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Conference Report

International Chemistry Olympiad 2025

Switzerland and Liechtenstein Represented in Dubai, United Arab Emirates

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Abstract: The 57th International Chemistry Olympiad (IChO) in Dubai brought together 354 students from 90 countries, including full delegations of four students from both Switzerland and Liechtenstein. Following an intensive selection and preparation process, the teams competed in challenging theoretical and practical exams, participated in cultural activities and were given the opportunity to network with chemistry talents from all over the world. With three bronze medals and one honorable mention, Switzerland has achieved their best result in over 20 years. The next IChO will be hosted in Tashkent, Uzbekistan, in July 2026.

Keywords: Extracurricular education · International Chemistry Olympiad · IChO · Swiss students

The International Chemistry Olympiad (IChO) is an annual chemistry competition for high school students from all around the world.[1] Four students from each country's participating delegation are invited to the annually changing host country to compete against their peers and to forge new bonds. The students are tasked with demonstrating their chemistry prowess in two 5-hour practical and theoretical exams. The qualifying students are accompanied by a handful of mentors, whose are tasked with preparing the students in advance, to translate the official English exam into the respective national languages, and to ensure a fair and transparent competition.

The 57th International Chemistry Olympiad 2025 was hosted in Dubai, United Arab Emirates (UAE). The event took place from the 5th to the 14th of July and marked the second time in a row the event was hosted on the Arabian peninsula. With 354 participants from 90 countries, this marked the largest IChO to date.[2,3]

The spots for both the Swiss and Liechtenstein delegations are awarded to the best participants at the Swiss Chemistry Olympiad (SwissChO), with Liechtenstein forming a full delegation of four students for the first time ever. The SwissChO finals take place annually in the week after Easter at ETH Zurich, where students are tested in a 3-hour practical and a 3-hour theoretical exam on their skills and knowledge of chemistry.[4] The students representing Liechtenstein participate in the same competition, but are ranked separately. The Swiss delegation at IChO 2025 consisted of:

- *Ruben Locher*, Berufsfachschule Oberwallis, VS
- *Stanisław Bektaş*, International School of Schaffhausen, SH
- *Carl-Philipp Cachej*, MNG Rämibühl, ZH
- *Maya Post*, Kantonsschule Hohe Promenade, ZH

The four students selected from Liechtenstein (all from Liechtensteinisches Gymnasium, FL) were:

- *Giulio Vogt*
- *Leonhard Mayer*
- *David Hasler*
- *Viola von Loesch*

These eight participants proved their talents through multiple rounds of selection, prevailing against over 800 participants in the first round in 2025 – the largest number to date.[5]

This year marked a new approach to the preparation of the students for the international event, as more teaching and laboratory preparation courses were offered than in previous years. During these events, the students' chemistry knowledge was significantly extended beyond what is taught in high school curricula. Special emphasis was placed on the fields of advanced difficulty – a selection of topics chosen every year by the hosts that may go beyond normal IChO difficulty.[6] This year for example, diastereoselective reactions using Felkin-Anh and Zimmerman-Traxler models were one such field (see Excerpt 2). We are especially grateful to Prof. Michal Juríček and his team at the University of Zurich (UZH) for their crucial support of two days in the laboratory at UZH.[7] With the team's help, the students tackled more advanced practical problems that prepared them well for the competition in Dubai.

Fig. 1. Students and teachers during the practical preparatory weekend at UZH. Photo: Swiss Chemistry Olympiad.

The combined delegations departed to Dubai in early July. Even during the flight, the students were challenging themselves with preparatory problems, asking the mentors for help whenever they got stuck. Although the two exams take up a significant part of the event for the students, they nevertheless had many opportunities to partake in international exchange. Furthermore, their program included numerous occasions to explore Dubai and to experience the local culture.

Among the highlights during the stay in the UAE was a visit to a theme park and a visit to the Société Générale de Surveillance (SGS) headquarters for the Middle East accompanied by Swiss diplomatic staff.[8,9]

The practical exam was focused on analytical methods, especially on amino acids, copper and iron complexes and various alcohols, carbonyl- and imine-containing compounds. A selection of excerpts from the exams are given below.[10]

Excerpt 1 – Theoretical Exam, Physical Chemistry

Freshwater is scarce in the arid climate of the UAE. The country relies on solar-powered desalination plants to produce freshwater. […] Assume seawater in Dubai is at 25 °C and is an

Fig. 2. Combined Swiss and Liechtenstein delegations with mentors. Back l.t.r.: Carole Zermatten, Daniel Isler, Leonhard Mayer, Ruben Locher, Andrei Shved, Giulio Vogt, Fabian Hollinger, Silas Waldvogel. Front l.t.r.: David Hasler, Viola von Loesch, Maya Post, Carl-Philipp Cachej, Stanisław Bektaş. Photo: Swiss Chemistry Olympiad.

aqueous solution of 3.45wt-% NaCl. Assume complete ionisation of NaCl in water. The boiling point of seawater is higher than that of pure water with the boiling point elevation constant K_b = 0.5120 K kg mol^{-1}.

[Throughout the following tasks, the students were guided through the physical properties of aqueous solutions, and learned how they are exploited in multi-stage flash desalination.]

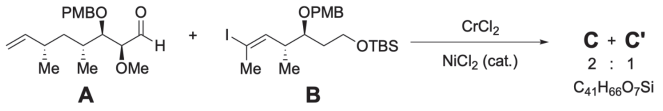
5.1 Calculate the boiling point, T, (in °C) of Dubai seawater at atmospheric pressure.

5.2 Calculate the mass percentage of NaCl, w_{NaCl}, in water that has a boiling point, T_b = 378.00 K.

5.3 The boiling point of seawater also increases as pressure increases. **Calculate** the boiling point, T_2, (in °C) of the initial Dubai seawater at a pressure, p = 2.50 atm. The latent heat of vaporisation of water, E_{vap} = 2260 kJ kg^{-1} (40.716 kJ/mol). Assume this is the same for seawater.

Excerpt 2 – Theoretical Exam, Organic Chemistry

Rapamycin was isolated from the bacterium Streptomyces hygroscopicus in 1972. It acts as a 'molecular glue' and inhibits the activity of the protein mTOR through binding to another protein. It has been used to treat various diseases. The stereochemical complexity of rapamycin makes its total synthesis challenging. The figure shows part of the first total synthesis by the Nicolaou group.[11]



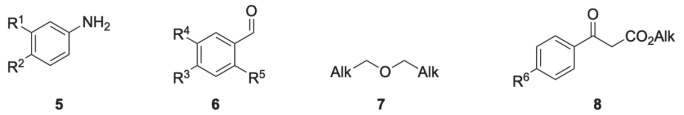
*The major stereoisomer (**C**) is formed from the chromium-mediated coupling reaction of aldehyde **A** and vinyl iodide **B** and can be predicted using the Felkin-Anh model without chelation.*

2.1a Draw a Newman projection showing the best approach of the nucleophile in this reaction. Use the labels =O, –H, –R^1, –OMe, and Nu.

2.1b Draw the full structure of the major diastereomer **C** showing all stereochemistry.

Excerpt 3 – Practical Exam

*Reagent concentration affects the rate of most chemical reactions. This often makes solventless reactions (reactions performed with little or no solvent) more robust than reactions performed in solvents. In this task you will perform a set of almost solventless reactions on a small scale to identify unknown compounds. This solventless technique allows these reactions to occur in 10 min, compared to 1–10 h in solvent. You have four unknown samples: **E**, **F**, **G**, and **H**. Each sample is different and contains one of the seven compounds listed below (**5–11**). Reaction progress will be monitored using thin-layer chromatography (TLC) visualised with a permanganate stain.*



Do not rely on the smell or physical state of any compound for identification. The substituents have not been given to prevent this. 'Alk' is an alkyl substituent. The substituents R^1–R^6 are inert in reactions you will perform. We recommend relying on the experimental tests performed to identify the samples.

[In this practical task, the students were provided with eight vials, containing unknown substances. They were instructed to perform solubility and miscibility tests, run TLC plates with the pure unknowns and the outcome of the pairwise reactions between unknowns in 1:3 or 1:6 ethyl acetate:hexane eluents. In the end, the vials with unknowns had to be matched to the compounds shown in the figure above]. For the full experimental procedure, see part B, task 3 in the practical exam.[10]

Readers are invited to attempt to solve the presented theoretical excerpts, each solvable within 10 minutes with the solutions provided in the reference list.[12] This year's achievement was exceptional, as the Swiss delegation earned their best result in over 20 years.[13] Ruben Locher, Stanisław Bektaş and Carl-Philipp Cachej each won a bronze medal. Maya Post was awarded with an honorable mention.

The 58th International Chemistry Olympiad 2026 will be hosted in Tashkent, Uzbekistan.[14]

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[12] Solutions to the presented problems:

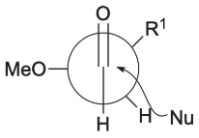
5.1 $\Delta T_b = i\, K_b\, m = 2 \cdot 0.512$ K kg mol^{-1} $\cdot$ 0.6114 kg mol^{-1} = 0.63 K, with i the van't Hoff factor (2) and m the molality. This means the elevated boiling point will be T = 373.78 K

5.2 The boiling point is to be raised by ΔT_b = 4.85 K, so we need: $m = \Delta T_b / (i\, K_b)$ = 4.74 mol kg^{-1}, which corresponds to w_{NaCl} = 21.7%.

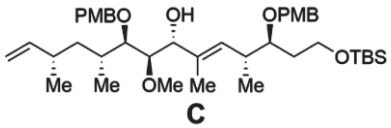
5.3 Using the Clausius Clapeyron equation:
we get T_2 = 128.73 °C.

$$ln\frac{P_2}{P_1} = -\frac{\Delta H_{vap}}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

2.1a Using the polar Felkin-Anh model (electronegative OMe perpendicular to the plane of the aldehyde), one obtains this idealised approach of the nucleophile.



2.1b The newly formed alcohol in product **C** has the absolute configuration (*R*), as can be inferred from the transition state shown in **2.1a**.



C

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