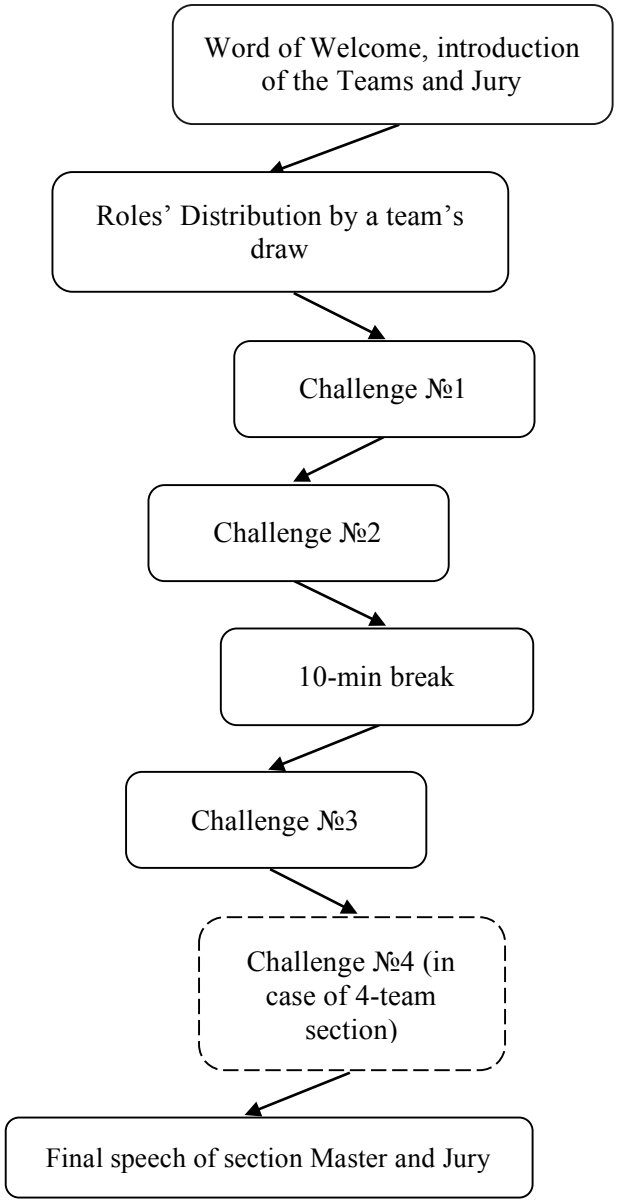
The Jury of the section is presented from invited experts, whose task is to score the performance of the participants during the Tournament. Before scoring Jury members may ask the Speaker, the Opponent and the Reviewer questions to understand for themselves the point of view of each participant better, as well as to assess the level of their competence. Jurors may openly point out the strengths and weaknesses in the work of the participants. After the scores have been announced, the captains of the teams, which took part in the challenge, have the right to ask the Jury to explain why this or that score was given.

The Chairman of the Jury is a member of the jury, who is responsible for cooperating with the Master and teams to insure the rules of the Tournament are carried out. The Chairman has to ensure the rules are fully carried out during the challenge, including silence and order.

The Coach of a team is a person accompanying a team or a team coach. The coach has the right to become a jury in those sections in which his team is not playing, if he/she meets the requirements of the Jury. If the Coach is not a member of the jury, then he/she can stay in the section as a viewer and is not allowed to sit next to his/her team during a challenge.

Participants registration is performed at first day of Tournament. At the beginning of each Tournament day the Captain gives the information about rejected tasks related to this particular day. During each day one team may reject no more than one problem. So, the team can reject two problems (1 problem per each block).

3. Cycle scheme



4. Challenge procedure (the discussion of a single problem)

№	Course of action during a challenge and their time frames	
1	− The captain of the challenging team determines the number of the problem that his team wishes to challenge the speaker team to − The captain of the speaker team accepts the Challenge and announces the full name of the Speaker to the problem − The captain of the opposing team announces the full name of the Opponent to the problem − The captain of the reviewing team announces the full name of the Reviewer to the problem	2 min
2	The Speaker's report	10 min
3	Preparation of the Opponent to polemics (with the team)	1 min
4	«Speaker-Opponent» polemics	5+5=10 min
5	Preparation of the opposition (with the team)	2 min
6	The Opponent's speech	5 min
7	The Speaker's response to the opposition	1 min
8	The Reviewer's Speech	3 min
9	«Speaker-Opponent-Reviewer» polemics	5 min
10	Questions and comments from the Jury, discussion of the problem	8 min
11	Questions from the viewers	1 min
12	Scoring by the Jury members in their blanks	1 min
13	The announcement of the scores	1 min
14	Jury members' words and comments	2 min
	In total ≈50–55 min for a challenge	

The beginning of a challenge

At the beginning of each challenge the Master announces the roles each team will be playing during the challenge. The opposing team can choose any problem, except:

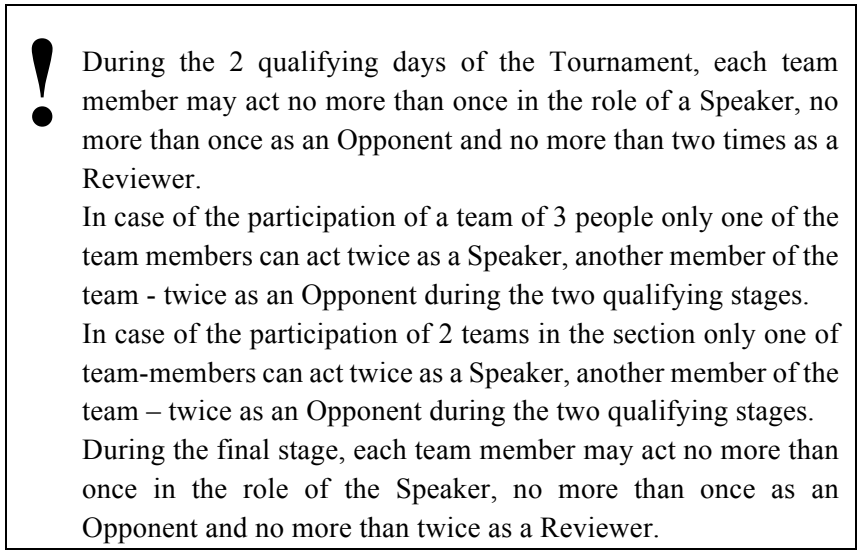
1) a problem which the speaking team has officially **rejected beforehand**;
2) a problem that **was already reported** by the speaking team;
3) a problem that **was already played** in this cycle

If a challenge is not possible, the latter requirement is canceled.

After the opposing team has chosen a problem, the captain of the team makes the challenge, for example: "We challenge the team St. Petersburg State University-1 to problem №2".

If the challenge was made correctly, the captain of the speaking team responds, for example: "We accept the challenge. The Speaker to problem №2 will be John Doe".

The captains of the respective teams announce the names of the Opponent and Reviewer for this problem, after which the Speaker is invited to report.



Changing roles during the cycle

The first challenge of each cycle begins with the participants selecting roles in the challenge. The section Master announces the numbers of the problems, which have already been reported by each team, as well as the numbers of the problems which have been rejected. The team-to-role distribution is defined according to draw. The results of the distribution are entered into the Tournament table by the Master (S – Speaker, O – Opponent, R – Reviewer).

This table fully defines how the roles are switched during the cycle for section consisting of 4 teams:

	Challenge №1	Challenge №2	Challenge №3	Challenge №4
Team 1	S	–	R	O
Team 2	O	S	–	R
Team 3	R	O	S	–
Team 4	–	R	O	S

This table fully defines how the roles are switched during the cycle for section consisting of 3 teams:

	Challenge №1	Challenge №2	Challenge №3
Team 1	S	R	O
Team 2	O	S	R
Team 3	R	O	S

This table fully defines how the roles are switched during the cycle for section consisting of 2 teams:

<table>
<tr><th></th><th>Challenge №1</th><th>Challenge №2</th></tr>
<tr><td rowspan="2">Team 1</td><td rowspan="2">S</td><td>O</td></tr>
<tr><td>R</td></tr>
<tr><td rowspan="2">Team 2</td><td>O</td><td rowspan="2">S</td></tr>
<tr><td>R</td></tr>
</table>

5. The Speaker's report

The main Speaker task is to present the solution of the problem **in 10 minutes**, accompanying his/her report with a multimedia presentation. While preparing the report, it is recommended to keep in mind the following questions, which can serve as a general plan of a performance:

- What is the essence of the problem and what is required to be solved?
- What is known about this problem in literature sources?
- What is the essence of the solution you propose? How to implement it in practice? What are its strengths and weaknesses? Are there alternative solutions?
- What conclusions can be drawn from the work you have done? What solution of the problem do you propose as the best and why?

All the parts of the report should be linked, the course of the solution should be convincing and understandable, the information should be comprehensible and sufficient to understand the essence of the problem and the proposed solution. It is advised to rehearse the report in advance to make sure all the required material can be shown within the given timeframe.

Important for the Speaker

- The multimedia presentation in *.ppt or *.pdf formats is given to the expert committee of the Tournament **beforehand** (during registration).
- The report should be done in a **loud voice**, addressing the audience.
- The Speaker can ask a member of his team to help him with switching slides, if necessary.
- At the end of performance, the Speaker has to notify the Jury and the Opponent about it ("The report is finished").
- When answering the questions of the Jury, the Speaker should be very brief, only answering the question that is put forward, and should not retell his report.
- If necessary, the Speaker is permitted to use hand written notes during the performance. However, **reading the text of the report from a sheet or from slides** will greatly reduce the score for the Speaker's performance.
- It is recommended Speaker does some notes when Opposition in order to not miss some important points of the Opponent speech.

Important for the presentation

- All slides of the presentation, except the title slide, must be clearly **numbered**.
- When using information from literature it is recommended that the source is referred to at the bottom of the slide (by giving its bibliographical reference, including the title of the work). If it is inconvenient to put the full reference title on the slide, one must make a separate slide with a numbered **list of references** and refer to these sources with figures, for example [1].
- The presentation should not be overloaded with text. It should contain only illustrative material that supports the report and makes the solution clearer and easier to understand. Text in the presentation is recommended to be used for titles, labels, formulas, brief thesis sentences, as well as conclusions and the list of references.

6. «Speaker-Opponent» polemics

«Speaker-Opponent» polemics is a scientific discussion, during which the opponent takes a closer look at the solution the Speaker proposed to understand how well the problem was solved. **The polemics is held in the form of a free talk**: the Opponent asks questions to the Speaker – the Speaker answers them, The Opponent casts doubt on some parts of the solution, indicates the Speaker his errors and omissions – the Speaker brings counterarguments or agrees with the fair criticism, etc.

The polemics shows how well representatives of the teams handle the scientific part of the problem under discussion, as well as how quickly they are able to respond to the arguments of their opponent and correctly defend their point of view.

Time for polemics is recorded **separately** for the Speaker and the Opponent. **Each participant** of the polemics has exactly **5 minutes**. When his/her 5 minutes are over the participant has no right to continue the polemics.

Important information for the polemics

- The main objective of the Speaker-Opponent polemics is to discuss and clarify the presented solution of the problem in detail.
- Prior to the polemics the Opponent is given **1 minute** to consult with his team: to discuss which points to focus on, which questions to ask, etc.
- During the polemics only the solution to the problem **proposed by the Speaker** should be discussed, as well as the scientific aspects that are important to the solution.
- The polemics should be carried out in a polite, friendly manner, eliminating offensive remarks and psychological pressure on the opponent.
- During the polemics the Opponent should try to clarify the solution as well as possible for him/herself, find its weaknesses. After the polemics the Opponent should have a quite definite opinion on how well and how fully the problem was solved by the Speaker team.
- During the polemics the Speaker should answer the Opponent's questions as clearly as possible, try to demonstrate the logic and consistency of his/her solution.
- The Opponent is not recommended to give extensive criticism of the solution or state his/her opinion in detail during polemics – this should be done **during the opposition**.
- The polemics should be based primarily on **scientific evidence** and common sense. If reasonable arguments speak in favor of the opponent, it should be admitted. There is no sense to defend a false point of view. Still, a stated point of you should be defended up to the logical end, as the opponent could be wrong, too.

7. The Opponent's speech (The Opposition)

Preparing the opposition

The opposing team is given 2 minutes to prepare the opposition. During this time the Opponent and the Speaker return to their teams and they can discuss questions which remained unresolved or newly emerged in the polemics. The opposing team prepares a critical analysis of the solution. The score for the opposition is given to the whole team, not just to a particular Opponent. Participants are encouraged to actively assist in preparing the Opponent for his statement, to note additional inaccuracies in the solution, which had not been discussed in the polemics, to make the analysis of the solution more complete.

Opposing

The opposition is a whole, structured speech, during which the Opponent should express and argue his/her opinion on the completeness and quality of the solution of the problem presented by the Speaker. The Opposition should fit a **5 minutes'** time frame.

While preparing the opposition it is recommended to keep the following questions in mind, which can serve as the general plan of the performance:

- Did the team of the Speaker understand the essence of the problem?

●How well was the overview of the literature done, was it useful for solving the problem?
●Does the proposed solution comply to all the points of the text of the problem? Is the solution scientifically argumented? What can be difficult in its practical implementation? Has a comparison with alternative solutions been done?
●How adequate are the conclusions of the Speaker team in the end of the solution? Is the problem solved?

The response to the opposition

After the speech of the Opponent, the Speaker has the opportunity to answer **in 1 minute** to the opposition: point to unreasonable criticism, unfair judgments of the Opponent or misunderstanding of the solution on his/her part. If the Opponent in his/her statement incorrectly interprets some parts of the report or polemics, the Speaker should explain that.

Important information for the Opponent

●The speech of the Opponent must be addressed not only the Speaker, but to the entire audience – members of the jury, participants and viewers.
●During his/her speech the Opponent may use his/her own notes, but not other sources of information
●The Opponent must put weaknesses in the solution to reasonable criticism: to point out false statements, unfounded assumptions, logical errors, unaccounted facts, misunderstanding of the conditions of the problem by the Speaker team, etc.
●The Opponent can briefly mention the most successful places in the solution, explaining at the same time, what is their significance.
●During his/her speech the Opponent can and should use the information he obtained in the polemics, but does not have to analyze the polemics itself – that is the task of the Reviewer.
●The Opponent shouldn't be afraid to repeat during the opposition what has been said in the polemics. The opposition is scored separately and it should contain all the main points that are important to assess the solution.
●The Opponent must correctly sort out priorities: pay more attention to significant shortcomings of the solutions and less regard minor flaws.
●The opposition should concern only the essence of the problem. Comments about the design of the presentation and Speaker's public speaking skills are prohibited.
●The Opponent cannot retell his/her solution to the problem, but can show his/her knowledge of the subject under discussion, by pointing out the effects, laws, and other scientific aspects that were not considered by the Speaker in his/her speech, but that should be considered in accordance with the conditions of the problem.
●At the end of his/her performance, on the basis of his/her analysis, the Opponent must conclude to what extent the problem was solved by the speaker team, for example: «I think that the problem has been solved completely», «I believe that the problem has been solved by part because not all the conditions were taken into account», «I think that the problem has not been solved».
●The Opponent must clearly inform the audience about the end of his/her speech, for example, with the phrase «Opposition is complete».

8. The Reviewer's speech

The task of the Reviewer is to give an objective assessment of the solution of the problem, as well as the performance of the Speaker and the Opponents in a timeframe of **3 minutes**. The Reviewer should determine how well they coped with their roles, analyze the understanding of the problem being discussed by the Speaker and the Opponent.

Important information for the Reviewer

●The Reviewer should address his/her speech not only to the Speaker and the Opponent, but to the entire audience – members of the Jury, participants and viewers. Reviewer can use own notes but no other information sources.

●The Reviewer should point out the flaws in the solution that were not noticed by the Opponent, namely false statements, unfounded assumptions, points of the conditions of the problem that were not accounted for in the proposed solution, etc.

●In the case of unjustified criticism of the solution from the Opponent, the Reviewer should provide arguments in support of the Speaker.

●The Reviewer should assess the quality of the Speaker's presentation in terms of clarity, neatness, presence of the necessary functional elements (headers, labels, slide numeration, list of references, etc.).

●The Reviewer should assess the quality of the polemics between the Speaker and the Opponent, point out the strengths and weaknesses both in terms of the correctness of their behavior, convincingness, oratory skills, etc.

●The Reviewer should draw conclusions on the following issues:

➢How fully was the problem solved?

➢How well did the Speaker cope with his role?

➢How well did the Opponent cope with his role?

●The Reviewer should clearly inform the audience that his/her speech has ended, for example, with the phrase «Review is complete».

9. «Speaker-Opponent-Reviewer» Polemics

«Speaker-Opponent-Reviewer» polemics or «triple polemics» is necessary in order to give participants the opportunity to discuss some unresolved issues and to try to reach an agreement if there was any controversy. During the triple polemics anything that took place during the challenge can be discussed. The Speaker and the Opponent can respond to the criticism of the Reviewer – to agree with it or give arguments in their own defense.

Triple polemics is carried out in a free form just as the «Speaker-Opponent» polemics. A total of 5 minutes is given for the triple polemics, the length of the performance of each participant is not regulated.

10. Scoring the participants

At the end of the challenge, each member of the jury gives a total of scores for the participants, 1 to 10 points per each.

●The speaking Team is given 3 scores: for the solution of the problem, for the presentation, as well as a personal score for the Speaker's work.

●The opposing Team is given 2 scores: for the opposition and a personal score for the Opponent's work.

●The reviewing Team is given 2 score for: the reviewing and a personal score for the Reviewer's work.

All the scores, except the personal scores for the Speaker's, Opponent's and Reviewer's work, are publicly announced by the Jury at the end of the challenge.

The Problem Solution	**Final mark (from 1 to 10 points):**	Total
Problem statement	Analysis of the problem statement, indication of important points for the solution. Introduction of additional conditions and limitations, which are taken into account in the solution.	up to 2 points
Information review about the problem	Analysis of original sources (books, articles, patents, thesis abstracts, etc.), completeness and reliability of information.	up to 2 points

Working through of the proposed solution	Scored whatever is possible: – Creating a scheme / model of the proposed process, installation, synthesis, etc. – Calculations justifying the solutions actuality. – Experimental confirmation of the solution. – Economic evaluation of proposed ideas, their profitability.	up to 3 points
Analysis and evaluation of own solution	Consideration of advantages and drawbacks of the solution, comparative characteristic of existing approaches with the proposed solution.	up to 3 points
Fines	– Factual errors and incorrect statements in the solution (1–3). – Logical errors in the construction of the solution (1–2). – Incomplete solution, not all tasks stated in the problem are answered (1–4). – The solution doesn't work or is not applicable under given conditions (1–2).	
Bonuses	– Originality of the solution: Presence and quality of own original ideas or ideas that improve known solutions (1–2). – Consideration of non-obvious, but importa facts affecting the solution (1–2).	

The Presentation	**Final mark (from 1 to 10 points):**	Total
Display of the scientific idea	Accessibility of the report to the listener, the relevance of diagrams, drawings, tables and other pictorial elements of the report, the presence of definitions of specific terms.	up to 4 points
Appearance of the presentation	The presentation's design and visual content. Presence and functionality of titles, signs, drawings, definitions of abbreviations, references, slide numeration, etc.	up to 3 points
Logic and consistency of narration	Interconnection between various parts of the report, the credibility and clarity of the solving process, the presence and accessibility of the information needed for understanding the essence of the problem and the proposed solution.	up to 3 points
Fines	– Reading from the sheet/from slides (1–3). – Problems with performance duration (1–3).	
Bonuses	– Additional demonstrational material to help the perception of the solution (1). – Successfully finding a way to demonstrate a difficult-to-understand material (1).	

The Opposition	**Final mark (from 1 to 10 points):**	Total
Evaluation of the proposed solution	Adequacy of the findings made by the Opponent considering the fullness and quality of the proposed solution.	up to 2 points
Indication of drawbacks of the solution	The fullness and significance of the found shortcomings in the Speaker's solution, indication of the facts the Speaker left out.	up to 4 points
Justification of criticism and statements	Scientific validity of given criticism and solution analysis, the availability and quality of arguments used to explain own point of view.	up to 4 points
Fines	– Factual errors in the opposition (1–3). – Logic errors in the opposition (1–2). – Retelling of own solution (1–2).	
Bonuses	– Consideration of non-obvious but important facts, which affect the analysis of the solution (1–2).	

The Reviewing	**Final mark (from 1 to 10 points):**	Total
Evaluation of the Problem Solution	Adequacy and validity of the assessment made about the Problem Solution.	up to 2 points
Evaluation of the Presentation	Adequacy and validity of the assessment made about the Presentation.	up to 2 points
Evaluation of the Speaker's work	Adequacy and validity of the assessment made about the Speaker's Work.	up to 2 points
Evaluation of the Opposition	Adequacy and validity of the assessment made about the Opposition.	up to 2 points
Evaluation of the Opponent's work	Adequacy and validity of the assessment made about the Opponent's work.	up to 2 points
Fines	– Factual errors and incorrect statements (1–3). – Logic errors (1–2). – Incorrect behavior (1–2). – Quiet or slurred speech (1).	
Bonuses	– Resourcefulness and the ability to hold the blow (1–2). – Answering questions and erudition (1–2).	

The Speaker / the Opponent/ the Reviewer **Final mark (from 1 to 10 points):**		**Speaker** Total	**Opponent** Total	**Reviewer** Total
Answering questions, erudition and mastery of the material	Scientific validity of the statements, the ability to think and properly use scientific terminology, the knowledge of the report subject, the answers to questions of the jury, the opponent etc.	up to 4 points	up to 4 points	up to 4 points
Polemical skills	Ability to argue intelligently, ask questions, find weaknesses in the opponents' arguments, to listen to opponents and to hear questions and answer them appropriately.	up to 3 points	up to 3 points	up to 3 points
Oratory skills	Emotion, eloquence and persuasiveness of the performance, correctness of phrase construction and word use.	up to 3 points	up to 3 points	up to 3 points
Fines	– Factual errors and incorrect statements during the polemics and while answering questions (1–3). – Logic errors (1–2). – Incorrect behavior (1–2). – Quiet or slurred speech (1).			
Bonuses	– Resourcefulness and the ability to hold the blow (1–2).			

11. Final

Finalists (3 teams) of the Tournament are determined on the sum of all points scored the team during the 3 rounds of the Tournament. Personal evaluation of the Speaker, the Opponent and the Reviewer are taken into account.

The final consists of 1 cycle. Each team reports only one problem. Thus, during the Final, the team plays once as a Speaker, an Opponent and a Reviewer. During the final stage, each team member may act no more than once in the role of the Speaker, no more than once as an Opponent and no more than twice as a Reviewer.

At the final, each team determines the task it will report itself. Finalist must announce numbers of relevant tasks immediately after the announcement results of qualifying days. Task numbers are announced in order of decreasing the rating after qualifying days. Selected task should not be played by this team as a Speaker for previous playing days. The team does not have the right to choose the task that was previously selected by another team.

The team, winning in the Final, is awarded Gold medals of Tournament. The second place and third place team are awarded Silver and Bronze medals respectively.

All other teams of the Tournament receive certificates of participation.

12. Appeal

Appeal of the received during the Tournament points is not provided, as the assessment is set by several experts.

Complaints and wishes are submitted in writing form to the Director of the Tournament through the Teams' coordinator.

13. Winners of the individual tournament competition

Winners of the individual tournament competition are determined based on the number of points scored by the participants as part of teams participating in the Tournament during 2 qualifying days. The number of diplomas of winners and prize-winners of the Tournament is determined by the Organizing Committee of the Tournament.

The maximum possible number of Winners is 10% of the total number of participants in the intramural round of the Tournament. The maximum possible number of prize-winners is 20% of the total number of participants in the intramural round of the Tournament.

14. Official language

The official language of the Tournament is English.

List of the Intramural Round Participants

Team "Shock Wave" Russia Novosibirsk State University Anna Iurchenkova (c) Rodion Ivashchenko Konstantin Ivanov Dmitry Vinogradov Sergey Zhukov	**Team "Add Water"** Russia Skolkovo Institute of Science and Technology Ekaterina Malysheva (c) Anna Zhdanova Oxana Rusanova
Team "Young's modulus" Russia Novosibirsk State University, South Ural State University, Chelyabinsk State University Aleksei Popov (c) Mikhail Fofanov Olga Borodina Alexander Gorobets Polina Fortygina	**Team "UFS"** Republic of South Africa University of the Free State Shaun Redgard (c) Edward Lee Chantelle Booysen *Coach*: Dr. Hendrik van Heerden

Team "Alabrys" Russia Kazan Federal University, Pushchino State Institute of Natural Sciences Aleksei Shulyat'ev (c) Aleksei Dovzhenko Anastasia Syrocheva Danil Kuznetsov Ivan Kharyushin *Coach*: Diliara Khaibrakhmanova	**Team "How do you like that, Elon Musk"** Russia Lomonosov Moscow State University, Moscow Institute of Physics and Technology Alexander Voskoboinikov (c) Nadezhda Lukashevich Veronika Novikova Semen Popov *Coach*: Klim Sladkov

Members of the International Organizing Committee (IOC)

Founder	Dr Sergey Safonov
President	Dr Alexandra Souvorova
Director	Ms Valeria Burianova
Vice-Director, Teams' Coordinator	Ms Vera Somova
Vice-Teams' Coordinator	Ms Alina Sumina
Jury's Coordinator	Dr Andrei Shishov
Head of Technical Office	Ms Lyaysan Galiullina
Press Secretary	Mrs Dina Mostovaya
Web-developer	Mr Anton Shelyganov
Designer	Ms Daria Poloneeva
Scientific Translator	Ms Kate Gotina
Editor	Ms Mariia Kostareva

Counting Board

Head of Counting Board	Ms Galina Grechishnikova
Member of Counting Board	Ms Elizaveta Maksimova

Financial Group

Sponsor Coordinator	Mr Vlad Kisin
Sponsor Coordinator	Mr Vladimir Sologubov
Sponsor Coordinator	Mrs Lucia Erskine

PR-department

Head of PR-department	Ms Firuza Shakirova
Member of PR-department	Ms Margarita Zhmyhova
Member of PR-department	Ms Elena Ivanova

SMM Group

Member of SMM group	Ms Polina Baburova
Member of SMM group	Mr Egor Baranovskiy
Member of SMM group	Mr Ilya Mongilev

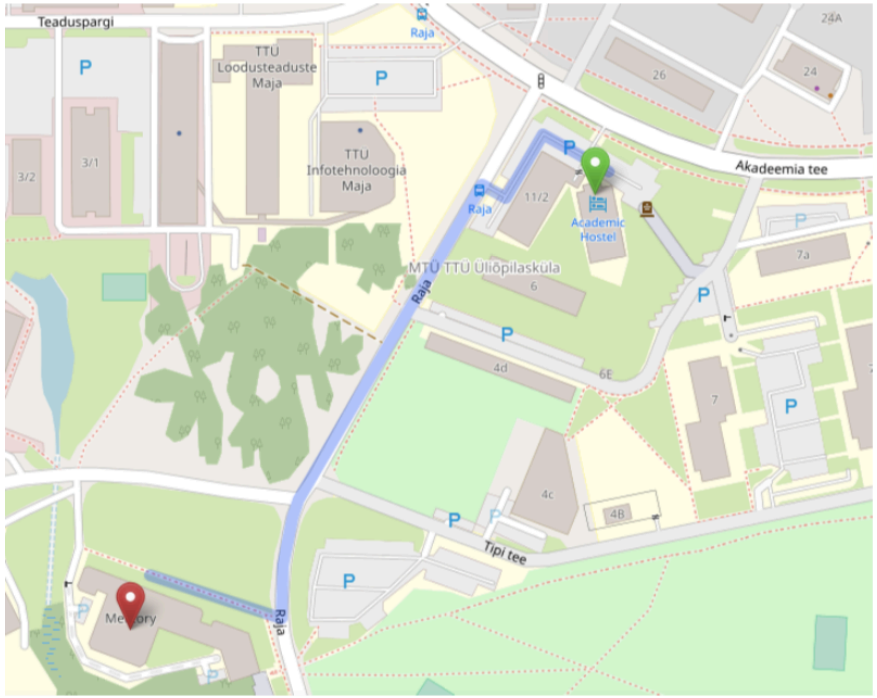
Science Council

Head of Science Council	Dr Alexandra Souvorova
Secretary of Science Council	Dr Nikita Tsvetov
Member of Science Council	Mr Anton Golyshev
Member of Science Council	Mr Konstantin Benken
Member of Science Council	Ms Elizaveta Pustovoyt
Member of Science Council	Dr Anna Starikova
Member of Science Council	Ms Anastasia Yakimanskaya
Member of Science Council	Dr Andrei Shishov
Member of Science Council	Dr Sergey Safonov

Extramural Round Experts

Extramural Round Expert	Dr Nikita Tsvetov
Extramural Round Expert	Dr Olga Milyaeva
Extramural Round Expert	Mr Alexander Guliashko
Extramural Round Expert	Mr Konstantin Benken
Extramural Round Expert	Dr Oleg Silyukov
Extramural Round Expert	Dr Andrei Shishov

Maps



Address of the hostel – Academic hostel (Akadeemia tee 11/1, Tallinn 12616)

Address of the conference hall – Mektory Maja (Raja street 15, Tallinn 12616) – 5-minute walk from hostel

Food

Cafes, canteens

Mektory kohvik (Maepealse street, 1)
Daily (Akadeemia Road, 15A)
Akadeemia Kohvik (Akadeemia Road, 15A)
Ttu Cafe Deli (Ehitajate Road, 5)
Restaurant Mets (Maealuse street, 2/1)
Skype Cafeteria (Akadeemia Road, 15B)
Rahva Toit (Akadeemia Road, 3)
Ttu VI Korpuse Kohvik (Ehitajate Road, 5/6)

Restaurants

Tudengikohvik (Estonia, Tallinn, Raja street)
Pirosmani Restoran (Uliopilaste street)
Italiano Trattoria and Pizzeria (Kadaka Road, 183B/2)

Fast food

BitStop kohvik (Raja street, 4C)
Keemia Burks (Akadeemia Road,3A)
Staap (Akadeemia Road)

Other

Itk Tudengibaar (Ehitajate Road, 5/6) – Pub, bar
Nohik (Ehitajate Road, 5/1) – Coffee shop
Pizza kiosk (Teaduspargi street, near Akadeemia Road, 21/7) – Pizzeria
Mardi Loss (Trummi street, 4) – Pub,bar