

Problems for the 13th IYNT 2025

Forsan et haec olim meminisse iuvabit.
Vergilius

Main Problems for Science Fight 1

1. Squawking cup

A long thread is attached to the bottom of a plastic cup. Wrap tightly a piece of wet paper towel around the thread and pull it down. Investigate and explain the squawking sound created in this experiment.

2. Saliva

What amount of human saliva is sufficient to break down a fixed amount of starch into sugars? Is it possible to detect differences in enzymatic activity and other properties of saliva for each member of your team?

3. Blue bottle

A solution of methylene blue and an alkaline solution of a reducing agent are mixed. Under certain conditions, the resulting solution may repeatedly change color from blue to colorless and back. How many cycles of color change can be observed depending on the ratio of components and other parameters?

4. Wobbly bridge

A horizontal metal ruler extends into the air and is supported just at one end, like a cantilever bridge. A plastic cup is attached to the other end of the ruler. Water droplets fall into the cup from a dropper at regular time intervals. Motionless at first, the bridge starts oscillating up and down, and then again comes to rest. Investigate and explain this effect.

5. Euglena

Species of the genus *Euglena* are sensitive to light. How does the color of a water sample containing *Euglena* depend on light levels and presence of nutrients?

6. Explosive precipitate

Ammonia and iodine can be used to produce a dark precipitate which is stable when wet but explosive when dry. Demonstrate how this precipitate detonates in safe conditions and estimate what energy is released in the detonation.

Main Problems for Science Fight 2

7. Vacuum flasks

Measure experimentally how fast the hot water in a vacuum flask cools down to room temperature. What parameters of vacuum flasks influence their efficacy?

8. Germination rate

If several dry seeds are exposed to the suitable conditions, some seeds germinate much sooner than others. What factors are essential for one particular seed to germinate? Investigate how the fraction of germinated seeds increases with time.

9. Film development

The amount of time required to develop a sample of black-and-white photographic film depends on various factors and may be unknown if the film is expired. Try various methods to measure the optimum development time for such a film using a developer of your choice. What methods are fast enough to test a film sample provided by your opponent in the Science Fight?

10. Precise time

Mechanical watches are notorious for losing or gaining time depending on conditions in which they are used. Compare the accuracy of several watches and find the factors which affect the rate of any mechanical watch.

11. Drying hair

It is sometimes said that drying hair with hot air damages hair. Use a microscope to put this statement to a test.

12. Reed diffusers

One or several reeds are inserted into a bottle containing an alcohol-water-oil mixture. Investigate and explain how evaporation rate depends on the number of reeds and other relevant parameters.

Problems *Invent Yourself* for Science Fight 3

13. Invent Yourself: Mathematical artwork

Suggest a problem on methods or functions that can be used to describe a 2D drawing with a minimum amount of numerical data. What changes in the data are sufficient to make a depicted real-life object unrecognizable by humans?

14. Invent Yourself: Seriation

Seriation is a method in archaeology that allows to chronologically order several similar finds by comparing gradual changes in contents and style of each find. Seriation is useful if absolute dating is impossible. Design experiments or suggest cases in which undated real-life finds may be chronologically ordered with seriation.

15. Invent Yourself: Light scattering

Formulate a problem that links the visible color of a real-life object to the effect of light scattering.

16. Invent Yourself: Large microscopic organisms

A majority of unicellular organisms are too small to be seen with naked eye, but some of them are larger than others. Propose a problem to demonstrate and investigate the largest unicellular organism that can be found in the natural habitat of your area.

17. Invent Yourself: Sixth sense

Sensory organs of various animals may allow them detecting the stimuli inaccessible to human perception. Suggest a problem that requires studying the sensitivity of a receptor in animals of your choice.

The problems are authored by Nikita Chernikov, Artem Golomolzin, Anastasiya Litvinova, Ilya Martchenko, and Evgeny Yunosov. Selected, prepared, and edited by Ilya Martchenko and Nikita Chernikov. This official set of problems for the 13th IYNT 2025 is approved by General Council of the IYNT and can be used only at the events endorsed by the General Council of the IYNT.

Released in Batumi on July 27, 2024.