



Canadian Chemistry & Physics Olympiads Olympiades canadiennes de chimie & physique

Special Report 2009



National Office

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Since 1985, the Chemistry & Physics Olympiads has been fostering a wider appreciation of chemistry and physics as careers for talented young pre-university Canadian students, and promoting improved teaching standards in both disciplines.

A few dates from the history of the Chemistry & Physics Olympiad

- 1968 First IChO held, in Prague, Czechoslovakia
- 1974 Sweden becomes the first nation outside “Soviet block” to participate
- 1980 Austria hosts first IChO held outside “Soviet block”
- 1986 Canada first participates in the IChO, held in Leiden (The Netherlands)
- 1987 First student from outside Toronto qualifies for the national team
- 1988 Canadian program becomes “national”
- 1989 Inaugural training camp, held at the UBC
(12 students: Québec (4), Ontario (4), BC (3), Nova Scotia (1))
- 1991 First “stop over” for the team members, held at Merck Frosst Center for Therapeutic Research prior to the 23rd IChO in Poland.
- 1997 Canada hosts the IChO (Sudbury) and IPhO (Montreal)
- 2003 Best performance of Canadian students at IChO (1 gold, 2 silver, 1 bronze)
- 2006 Best performance of Canadian students at IChO (1 gold, 2 silver, 1 bronze) & IPhO (2 gold, 2 bronze, 1 honourable mention)
- 2007 Best performance of Canadian students at IPhO (2 gold, 2 bronze, 1 honourable mention)
- 2008 Most combined medals for IChO and IPcO teams (1 gold, 3 silver, 5 bronze)
- 2009 Both IChO and IPhO teams won four medals each (1 silver and 3 bronze)





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Jason Harlow, *NOF Lecturer*

Andrzej Kotlicki, *IPhO Team Leader*

Natalia Krasnopolskaia, *NOF Lab Coordinator*

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Daily lectures, exams and laboratory exercises allowed us to select the best students to represent Canada at the International Finals.

National Finals

University of Toronto

June 2 - 8, 2009

The International Chemistry and Physics Olympiads (IChO and IPhO) have risen from very humble beginnings in 1967, when only three nations from Eastern Europe participated. The Olympiads have been held every year since and they now attract close to 80 countries from all continents. The goal of these competitions was, and continues to be, the encouragement of excellence

in science education throughout the world; these competitions are the most prestigious of their kind for students at the high school or CÉGEP level.

Canada first participated in the International Chemistry Olympiad in 1986 and in the International Physics Olympiad in 1985. Since 1986, our Chemistry students have won 6 Gold, 18 Silver, and 43 Bronze Medals, along with

two Honourable Mentions. Since 1985, our Physics students have won 8 Gold, 11 Silver, and 33 Bronze Medals, in addition to 29 Honourable Mentions.

Students take part in the Olympiads by first sitting one of several selection examinations. These examinations take place in mid-to-late April or early May. In addition to the above examinations, students in Western Canada and





Chemistry Students in the labs



Judging during the IChO Finals

in Ontario may be invited to a Regional Olympiad training session based on their results in a year-long training program.

At the Finals, the Canadian teams are selected to compete in the International Olympiads for Chemistry and Physics, where the best students from some 80 nations compete for gold, silver and bronze medals. Participation in the Canadian Finals

or an International Olympiad is a tremendous experience and a unique opportunity to travel and meet fellow students from around the world who share similar interests.

The 2009 National Olympiad Finals were held at the University of Toronto.

The composition of the National Finals accurately illustrates the national character of the program.

A traditional feature of the National Finals is a visit to an industrial or research laboratory. Chemistry students visited the NMR facilities at the University of Toronto at Scarborough. Professor André Simpson presented a very interesting application of NMR studies for analysis of a popular drink "Red Bull". Physics students visited the Perimeter Institute for Theoretical Physics in Guelph, ON.





Chemistry Students attending the National Finals



From left: Andy Dicks, Connie Zhao, Asparouh Lilov, Jeremy Witmer, Eric Coomes and Patrick Kim

Chemistry

Based on the results of the Canada-wide examinations in chemistry (CCC exam) and physics (CAP exam) and other local competitions, 10 chemistry students and eleven physics students participated in the 2009 National Finals at the University of Toronto.

Chemistry finalists came from the following provinces: British Columbia (2 students), Alberta (1), Nova Scotia (1), Ontario (5), and Quebec (1). Here is the complete list of students participating in chemistry finals:

Brian Bi, *Woburn Collegiate Institute (Scarborough, ON)*
¹Eric Anthony Coomes, *Appleby College (Oakville, ON)*
Vivek Kesarwani, *University of Toronto Schools (Toronto, ON)*
Jason Kwok, *University of Toronto Schools (Toronto, ON)*
¹Asparouh Lilov, *Marianapolis College (Montreal, QC)*
Ryan Lo, *Steveston-London Secondary School (Richmond, BC)*
¹Jeremy David Witmer, *Yale Secondary School (Abbotsford, BC)*
Ray Xing, *Western Canada High School (Calgary, AB)*
Dongbin Zhang, *Citadel High School (Halifax, NS)*
¹Connie Ann Zhao, *University Toronto School (Toronto, ON)*

Chemistry Instructors:

Scott Browning, *University of Toronto (Toronto, ON)*
Vesna Cotic, *University of Toronto (Toronto, ON)*
Katherine Darvesh, *Mount Saint Vincent University (Halifax, NS)*
²Andrew Dicks, *University of Toronto (Toronto, ON)*
Patrick Kim, *University of Toronto (Toronto, ON)*
Hyungjin Lee, *University of Toronto (Toronto, ON)*
²Jeffrey Mo, *Massachusetts Institute of Technology (Boston, MA)*
Stanislaw Skonieczny, *University of Toronto (Toronto, ON)*

¹Students selected to represent Canada at the 41st IChO, Cambridge, U.K., July 18-27, 2009

²Mentors



Physics Students attending the National Finals



From left: Shawn Xu, Jonathan Zung, Michael Zhang, Remy Abraham Mock and Jixuan Wang

Physics

The physics field was made up of students originating from the following provinces: British Columbia (3 students), Ontario (6), and Quebec (2).

The following students participated in the National Olympiad Finals:

Jaebum Chung, *St Theresa Of Lisieux School (Richmond Hill, ON)*

Tianyi (Albert) Hu, *Northern Secondary School (Toronto, ON)*

Dodam Ih, *Appleby College (Oakville, ON)*

Nikita Lvov, *Marianopolis College (Montreal, QC)*

Ali Majdzadeh, *Port Moody Senior Secondary School (Coquitlam, BC)*

¹Remy Abraham Mock, *Mt. Douglas Secondary School (Victoria, BC)*

Jordan Payette, *Collège de Bois-de-Boulogne (Laval, QC)*

¹Jixuan Wang, *Don Mills Collegiate Institute (Toronto, ON)*

¹Xiao Heng (Shawn) Xu, *Burnaby North Secondary School (Burnaby, BC)*

¹Zhaoxi Michael Zhang, *Crescent School (Richmond Hill, ON)*

¹Jonathan Samuel Zung, *University of Toronto Schools (Toronto, ON)*

Physics Instructors

Tetyana Antimirova, *Ryerson University (Toronto, ON)*

Boris Braverman, *University of Toronto (Toronto, ON)*

Jason Harlow, *University of Toronto (Toronto, ON)*

Natalia Krasnopolskaia, *University of Toronto (Toronto, ON)*

Vatche Deyirmenjian, *University of Toronto (Toronto, ON)*

Physics Mentors

Andrzej Kotlicki, *University of British Columbia, (Vancouver, BC)*

Guillaume Chabot-Couture, *Stanford University (Palo Alto, CA)*

¹Students selected to represent Canada at the 40th IPhO, Mérida, México, July 11-19, 2009

Chemistry



The Canadian team at the 41st IChO.
From left: Eric Coomes, Connie Zhao,
Dr. Andrew P. Dicks, Jeffrey Mo, Jeremy
Witmer, and Asparouh Lilov

International Finals - 41st IChO

Cambridge, U.K.

July 18 – 27, 2009

The 41st International Chemistry Olympiad was held between July 18th – 27th 2009 at the University of Cambridge. Teams attended from 66 countries worldwide with 250 students participating in total. The Canadian team enjoyed (unsurprisingly) mixed weather throughout their stay in England, with plenty of rain thrown in. Mentors split their time between Robinson College (Cambridge) and St. Anne's College (Oxford), where much of their academic work took place. This made

for an exciting cultural experience with chances to explore the ivory towers in both cities. Faculty from Cambridge, Oxford and the University of East Anglia organised the academic part of the competition. This year there were three practical problems (designed to take five hours of laboratory time) and six theoretical questions.

The laboratory experiments involved an environmentally friendly aldol condensation in the absence of solvent with isola-

tion and purification of the resulting solid. Students also analysed a copper (II) complex containing multiple elements by titration to deduce its molecular formula. In a novel and applauded style, the final problem had a "inquiry-based" feature where students designed a method to calculate the critical micelle concentration of a surfactant. This proved the most challenging question throughout the whole program. Three of the six theoretical tasks focused on physical concepts: estimating the

Medal Standings at the 41st IChO, Cambridge, U.K., 2009 (Top 26 Countries)

HM = Honourable Mention.

Place	Country	G	S	B	HM	Place	Country	G	S	B	HM
1	Chinese Taipei	4				15	Belarus	1		3	
2	China	3	1			17	Israel	1		1	
2	Russian Federation	3	1			18	India		4		
4	Korea Republic	3				18	Thailand		4		
5	Singapore	2	2			18	United Kingdom		4		
6	Japan	2	1	1		21	Australia		3	1	
7	U.S.A.	1	3			21	Poland		3	1	
8	Germany	1	2	1		23	Lithuania		2	2	
8	Hungary	1	2	1		24	Turkey		2	1	
8	Vietnam	1	2	1		25	Canada		1	3	
11	Romania	1	1	2		25	Czech Republic		1	3	
12	Estonia	1	1	1	1	25	Indonesia		1	3	
13	France	1	1	1		25	Mexico		1	3	
13	Iran	1	1	1		25	New Zealand		1	3	
15	Austria	1		3		25	Ukraine		1	3	

Avogadro constant, interstellar production of hydrogen gas and protein folding. Two organic problems were built around synthesis of amprenavir (an anti-HIV drug) and epoxy resin preparation. Lastly, transition metal complex structure and analysis formed the basis of an inorganic chemistry challenge. Peter Wothers, the scientific committee chairman, was a competitor on the U.K. team in 1987 (Hungary). His intimate knowledge of Olympiad mechanisms on many lev-

els ensured the academic component ran incredibly smoothly.

The Canadian team performed well, winning one silver medal (Asparouh Lillov, ranked 67th overall) and three bronze medals (Eric Coomes (108th), Connie Zhao (115th) and Jeremy Witmer (155th)). A total of 28 gold medals, 54 silver medals, 82 bronze medals and 9 honourable mentions were awarded amongst the 250 participants. The Canadian results matched those of one year

ago at the 40th International Chemistry Olympiad, held in Budapest. Unusually this year, the top eight gold medals were awarded to students from eight different countries (China, Israel, Taiwan, Romania, Korea, Japan, France and Russia). As Israel has only been competing for five years it represents a tremendous achievement for an Israeli student to be ranked second in the world.



Physics



The Canadian team at the 40th IPhO. From left: Professor Andrzej Kotlicki, Remy Abraham Mock, Jixuan Wang, Michael Zhang, Shawn Xu, Jonathan Zung and Guillaume Chabot-Couture

International Finals - 40th IPhO

Mérida, México

July 11 - 19, 2009

While most travelers head to Cancun for a beach vacation amongst a sea of tourists, this year the 40th International Physics Olympiad (IPhO) was held in Mérida, México a few hours from Cancun on the calmer Northern edge of the Yucatan peninsula. From the 11th to the 20th of July, a total of 73 countries participated in the competition while 12 countries cancelled their participation due to the swine flu scare. The organizers treated the scare seriously, measuring the skin temperature of each participant daily with an infrared

thermometer and having two doctors on staff at all times. In the end, no cases were found among the participants.

The competition was important for the Mexican state of Yucatan whose governor, the honourable Ivonne Pacheco, opened it with a warm, personal speech to participants. Several other speakers from the Organizing Committee, the government, Mexican universities, the Mexican Physical Society and the IPhO organization welcomed the participants, stressed the importance of Science and Educa-

tion, congratulated the students their achievement in being selected as the team members representing their countries, and wished them success in the competition. There were a total of three evening lectures presented to students and leaders, including one from the 1993 Nobel Prize Laureate Professor Joseph Taylor on binary pulsars astronomy.

The academic part of the competition was organized by the faculty members from the National University of Mexico, the University of Yucatan and other Mex-



Medal Standing at the 40th IPHO, Mérida, México, 2009 (Top 30 Countries)

Place	Country	G	S	B	HM	Place	Country	G	S	B	HM
1	China	5				16	Israel	1	1	3	
2	India	4	1			16	Serbia	1	1	3	
2	United States	4	1			18	Poland	1	1	2	1
2	Korea Republic	4	1			19	Slovakia	1		4	
5	Chinese Taipei	3	2			20	Germany		5		
5	Russian Federation	3	2			20	Vietnam		5		
5	Romania	3	2			22	Belarus		3	2	
8	Singapore	2	3			22	France		3	2	
9	Kazakhstan	2	2			22	Great Britain		3	2	
10	Japan	2	1	2		25	Czech Republic		2	3	
11	Thailand	1	4			26	Brazil		2	2	1
12	Hungary	1	3	1		26	Bulgaria		2	2	1
12	Indonesia	1	3	1		29	Canada		1	3	1
14	Hong Kong	1	2	2		29	Australia		1	2	1
15	Turkey	1	2	1	1	30	Estonia		1	1	2

ican universities and research centers. All five problems, both theoretical and experimental, were well prepared and tested the students' original thinking and experimental abilities. Just in time for the 40th anniversary of the first human on the Moon, the theoretical problems featured astronomical problems. The first discussed the transfer of angular momentum from the Earth to the Moon through the tides the latter induces on the former as well as, for example, the yearly increase of the Earth-Moon distance. The sec-

ond problem discussed the physics of laser cooling, an important tool in the creation of Bose-Einstein condensates. The last problem showed to students how quantum mechanical effects are important to the fusion of hydrogen into helium that takes place at the center of stars by having them calculate both the fusion temperature and the M/R ratio of stars on the main sequence. The experimental problems were also particularly interesting. The first had the students measure the wavelength of a HeNe laser using the diffraction from a sharp

razor blade while, in the second, the students had to characterize the birefringence of a thin slab of mica using polarizers.

The Canadian team performed well, winning one silver medal (Jixuan Wang), three bronze medals (Remy Mock, Shawn Xu, Jonathan Zung) and an honourable mention (Michael Zhang). A total of 41 gold medals, 70 silver medals, 79 bronze medals and 45 honorary mentions were awarded amongst the 316 participating students.

Canada is the only country in the listed tables with the organization of Chemistry and Physics Olympiads based entirely on volunteer work. Fundraising, organizing the academic program with related provincial and national selection processes, team training and escorting of students to international competition venues was all done by volunteers. That is why we very grateful to dozens of individuals across the country for their involvement and expertise

We are very thankful to Professor Pekka Sinervo, former Dean of the Faculty of Arts and Science, University of Toronto for his interest and financial support. In fact, more than 30% of our annual budget comes from this source. Professor Sinervo also provided special scholarships for students who qualify for the Canadian teams in Chemistry and Physics and choose to study at the University of

Toronto. The Faculty of Arts and Science of the University Of Toronto remains our most important sponsor.

Our second most important sponsor is the PromoScience Division of

istry Departments of universities across Canada to make donations toward the Olympiad. We also get secretarial and technical support from the University of Toronto's Department of Chemistry.

Sponsors & Supporters

NSERC. We are very grateful that the NSERC resumed their support to the most talented high school students in Canada.

We are also grateful to Professor Scott Mabury, former Chair of the Department of Chemistry, University of Toronto, for his support of our program and his initiative to approach the Chem

The University of British Columbia also helped substantially in 2009. Professor Gordon Bates obtained sponsorship from the Chemistry Department and Professor Andrzej Kotlicki enlisted the support of the Department of Physics and Astronomy.

We also thank our industrial supporters: Imperial Oil Foundation, Boehringer Ingelheim and Rechem.

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