Bulgarian IPhO Team Selection Tests

Following the Bulgarian Physics Olympiad, the ten highest-scoring participants are invited to a two-week training camp where the IPhO team is finalised. The files on this page contain the team selection tests given out at the camp between 2005 and 2025. Even though the organisers will allow the contestants to keep the problems, they seem reluctant to share them with next year's participants. Apart from that, no official solutions are published, which makes it quite difficult to actually prepare for the thing.

In 2024 I collated all the problems that I could get my hands on, and wrote detailed solutions for a good chunk of those. As of now, there are about 130 theoretical problems, 25 experimental problems, and 70 solutions. But since LLMs can now outdo humans when correctly prompted, I do not plan on writing any more solutions – sorry. Many problems are still missing, and if you can add something to the collection (email me!), it'd be greatly appreciated.

The exam format for the TSTs is as follows:

- Three separate short exams that consist of a single problem, to be solved in about an hour. Each short exam is worth 5 points, for a total of 15.
- A theoretical exam consisting of ten problems, which lasts for 5 hours. Each problem is worth 3 points, for a total of 30.
- An experimental exam consisting of two problems, also 5 hours long. The problems are worth 15 points, for a total of 30.

For better or worse, the rules are as constant as the north star, and they haven't changed since 2006. As for problem difficulty, the TSTs are generally easier than what you'd see in Kevin Zhou's handouts or Jaan Kalda's study guides (though there's the occasional backbreaker here as well). If you're looking for something to bridge the gap, these problems might be for you.

Now for the credits. The TSTs are managed by Miroslav Abrashev, Victor Ivanov, and Dimitar Marvakov. The problems are mostly their own, but many are taken from the massive MIPT problem book (4200 problems, better than Irodov and also more difficult; no solutions though). I would also like to acknowledge Georgi Aleksandrov, Margulan Ismoldayev, Georgi Kostadinov, and Bayan Gechev for digging up some of the problems and sharing them with me.

Finally, on the off chance that you want to make something similar, I've uploaded my `.tex` sources and figures to GitHub. I keep all the problems on separate files, which I then bind using a master file. The code should be legible, but if you need help, or, conversely, if you can improve the setup, do get in touch.

Good luck!
Last updated: February 3, 2026

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Some pointers towards extra solutions

There are some TST problems for which I haven't written solutions, but I've still managed to find identical problems elsewhere. This is useful because those other sources often include solutions, or at the very least numerical answers. Unfortunately, you might meet with a language gap, but translation software will help you in most cases.

2005 T4 – The same as Problem 1 from Day 2 of the 2014 Bulgarian Physics Olympiad.

2005 T7 – Part (a) is 2.38 from MIPT, Volume 3. For Part (b), I think you're just expected to divide the ground state energy by n^2.

2006 T2 – IZhO 2026 1C is a more difficult variant of this problem.

2006 T10 – Same as **2023 T8**, for which I've already written up a solution.

2022 S1 – Very similar to Problem 2 from Day 2 of the 2013 Bulgarian Physics Olympiad.

2023 T7 – Parts (a) and (b) are respectively 8.21 and 8.41 from MIPT, Volume 1.

2024 S1 – This is a slight generalisation of IOAA 2009 T16.

2024 S3 – Parts (a) and (b) are like Problem 2 of the 2006 Bulgarian National Olympiad. Part (c) is related to **2006 T8**, but I don't have a solution for either of those.

2024 T1 – A repeat of **2008 T3**.

2024 T2 – An easier version of **2018 S1**. The answer here is $h = 2l/3$.

2024 T3 – Almost the same as Problem 2.2 from the 2011 Bulgarian Spring Physics Competition.

2024 T6 – This Wikipedia page has an outline solution. Alternatively, see this video. Or just APhO 2025 Problem 3E.

2024 T9 – Part (a) is 2.31 from MIPT, Volume 3. Part (b) is Problem 3 from the 1999 Bulgarian National Physics Competition; that part is also the same as **2006 T9**.

2024 T10 – This is Problem 193 from 200 PPP. It's also been set as Problem 1 in Kevin Zhou's Handout E4. As far as I know, its first appearance is on the 1971 USSR Olympiad.