

**Grand final**  
**International Natural Sciences Tournament**  
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**Problems of Grand final**  
**XI International Natural Sciences Tournament**  
**Block A**

**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.

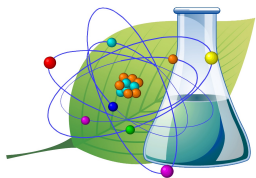
However, this problem would be solvable if the plastic particles could adhere to each other forming the larger fractions. Such fractions would be less harmful and easier to recycle.

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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#### **4. The masks**

The coronavirus pandemic makes millions of people all around the world wear protective masks. However, the masks are used not only for protection from viruses and bacteria but also from toxins, various types of dust, *etc.* Suggest a mask model with an indicator that would change any noticeable for anyone characteristic in case of any mask dysfunction. The indicator mask model has to be safe in usage.

#### **5. Grey goo**

Grey goo is a hypothetical doomsday scenario associated with molecular nanotechnology achievements. It predicts that uncontrollable self-replicating nanorobots, carrying out their self-reproduction program, will consume all available Earth's material or biosphere substance that is biomass. This scenario is known as **ecophagy**.

Suggest a concept of a self-replication nanorobot, based on a real biological object modification, or a non-biological nanorobot capable of consumption/conversion of a certain common substance/material on the planet.

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The Grand final of the XI INST will be held online using videoconferencing software. The tournament dates are July 19–26, 2021. 10 Grand final problems will be presented, with 5 in each block. The distribution of the blocks in days and the detailed schedule of the tournament will be published no later than July 12, 2021. The scheme of this year online Grand final is the same as it is described in the [Rules&Regulations](#).

The participation fee for every team is €65. Teams should inform the Organizing committee about their desire to participate in the Grand final no later than July 5, 2021. The deadline for the fee payment is July 11, 2021.

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

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