

**Grand final**

**XI International Natural Sciences Tournament**

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## **Extramural round problems**

### **Grand final of XI International Natural Sciences Tournament**

#### **1. Vape me!**

A special medical vaporizer is used in medicine for the treatment of some diseases, but one of its drawbacks is a large size. Nevertheless, it is well-known that vapes are in high demand and quite popular. Come up with an idea of how to use vapes in medicine. What diseases can be treated using them? What restrictions on the choice of active substances does this technology impose? Specify what liquid is to be used in the proposed medical vape and justify your choice. Quantify the concentration of one or more chosen medicinal substances in vapour and compare it to real values used in current medical practice.

**Attention!** The scientific council of the Tournament does not promote smoking e-cigarettes but suggests the participants reflecting on how to exploit the popular technology for the benefit of human health.

#### **2. Macroplastics**

Microplastics pollution in the ocean threatens marine life and the ecosystem. Simple methods of mitigating the pollution, based on microplastics filtration, have a number of serious shortcomings, they are even completely ineffective when dealing with plastic nanoparticles.

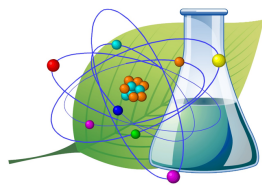
However, this problem would be solvable if the plastic particles could adhere to each other forming the larger fractions. Such fractions would be less harmful and easier to recycle.

Propose an idea of how to initiate a process of microplastics particles agglomeration chemically, physically, or biologically. The proposed solution should be applicable either globally or locally, *e.g.* on so-called garbage islands.

#### **3. Ants for people**

While sifting through the rubble, dogs are of invaluable assistance, but sometimes they cannot get close to the injured person, the smell of whom they have caught. Therefore, they cannot show rescuers the way to the person. Insects are much smaller in size, have a keen sense of smell and are sensitive to thermal radiation.

How can insects be used in search and rescue activities? Specify a signal, which can help insects to find a live person, and specify a way to transmit the precise and reliable signal to rescuers. Identify the limitations of your method.



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### **Important information**

The Tournament consists of the Extramural round and Grand final. To participate in the Extramural round the team (3–5 students+coach) should send clear and outstanding solutions of **two out of three Extramural round problems** before the 30<sup>th</sup> of September, 2020 (first wave) or before the 1<sup>st</sup> of November, 2020 (second wave).

Please, remember the following notes:

- participation in the Extramural round is free of charge;
- participation fees for the Grand final participants of the first and the second waves will be announced later.

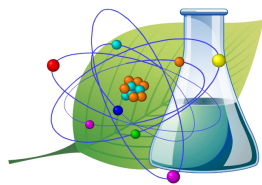
### **Submission of solutions**

Each solution of each problem consists of **both extended solution** ((\*.doc, \*.docx, \*.pdf) – 5 pages or less) **and presentation** (\*.ppt, \*.pptx \*.pdf). The solutions provided in the wrong formats are not accepted. Please, send separate files with presentations and extended solutions for each of the problems. Pay attention that there have to be no names, logos, or any other identification marks of your team/university in the presentations or extended solutions. All the solutions have to be sent before the deadline via the account on the [website](#). All the uploaded documents have to be archived. You will be able to upload only one archive via web-form.

### **Recommendations**

#### *Extended solution*

- Your team have to provide the neat document in \*.doc, \*.docx, \*.pdf formats (5 pages or less).
- All the parts of the extended solution 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.
- While preparing the extended solution, it is recommended to keep in mind the following questions:
  - ? What is the essence of the problem and what is required to be solved?
  - ? What is known about this problem in literature sources? Have any solutions been already proposed for the problem? What are the pros and cons of the known solution?
  - ? What is the essence of the solution you propose? How to implement it in practice? What are its pros and cons? Are there alternative solutions?



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? What conclusions can be drawn from the work you have done? What solution to the problem do you propose as the best and why?

- If it is necessary, provide an economic evaluation of proposed ideas, their profitability.
- When using information from literature, one should put the source is referred to at the numbered list of references at the end of the extended solution. Do not forget to refer to these sources with figures, for example [1] or <sup>1</sup>.
- If your team has conducted any experiment during the solving of the problem, it is highly recommended to include any information about it in the extended solution even if the result does not satisfy your team.

#### *Presentation*

- Your team should provide the neat document in \*.ppt, \*.pptx, \*.pdf formats (the number of slides is not limited but, please make it reasonable).
- Please, keep in mind that your presentation must correlate with your extended solution.
- The presentation should not be overloaded with text. It should contain only illustrative material that supports the extended solution 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.
- All slides of the presentation, except the title slide, should be numbered.
- All the pictures, graphs, tables, or any other graphical content should be clearly labelled. If this material is not original, then one should refer to the corresponding source of literature with figures.
- 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] or <sup>1</sup>.
- If your team has conducted any experiment during the solving of the problem, it is highly recommended to include any information (especially pictures, numbers, tables, *etc.*) about it in the presentation even if the result does not satisfy your team.

If you have any questions regarding the presented information, please do not hesitate to contact Teams' coordinator Ms Polina Lavrik via e-mail: [participants@scitourn.com](mailto:participants@scitourn.com).