

## THE BEST ACHIEVEMENT OF THE MACEDONIAN CHEMISTRY TEAM AT THE INTERNATIONAL CHEMISTRY OLYMPIAD 2023

After long three years of on-line competitions (2020–2022),<sup>1–3</sup> the Macedonian team came back at the International Chemistry Olympiad - IChO-2023 in a full glory. This has been our best result so far with 3 bronze medals won. The lack of experience with in-person participation did not affect our performance in the laboratory, although other participating teams were not able to attend live Olympiads as well. On the other hand, some countries did organize joint competitions when selecting their teams (Slovakia and Czech Republic) with practical exam as well. Others, joined together in-person to conduct the official on-line IChO competition. In 2022, some efforts were made, and the International Mendeleev Olympiad was organized in-person. Even though 16 countries participated, the Olympiad was successful and the students maintained their level of lab experience and competition spirit.

### Participation at the International Mendeleev Chemistry Olympiad – IMChO

Prior to the participation at the IChO-2023, the Macedonian team had the opportunity to take part at the International Mendeleev Chemistry Olympiad IMChO 2023, which was held in Astana, Kazakhstan from 1 to 6 of May. Unfortunately, no significant success was achieved at this Olympiad and the reason for that could be the lack of experience and the fact that the preparations were not fully conducted. Nevertheless, this participation was of great significance and the gained experience contributed for great results at the IChO-2023.

The selection process of the high school students started in October 2022, when some on-line and in-person lectures were organized for the pre-selected students (around 40), based on their achievement at the national chemistry competitions. After that, a round of qualifying exams were conducted and the best 10 students were allowed for further theoretical and practical preparation at the Institute of Chemistry in Skopje. Two of the selected students withdraw and in April the selection process was completed. Out of the 8 competing students, 4 were selected (Fig. 1) for participation at IMChO-2023:

- **Filip Bojadjevski**, 4<sup>th</sup> year student at City's High School "Orce Nikolov", Skopje,
- **Petar Mirchevski**, 2<sup>nd</sup> year student at Municipal High School "Mirche Acev", Prilep,
- **Mario Vanchoski**, 2<sup>nd</sup> year student at Municipal High School "Slavcho Stojmenski", Shtip,
- **Ivan Kostevski**, 2<sup>nd</sup> year student at Municipal High School "Slavcho Stojmenski", Shtip.

This year's IMChO organizers managed to present their city – Astana, and their country as being one of the excellence centers in Central Asia for educating and raising talented students. Also, every delegation had its own local leader in charge of the students, something that was not in practice during previous years. Both the students and the mentors had the opportunity to visit the special schools in Astana (Schoolchildren's Palace, NurOrda Educational Complex), and during the competing days, the mentors had the chance to participate in numerous roundtable discussions about the organizational model of the national competitions and the process of preparation of the selected students. The competition's practical and theoretical parts were held at the grandiose Nazarbayev University.

The hosts accommodated 114 students from 21 countries around the world.<sup>4</sup> For the very first time, a country from South America - Brazil, took part at this competition.



**Fig. 1.** At the opening ceremony of IMChO-2023 at Nazarbayev University in Astana, Kazakhstan. From left to right: Nazerke Abatbek (local team leader), Filip Bojadjevski, Petar Mirchevski, Ivan Kostevski, Mario Vanchoski, Miha Bukleski (mentor).

### Participation at the International Chemistry Olympiad – IchO

After the return from the IMChO, the preparations continued with all 8 students that were left prior to the first selection. Meanwhile, another student withdraw from the further competition. The upcoming lectures and practical work in the laboratory were very intense in the course of two weeks. After them, the new selection was conducted and again, the best 4 students were selected (Fig. 2), now to participate at IChO-2023:

- **Filip Bojadjevski**, 4<sup>th</sup> year student at City's High School "Orce Nikolov", Skopje (**bronze medal**),
- **Petar Mirchevski**, 2<sup>nd</sup> year student at Municipal High School "Mirche Acev", Prilep (**bronze medal**),
- **Marija Petrova**, 4<sup>th</sup> year student at City's High School "Rade Jovchevski-Korchagin", Skopje (**honorable mention**),
- **Mario Vanchoski**, 2<sup>nd</sup> year student at Municipal High School "Slavcho Stojmenski", Shtip (**bronze medal**).



**Fig. 2.** After the closing ceremony and the IChO-2023 in Zurich. From left to right: Marina Stefova (mentor), Filip Bojadjevski (**bronze medal**), Marija Petrova (**honorable mention**), Petar Mirchevski (**bronze medal**), Mario Vanchoski (**bronze medal**), Miha Bukleski (mentor).

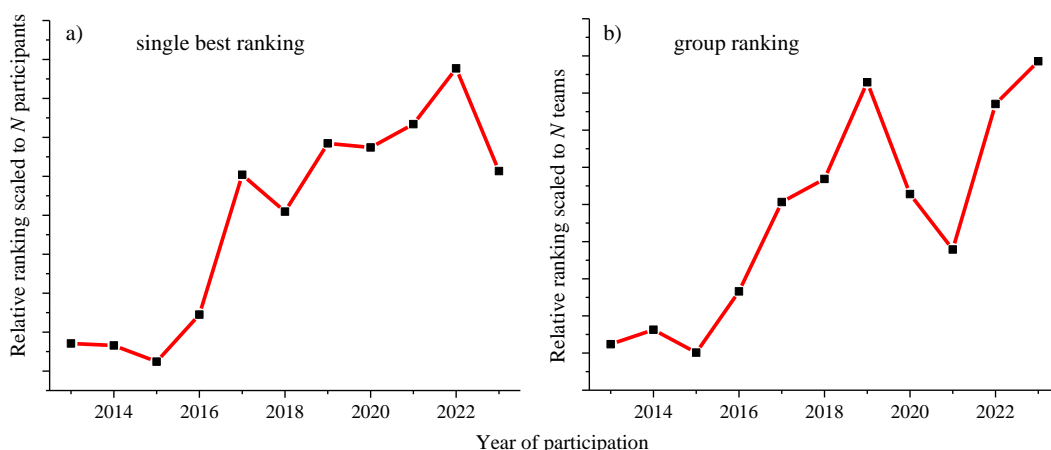
The IChO-2023 was held in Zurich, Switzerland and the host institution was the world renowned ETH University in Zurich. In the duration period, 16<sup>th</sup> to 25<sup>th</sup> of July, the organizers welcomed 348 students from 89 countries around the world.<sup>5</sup>

As in the previous years, the competition consisted of two parts, one practical 5 hours long exam, and one theoretical exam that was also 5 hours long. This year, the students were given 10 long and complex problems, and this was characterized as one of the most ample exams given so far, both in number of problems and number of characters. Nonetheless, our students managed to deal with the vast number of problems quite well and achieve solid results. Even the points of the student awarded with “honorable mention” were very close to the bronze medal (only 0.59 points away, or 2 students).

In the preparation and selection process, 6 professors from the Institute of Chemistry took part and also 3 former participants both at IMChO and IChO contributed to this. Several sponsors, municipalities and individuals contributed to the successful process of selection and participation at both Olympiads.

### Results and statistics

From the modest beginnings as participants at the 47<sup>th</sup> IChO (2015), when SCTM took over the national competitions in Macedonia, and the organization of the selection process, till today, there has been a positive trend in the results achieved.<sup>6–8</sup> According to the number of medals won this year at the IChO, it is obvious that the performance of the team is improving. That can be seen explicitly on the graph shown for the cumulative performance of all members (Fig. 3). Concerning the team performance, it can be seen that we have recorded a drop in the performance in years 2020 and 2021. This can be explained by the reduced preparation of the students and the on-line training. On the other hand, in 2022, the SCTM team started with the preparations and lectures in-person, and the results started to improve, so the ones achieved in 2023 are the best so far.



**Fig. 3.** Best relative ranking improvement over the years of the (a) student with highest score and (b) entire team, scaled to the number of participants and maximal number of points won by the firstly ranged.

Another interesting thing is the number of times needed for the students to accomplish results that are good enough for winning medal. Starting from 2013, the first medal won by Filip Trajkovski was after his third participation at IChO. Same thing applies for the next medalist (Antonio Andonovski). From 2019, students obtained medals after their second participation (Stefan Damchevski, Stefan Stojkovikj, Aleksandar Trajkovski, Darko Stojchev and Anja Spasovska). This year, for the first time, two participants managed to win medals, right after their first participation at IChO.

### Conclusion

There is no better way to continue the "live" Olympiad than with achieving the best result so far. It was proven that the old-fashioned in-person preparations result with better ranking rather than the on-line lectures. Also, the participation at the Mendeleev Olympiad, gives the students, the experience needed in order to handle the pressure and stress better. Besides the mental performance, the experience in different laboratory environment, rather than the well-known "home" laboratory is of great help. At the end, the winning of 3 bronze medals and Honorable mention is our greatest achievement so far.

### References

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