

Problems for the 4th International Young Physicists' Tournament

Olympiets Youth Center, Moscow, Soviet Union; July 22–28, 1991 ^[1]

Critical edition: translated, restored, and commented text ^[2]

FINAL DRAFT. — Please do not re-publish. Suggestions and criticism welcome

*Is this black currant?
No, it is red currant.
But why is it white?
Because it is still green.* ^[3]

1. Invent yourself ^[4]

Propose a cycle of demonstrations ^[5] and experiments that can help to explain and visually demonstrate the physical nature of sound waves and the properties of sound.

2. Fortune teller ^[6]

When molten paraffin ^[7] is made to drip from a candle into a saucer with water, different solidified shapes are obtained, like a “lens”, a “boat”, an “inkblot”. Study the shape of the solidified droplets in dependence of altitude of their fall.

3. Geyser

A strong ceramic resistor in the shape of a hollow cylinder is placed into water so that the axis of the cylinder is vertical, and the top plane is slightly below ^[8] the water level. If electric current is passed through the resistor, the resistor, just like a geyser, periodically ejects portions of hot water upwards. Calculate and study experimentally the dependence of the eruption periods of the “geyser” on the power consumed by the resistor from the power supply unit. ^[9]

4. Self excitation ^[10]

A strong hum ^[11] sometimes happens on the concerts of newbie rock bands, when the microphone appears close to the speaker that reproduces the signals amplified from this very microphone. How do the frequency and the amplitude of the produced sound oscillations depend on the distance between the microphone and the speaker, and on their mutual orientation?

5. Cosmic monument

A particular supercivilization is eager to create a cosmic monument, an isolated planetary system of three planets, of which one should move along a trajectory close to an equilateral triangle. What mutual ratios of masses and of velocities for planets would you recommend? Develop also a project for a nearly square-shaped orbit.

6. Radiometer

Construct a device that measures the level of radiation. Use it to locate the major sources of radiation in everyday life. ^[12]

7. Runner

Estimate the maximum speed that a person can run with. Compare it with the experimental values. ^[13] In your opinion, what will be the world record in 100 m sprint in the year 2000?

8. Photograph of a television screen

The motion of a camera's shutter and its speed may be studied through taking photographs of a television image. ^[14] With this technique, measure the exposure time of your camera and the speed of the shutter.

9. Passive motor

An apple dropped ^[15] from a balcony of a multi-storey building will calmly descend into the hands of your friend, if you attach to the apple a propeller cut out of dense paper ^[16]. Explain the principle of work for such a parachute and study the dependence of the drag force on the descent rate and on the sizes of the propeller's blades.

10. Blowgun ^[17]

A small knitting needle, ^[18] with two rounded pieces of polyurethane foam ^[19] strung onto it, is shot ^[20] out of a blowgun. Find the optimal blowpipe size to shoot such a projectile. What maximum projectile speed did you succeed to achieve?

11. Gold cube

A cubic planet of pure gold evolves around the Sun and keeps one of its facets turned towards it. Estimate the difference of temperatures of the planet facets.

12. Little boat

A light little boat floats on the surface of a liquid electrolyte. When electric current is passed through the electrolyte, the boat starts moving. Estimate the speed of the boat.

^[21]

13. Wooden cube

A cube is cut out of a single piece of wood. The edge of the cube is much smaller than the diameter of the tree trunk from which it was cut out. Propose a method to determine the direction of wood fibers in the cube (the positive orientation of fibers is from the roots to the top of the tree.)

14. Moon ^[22]

Determine experimentally the ratio of brightnesses (illuminances) of sunlit and dark sides of the Moon at different lunar phases. ^[23] Compare them with the theoretical estimations.

15. Glider ^[22]

Construct a glider that is driven by a piece of soap. Your glider must win in two competitions: in racing against time for a distance of 50 cm and in floating for a longest range in a given direction (separate gliders may be constructed for each competition.) The linear dimensions of the glider may not exceed 6.28 cm. In the second competition, the glider may not carry more than 0.5 g of soap.

16. Sunset ^[24]

The Sun becomes red at sunset. What are the colors of the Moon, of Venus and of a bright star when they are low on the horizon?

17. Epigraph ^[25]

In our opinion, the epigraph to the Tournament problems may serve as a basis for serious researches as well as for excellent jokes. We expect both of these from you. ^[26]

Notes

[1] The report [Skrapits 1992] provides the dates of July 22-28, 1991, while [Stoliaroff CR 1991] provides the dates of July 23-28, 1991. Both reports were published after the event, and probably the official schedule read July 22-28, although the opening ceremony was confirmed to be held on July 23 [Stoliaroff CR 1991]

[2] The original problems for the 4th IYPT were prepared and distributed to participants in Russian language, the primary working language at the entire event (non-Russian speaking teams were assisted by interpreters.)

The primary “standard” source for this translation is the typeset Russian text of the problems for *the Correspondence Collective Competition (Заочный коллективный конкурс)* provided by LOC to Russian participant Sergey Romanchuk and shared in October 2010 [Romanchuk 1991].

An English translation has been prepared by the Organizing Committee and distributed to non-Russian speaking teams, at least the Dutch team. A two-page typeset OCR document titled *The problems of the IVth International Young Physicists' Tournament* coming from Evgeny Yunosov was preserved by Hans Jordens [Jordens 1991]. The language and style of this translated document may be considered quite rough, with some examples reading: “Estimate, please, velocity of such ship” or “In this way measure, please, exact values of exposures for your camera and its shuttes speed.”

A French translation titled *Problems for the IVth International Young Physicists' Tournament (1990-91) (Problèmes du IV^e tournoi international des jeunes physiciens (1990-91))* has been published by Jeanne Stoliaroff in *Bull. Union Phys.* in June 1991, shortly before the event [Stoliaroff 1991]. The source document is not reported, while the editorial board of the journal might have contributed to the translation, giving a special footnote (*note de la rédaction*) implying that they had a non-French version available. Some further linguistic details show that the French translation may not be considered a translation from the 1991 English text and, thus, is most likely translated directly from the Russian.

A Czech translation for the problems with no explicit title has been published in Ivan Štoll's article *IV. Ročník Turnaje mladých fyziků* in *Rozhledy mat.-fyz.* presumably in March-April 1992, 8 or 9 months after the competition [RMF 1992]. The source document is not reported, while the translation is made most probably from the Russian. It may be speculated, with no solid grounds, that the editorial board of the journal might have contributed to the translation.

The Slovak translation relies on the *Rozhledy mat.-fyz.* Czech text [TMF 1996], providing a direct reference to that source. There is as well all linguistic evidence that the Slovak text follows the 1992 Czech text and may not be considered a translation from the 1996 Czech text, or vice versa. The Slovak is linguistically very close to Czech and, to a lesser extent, Russian.

The list of 17 problems in Czech language titled *Problems for International Young Physicists' Tournament. 4. Russia — Moscow — 1991 (Úlohy mezinárodního turnaje mladých fyziků. 4. Rusko — Moskva — 1991)* was published by Zdeněk Kluíber in review book *Turnaj Mladých Fyziků* in 1996 [Kluíber 1996]. This Czech translation is found to be fully independent from the 1992 version, with very different style, wording and factual nuances.

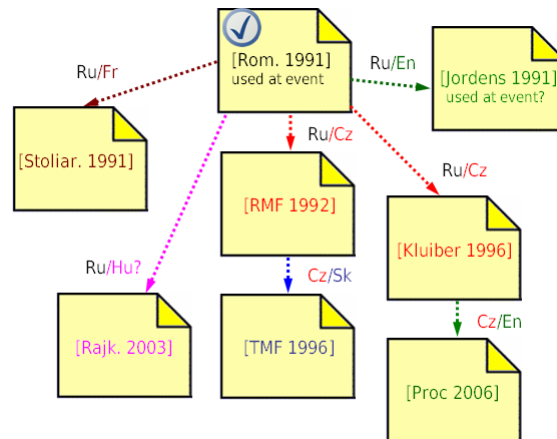
A different English version was published in 2006 by Silvina Simeonova in the *Proceedings of the 16th IYPT* on the basis of a text provided to the publishers by Zdeněk Kluíber [Proceedings 2006]. The year of translation and the source language are not reported. This version, however, is almost certainly translated from the Czech text because almost all notable distinctive details of the Czech text are reproduced in the 2006 English text.

The Hungarian version [Rajkovits 2003] is available as well.

Nothing on the 4th IYPT has been published in the *Kvant* magazine and on the Evgeny Yunosov's *Faraday Tournament* website (2002).

All available sources have certain mutual discrepancies in word order, in details and in style. No problems, however, are replaced with entirely different ones, which is the case with the problems for the 5th IYPT or the 2nd IYPT. There is detailed evidence from participants of the competition [Falus Fedorcsák 2009] that these very problems were discussed at the real stages of the 4th IYPT in July 1991.

The current document relies on the 1991 Russian text as the “standard” edition, and comments on all discrepancies against the 1991 English, French, 1992 Czech, 1996 Czech, Slovak, 2006 English, and Hungarian translations. The early draft of this translation has been performed in August 2008 from the Slovak and the Hungarian texts, revisions were made in January 2011 after the Russian *archetype* edition was found.



The history of text transmission: colors indicate the languages of the sources (black for the Russian, red for the Czech, blue for the Slovak, green for the English, pink for the Hungarian, brown for the French); dotted lines indicate that *notable* factual inaccuracies were introduced with translation or copying; the tick indicates the version taken as “standard” for the current edition

[3] The epigraph for the set of problems appears in the Russian, the French, the Slovak, in the 1996 Czech, and in the 2006 English text, while is omitted in other versions

[4] The Russian traditional title «Придумай сам» has been internationally translated as “Think up a problem yourself” at the 6th IYPT, the 7th IYPT and the 8th IYPT, but later most commonly as “Invent yourself” (at the 9th IYPT, the 10th IYPT and the 11th IYPT.) “Invent yourself” is used in the Soviet OC’s translation for 1991 [Jjordens 1991]. Other versions are: “Invent for yourself” (13th IYPT), “Your invention” (Soviet OC’s translation for the 3rd IYPT), “Think for yourselves” (Soviet OC’s translation of the *Kvant* text for 1989), “Invent it yourself” (1992 translations for the 5th IYPT)

[5] “Observations”, in the Slovak text

[6] “Riddle”, in the Slovak text

[7] “Wax”, in the Slovak text. “Paraffin (stearin)” in the French text

[8] “Top plane is slightly above or slightly below the water level”, in the 1991 English, Slovak, 1992 Czech, 1996 Czech, 2006 English translations

[9] “On the current delivered from the power supply”, in several translations. “On the power of current”, in the 1991 English and 2006 English texts. “On the power of voltage source”, in the Czech text

[10] “Feedback” in the Slovak and the 2006 English texts. “Auto-excitation or Larsen effect” in the French text

[11] “Buzzing” in the 1991 English text. “Whistle” in the Slovak text. “Strong noise” in the 2006 English text. The original Russian «гудение» is an open-ended term and does not necessarily mean a low-frequency tone

[12] “The main sources of radiation in common life”, according to the 1991 English and French texts. “In a flat, in an apartment”, in other versions. The original Russian «быт» can imply a household, but not necessarily an apartment

[13] The phrase “Compare it with experimental values” is missing in the 1991 English, and in the 2006 English texts

[14] The 1991 English text mentions the necessity to take a photograph of TV image only in the title of the problem, not in the text itself. It reads overall, “TV_screen photo”: “It is possible to investigate the motion of shuttes in your camera and determine the velocity of their motion. In this way measure, please, exact values of exposures for your camera and its shuttes speed”

[15] The original Russian text is ambiguous, as the word «брошенный» can imply both the release without initial speed and the launch in the air under any angle

[16] The 1992 Czech and the Slovak texts read, “rigid paper”, and specify that the propeller “is attached to this apple with a match”

[17] “Hunter’s gun”, according to the 1991 English text

[18] Wording about the needle and its size varies across the translations.

- [19] “*Porolon*”, a transliterated Russian name for a particular foamy material («поролон»), as it reads in the 1991 English, “*paralon*” in the 1996 Czech and 2006 English texts. It reads “*polystyrene*” in the 1992 Czech text, and “foam rubber” in the French text
- [20] “Is shot centrally”, in the Slovak text
- [21] Problems “Wooden cube”, “Moon”, “Glider” and “Epigraph” (Nos. 13, 14, 15, 17 in all other texts) are missing in the 1992 Czech text
- [22] Problems “Moon” and “Glider” follow in the opposite order in the 1996 Czech and in the 2006 English text and have there, respectfully, numbers: No. 14 “Glider” and No. 15 “Moon”
- [23] An additional detail in parentheses “(full moon, crescent etc.)” appears in the Slovak text
- [24] Problem “Sunset” appears as No. 13 in the 1992 Czech text
- [25] “Motto”, in the 2006 English text
- [26] The task to suggest such epigraphs, or “mottos”, is missing in the 2006 English text

Sources

[Romanchuk 1991] Турнир юных физиков: заочный коллективный конкурс. Russian text of the problems, from a handout provided by LOC to Russian participant Sergey Romanchuk in 1991

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[Stoliaroff 1991] [Jeanne Stoliaroff]. *Quatrième tournoi international des jeunes physiciens*. *Bull. Union Phys.* 85, No. 735, 1009-1011 (Juin 1991)

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[Skrapits 1992] Lajos Skrapits. *Ifjú Fizikusok Nemzetközi Versenye*. *Fizikai Szemle*, 1992/03, 119.o. (március 1992)

[Jordens 1991] *The problems of the IVth International Young Physicists' Tournament*, an English translation of the problems provided by LOC to Hans Jordens in 1991, OCR

[Falus Fedorcsák 2009] Private communication with Péter Falus and Péter Fedorcsák, Hungarian participants in 1991

[Romanchuk Salov 2010] Private communication with Sergey Romanchuk and Dmitri Salov, Russian participants in 1991

Translated, edited and commented by Ilya Martchenko. Originally translated in August 2008, revisions made until May 2011. This edition would never have been prepared without the early work in copying, translating, publishing and preserving problems, made in different years by Evgeny Yunosov, Sergey Romanchuk, Ivan Štoll, Jozef Brestenský, Zsuzsanna Rajkovits, Hans Jordens, Jaroslav Zhouf, Martin Plesch and others, without without important factual details on the 4th IYPT provided by Péter Falus and Péter Fedorcsák, without proofreading and valuable suggestions made by Matej Ftáčnik, Tymofii Nikolaienko, Timotheus Hell, and Dahl Winters.

Authors of the IYPT problems were often reported in late 1980s and early 1990s. The 1991 English text names them: A. Chomenko, T. Korneeva, A. Korotkov, A. Shapiro, S. Varlamov, E. Yunosov.

Everyone who may shed more light on early IYPTs is kindly invited to contribute.