

# 44<sup>th</sup> International Chemistry Olympiad

Washington DC, USA

July 2012

## Two Bronze Medals for Switzerland at the 44<sup>th</sup> International Chemistry Olympiad Held in Washington DC, USA

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**Abstract:** A team of four high school students from all over Switzerland represented their country at the 44<sup>th</sup> International Chemistry Olympiad (IChO) held in July 2012 in Washington D.C., USA. The exceptional performances of Thanh Phong Lê and Nina Gämperli in both practical and theoretical chemistry were rewarded by two bronze medals, reflecting their efforts during the year-long preparation prior to the competition.

**Keywords:** Chemistry competition · High school · International Chemistry Olympiad · Swiss students

The International Chemistry Olympiad (IChO) is an international competition of chemistry aimed at students at high school (gymnasium) level. The first competition was held in Prague, Czechoslovakia, in 1968 and it has been running ever since with the exception of 1971. Every year a different nation hosts the event and more and more countries have been participating, culminating this year with participants from 74 countries. The 2012 competition was organized by the American Chemical Society and generously sponsored by Dow, with the event itself held at the University of Maryland.

Since its first participation, initiated by Maurice Cosandey more than twenty years ago, Switzerland has achieved numerous medals, attracting more and more young chemists every year.

Switzerland was represented this year by:

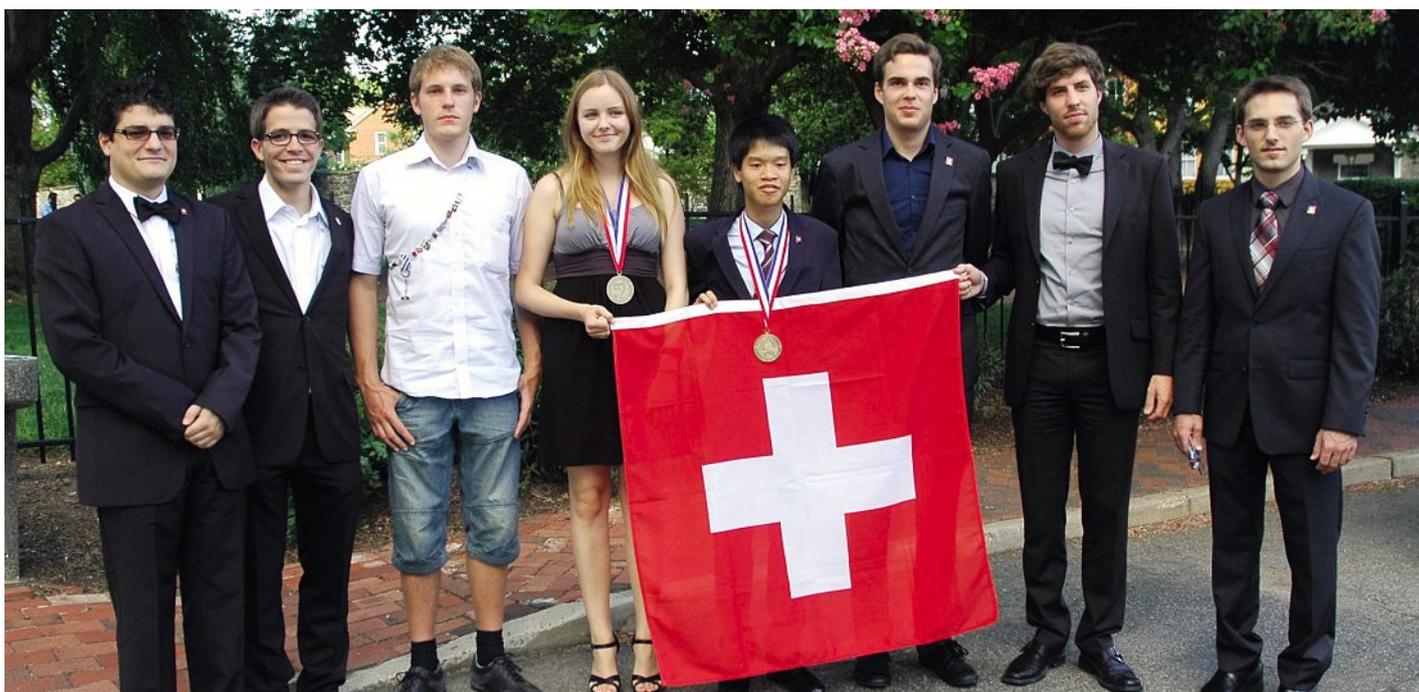
**Thanh Phong Lê** (Gymnase du Bugnon, Lausanne)  
**Nina Gämperli** (Kantonsschule am Burggraben, St. Gallen)  
**Boris Stolz** (Kantonsschule Hohe Promenade, Zurich)  
**Marc Milewski** (Kantonsschule Wohlen, Wohlen)

The students were accompanied by their mentors:

**Basile Wicky** (head-mentor, ETH Zurich)  
**Sebastian Keller** (mentor, ETH Zurich)  
**Peter Ludwig** (observer, ETH Zurich)  
**Alain Vaucher** (observer, ETH Zurich)

We are very proud to report, this year again,<sup>[1]</sup> two bronze medals for our Swiss team with the remarkable results of Thanh Phong Lê and Nina Gämperli. In order to achieve such a success they had to compete against almost 300 students in two exams of five hours each, one practical and the other on paper. The absolute winner of this year was Florian Berger from Germany, achieving an outstanding 97.6% of correct answers overall.<sup>[2]</sup> For the first time this year, a Liechtenstein team composed of Jasmina Büchel and Jonas Hasler (Liechtensteinisches Gymnasium Vaduz), who trained together with the Swiss delegation, also attended the IChO, under the mentoring of Karin Birbaum (ETH Zurich alumni) and Lucia Meier (ETH Zurich alumni).

But if competition is an important ingredient of such an event, there is much more to it. It is first of all a tale of passion, enthusiasm and thirst for discovery that attracts young chemists



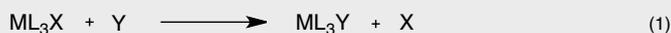
The Swiss team at the closing ceremony of the 44<sup>th</sup> IChO. From left to right, Peter Ludwig, Alain Vaucher, Marc Milewski, Nina Gämperli, Thanh Phong Lê, Boris Stolz, Basile Wicky, and Sebastian Keller.

from all over Switzerland to take part in the national competition and training camps organized each year by the Swiss Chemistry Olympiad (SwissChO). It is the same motivation that takes them all the way to the IChO, where they get the chance to meet like-minded people, smart young students with a will to learn. We would like to congratulate all the participants from both the national Olympiad and the IChO for their inquisitiveness and their eagerness to learn. The SwissChO wishes to thank all the members of its organization as well as our generous sponsors, which allowed us to be part of this formidable edition of the Chemistry Olympiad.

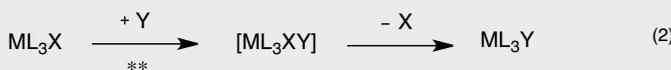
The next IChO will be held in July 2013 at the Moscow State University in Russia and we already look forward to another year of chemistry.

### Example of a Question at the IChO

Substitution of the ligand X by Y in square planar complexes can occur in either or both of two ways:

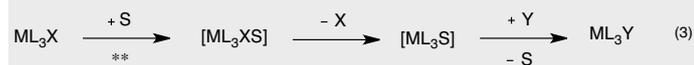


*Direct substitution:* The incoming ligand Y attaches to the central metal, forming a five-coordinate complex, which then rapidly eliminates ligand X to give the product  $\text{ML}_3\text{Y}$



\*\* = rate-determining step, rate constant =  $k_Y$

*Solvent-assisted substitution:* A solvent molecule S attaches to the central metal to give  $\text{ML}_3\text{XS}$ , which eliminates X to give  $\text{ML}_3\text{S}$ . Y rapidly displaces S to give  $\text{ML}_3\text{Y}$ .

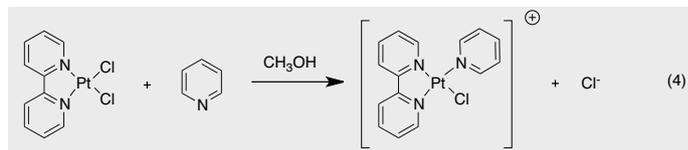


\*\* = rate-determining step, rate constant =  $k_S$

The overall rate law for such substitutions is

$$\text{Rate} = k_S[\text{ML}_3\text{X}] + k_Y[\text{Y}][\text{ML}_3\text{X}], \text{ when } [\text{Y}] \gg [\text{ML}_3\text{X}], \text{ then rate} = k_{\text{obs}}[\text{ML}_3\text{X}]$$

The values of  $k_S$  and  $k_Y$  depend on the reactants and the solvent involved. One example is the displacement of the Cl<sup>-</sup> ligand in a square planar platinum(II) complex,  $\text{ML}_2\text{X}_2$ , by pyridine ( $\text{C}_5\text{H}_5\text{N}$ ). (The  $\text{ML}_3\text{X}$  scheme above applies to  $\text{ML}_2\text{X}_2$ )



Values of  $k_{\text{obs}}$  ( $\text{s}^{-1}$ ) for reactions at 25 °C in methanol as a function of pyridine concentration (mol/L) are  $7.20 \times 10^{-4}$ ,  $3.45 \times 10^{-4}$  and  $1.75 \times 10^{-4}$  for 0.122, 0.061 and 0.030 respectively. Note that  $[\text{pyridine}] \gg$  the concentration of the platinum complex. Calculate the values of  $k_Y$  and  $k_S$  with the proper units for each constant.

**Answers:**  $k_Y = 5.8 \times 10^{-3} \text{ s}^{-1} \text{ M}^{-1}$  and  $k_S = 0 \text{ s}^{-1}$

More problems from the 44<sup>th</sup> IChO can be found at [www.icho2012.org](http://www.icho2012.org)

- [1] K. Birbaum, P. Ludwig, B. Wicky, A. Vaucher, *Chimia* **2012**, 66, 136.  
 [2] <http://www.icho2012.org/olympiad/all-results-and-rankings>