



## *Van 't Hoff: First ever Nobel Prize in Chemistry winner*

For the Netherlands, Chemistry 2001 was a special year, the 'Van 't Hoff-year'. More than a hundred years ago, in 1901, the first ever Nobel Prize for Chemistry was awarded to the Dutch physical chemist Jacobus Henricus Van 't Hoff. Van 't Hoff earned the Nobel prize for 'the discovery of the laws of chemical dynamics and osmotic pressure in solution', as the jury put it. The prize was not awarded for his description of the asymmetrical carbon atom, in itself worthy of a Nobel prize.

In 1901, Van 't Hoff was only 49 years old, but he already had a marvelous career behind him. In 1892 he became a member of the Royal Prussian Academy of Sciences, in 1893 he was awarded the Davy medal by the English Royal Society, and in 1894 he was named a 'Chevalier de la Légion d'Honneur' by France. Recently, he has been numbered among the 80 founders of chemistry. Starting from his ideas about the tetrahedral structure of carbon compounds, he moved on to chemical kinetics, osmotic pressure and geochemistry. Throughout the years he had to defend his ideas about stereochemistry and diluted solutions to the established chemists.

Van 't Hoff was born on August 30, 1852. In high school he developed his lifelong passion for chemistry. In 1869 he went to the Polytechnic School in Delft to study chemical technology. Two years later, after having gained his diploma at breakneck speed, he continued his studies in Leyden, focusing on mathematics and theoretical chemistry. Van 't Hoff wrote his thesis, entitled 'Contribution to the knowledge of cyanoacetic acid and malonic Acid' at the age of 22, in which he proposed the tetrahedral structure of carbon compounds.

*Visit the website:*

[www.chem.rug.nl/icho34](http://www.chem.rug.nl/icho34)

It would later be called 'a product of childish fantasy' by the German professor Herman Kolbe despite the fact that it was the perfect explanation for Pasteur's experiments with tartaric acid. After working as a private teacher, as a lecturer at the Veterinary College

See next page >>



Models of the tetrahedral structure of carbon compounds made by Van 't Hoff in 1875 for a friend.

## *Happy to present Catalyzer 2*

The team organizing the Olympiad is becoming more and more excited as the date of the Olympiad draws closer. We are eagerly looking forward to your arrival in Groningen. We would like to extend a particularly warm welcome to Egypt, Iceland and Turkmenistan, who are participating with official teams for the first time.

This mailing is being sent to you along with the preparatory problems. By the time you receive it, the preparatory problems will have appeared on the web site. Please note that only the numerical answers are listed on the web site. The worked solutions are included in the hard copy. This means that you will have control over the distribution of the worked solutions to the problems to your students.

A number of delegates will have to apply for visas via the Dutch Embassy in their home country. We have done everything possible to facilitate the process for obtaining visas. Please note that it will take about 4 weeks to get a visa as a result of the Schengen treaty. The microscale sets that will be used during the Olympiad can be obtained from Kimble-Kontes, see: <http://www.kimble-kontes.com/html/pg-748000-Microscale.html>. Binne Zwanenburg, chair of the academic committee, has assured me that the practical problems can also be performed with ordinary glassware. This is explained in more detail in the prep. tasks.



I would also like to wish you all the very best for the year 2002, and I look forward to welcoming you to Groningen in July.

**Jan Apotheker,**

*Chair of the organizing committee for the 34th International Chemistry Olympiad*



## Impressions of Mumbai

From 6-15 July 2001, host country India organized the 33rd International Chemistry Olympiad in Mumbai. The winners of the tournament came from China, Russia and Argentina. Although the Dutch team only managed to win a single bronze medal, the Olympiad was an unforgettable experience for them. The amazing impression made by the host country played a not inconsiderable part in this.

'Mumbai can't be compared with any other city I've ever visited,' says Jan Apotheker, the organizer of the International Chemistry Olympiad 2002 in the Netherlands. 'So many people, so much bustle in such a small place, unpaved, narrow streets, small stores and food stalls everywhere. Even when



Traffic in Mumbai

there was half a meter of water in the streets from the monsoon rains, life just carried on regardless. The Indians just quietly waded through it. I also noticed how colorful and tidily everyone was dressed despite everything.' The Mumbai traffic is also etched into the memories of the Dutch delegation. 'Everything was honking its horn and making a noise',

remembers delegate Maaïke van den Heuvel. 'It's amazing that we only crashed into a cab once.' In addition to life on the streets, contacts with the Indians and participants from other countries also made an impression. 'When I think back on India, our fantastic guide always springs to mind', says Van den Heuvel. 'She was a wonderful person, called Pooja. She fitted

## >> Van 't Hoff

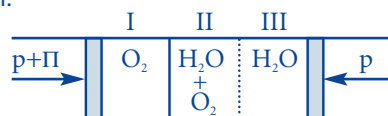


Van 't Hoff at the age of 20

in Utrecht and as a lecturer at the University of Amsterdam, in 1878 he was appointed Professor of Chemistry, Mineralogy and Geology. His inaugural address was entitled 'The power of imagination in Science'. The work he did in Amsterdam on equilibria finally led to him being awarded the Nobel Prize. The laboratory in which he carried out his work is named after him and is now a museum. Many students attended Amsterdam

University to be taught by Van 't Hoff but, according to the famous professor himself, a great deal of his time was wasted in teaching instead of his beloved research. In 1896, Max Planck invited him to go to Berlin as an Honorary Professor, giving him the opportunity to work without any teaching obligations. In spite of vigorous efforts by the city council of Amsterdam and the Ministry of Education to persuade him to stay, Van 't Hoff moved to Berlin. Through all of Van 't Hoff's work, one theme keeps recurring, that of affinity. In stereochemistry, four atoms are attracted to a central carbon atom. With this in his mind, he described the way molecules react with each other. In his concept of chemical equilibrium, attraction and repulsion play important roles. He also applied this to the attraction between liquid and dissolved material, which logically led to the theory of osmotic pressure. Finally, Van 't Hoff formulated a theory about salt deposits. Here, affinity determines the most stable formation. We can certainly be sure of one thing, subsequent chemists, right down to the

present day, still have an affinity with the ideas of Van 't Hoff, not only his theoretical innovations, but also his imagination.



### Van 't Hoff's Law

Van 't Hoff is known all over the world because of Van 't Hoff's Equation. The origin of this equation is a description of a three-compartment system, as illustrated in the figure. Pressure  $p$  is being exerted on the left-hand piston and pressure  $p$  is also being exerted on the right-hand one. Compartment II contains a gas which is hard to dissolve in a liquid. Oxygen dissolved in water is a good example of this. The pressure in compartments I and II is  $p+\Pi$ . A semi-permeable membrane separates compartments II and III; water is able to flow freely through the membrane but not oxygen. Van 't Hoff wondered whether 'the diluted gas in I acts according to the Boyle-Gay Lussac's Law, in compartments II and III Henry's Law can be applied (that states that the gas pressure in I is proportional to the concentration of gas in II). How can the osmotic pressure be related to the elastic pressure in I, depending on the amount of gas in the several compartments? Changing the volume of one of the compartments I or II directly influences the volume of the other, according to Henry's Law. Thus it can be demonstrated that the osmotic pressure of the solution is identical to the elastic pressure of the gas, in this case the concentration of the gas is equal in both compartments.' Van 't Hoff concluded that the osmotic pressure can be described by the following formula  $\Pi=iRTx$ , where  $x$  is the molarity,  $i$  is the so-called Van 't Hoff factor of the gas,  $R$  is the gas constant and  $T$  is the temperature. This formula is now known as the Van 't Hoff equation.



## Dear Friends and Colleagues,

It is a privilege and a great pleasure to welcome you to the 34th International Chemistry Olympiad.

After fifteen years we are very glad to organize this prestigious event once again in the Netherlands. It is the University of Groningen that took the initiative.

We set up a team of enthusiastic organizers and a scientific committee with well known chemists from all Dutch universities. Together with a strong financial support from the Government and our chemical industry we are well prepared to work on every detail of 'our' IChO in July 2002.

More than a hundred years after the first Nobel Prize for chemistry for the Dutch chemist Van 't Hoff we have a strongly developed chemical science and chemical industry. Groningen is an interesting north pole of this chemistry.

We are sure that we can make the 34th IChO especially memorable at the chemical as well as at the social and cultural level.

Looking forward seeing you all in the Netherlands, Groningen summer 2002.



With best wishes,

**Wout Davids**  
President of the  
34th IChO

perfectly into our team. We are all rather creative, or at least that's what we think, with the result that we are always drawing strange figures, portraits of each other. Pooja was just as mad and drew along with us. To top it off, she was an incredibly nice person. She even got up specially at 6 o'clock one morning, just to wish us luck.' The winner of the bronze medal, Daan Brinks, also fondly remembers the people he met in Mumbai. 'National Olympiads are great for making contacts but it's even better when you are standing talking in broken English during an international Olympiad with people from three different countries and you have the feeling that they know what you're talking about. And then our team is usually great fun. Despite the fact that we all were ill at some point, the Olympiad was a roaring success as far as I'm concerned.'

### Conceptual ideas

Jan Apotheker is very positive about the organization of the 33rd International Chemistry Olympiad. 'In the brief time that the host country had to organize it, they managed to achieve an incredible amount. It looked very good. The atmosphere was very positive, quiet, and amiable.' As a

didactician, Apotheker was also pleased with the problems set for the students. 'I was particularly impressed with the fact that conceptual ideas were also included in the problems. For example, one of the questions was about the hydrogen atom, consisting of a nucleus, a proton and an electron orbiting the nucleus. What happens when you replace that electron by a muon, a particle with the same charge but a different mass. You can only answer this question if you really understand the concept of an atom. The really brilliant people are particularly good at dealing with this kind of questions.' Jan Apotheker soaked up everything he saw in India. What did he learn for the Olympiad in Groningen? 'They had organized their computer room particularly well. I also noticed that at a certain moment you need to have a computer printout of the final problems. Everyone could get hold of them via the Internet, but that kind of printout is more important than I'd thought. I also learned that it is important to plan in enough breaks. Even as a supervisor you hardly have a moment's peace. You only sleep four hours a night. All in all, Olympiads are hard work.'

### Results ICHO 33 Mumbai, India

#### Top Three (scores out of 100)

- 1 Siyuan Chen(China), score: 92,31
- 2 Iouri Chliapnikov (Russian Federation), score: 91,51
- 3 Esteban Andres Ganc (Argentina), score: 90,20

#### Special Prizes

*Best Overall Performance*  
Siyuan Chen (China), score: 92,31

*Best Performance among  
Female Participants*

Shadi Rajabi (Iran), score: 90,18

## Lessons in Dutch

### Part 1

- Hello, how are you?
- I'm all right thank you.
- Thank you.
- Please.
- It's cold, isn't it?
- Good morning.
- Good night.
- Good luck!
- How much is that in euros?
- Are you going to the party tonight?
- Please may I have a cup of coffee/a cup of tea/ a beer/a glass of wine?
- Hallo, hoe gaat het?
- Met mij gaat het goed, dank je.
- Dankjewel.
- Alsjeblieft.
- Koud hè?
- Goeiemorgen!
- Welterusten.
- Veel succes!
- Hoeveel Euro kost dat?
- Ga je vanavond naar het feest?
- Mag ik een kopje koffie/ kop thee/pilsje/ glaasje wijn?



## Practical Information

### Participation and Registration

All registration forms have been sent out to the head mentors before Christmas.

You will also find a copy of them on the official website of the 34th IChO. The country registration form and the payment form must be returned to us by **February 1, 2002**, the mentors', observers' and guests' registration forms by **March 1**, while the students' registration forms and travel details can wait until **May 15, 2002**. Payments should be made by **March 1, 2002**.

A **Delegation** consists of six participants: two mentors and four competitors (students). Accommodation, meals and programs for the two mentors and 4 students are provided by the organizers. A delegation may be extended to 7 by a scientific observer. The scientific observer and any accompanying guests must pay a registration fee of US\$ 1500.

**Mentors** should be experienced and trusted advisors with a good command of the English language. They must be able to translate the examination papers from the English version into their pupils language and to participate in the discussions of the International Jury.

A **Scientific Observer** is a person who is participating for a competing delegation in order to gather experience to become a mentor in future olympiads. The scientific observer, therefore, is allowed to participate in translating the examinations and to attend the meetings of the International Jury. A scientific observer can also be an official delegate from a country, that is planning to participate in the olympiad in the coming years. Each observing country is allowed to send one observer, who will enjoy the same privileges as the scientific observer. The registration fee for him/her is also US\$ 1500.

**Students** are the competitors. They must not be enrolled in university, and they can only be enrolled as students in secondary schools not specialized in chemistry. If they have already graduated from secondary school the organisation must be informed about the month and the year of their graduation. (See the students' registration form). Furthermore, students must be under the age of 20 at July 1, 2002. The age of the participants will be checked in their **passports** at registration.

**Guests** are persons not allowed to participate in any formal activities of the International Jury. Their registration fee is US\$ 1500, which covers accommodation, meals and a guest program.

**Registration Fee.** This standard registration fee covers a full delegation of four students and two mentors. This is a standard fee, and no discount will be given to smaller delegations.

$$\text{Participation fee} = 100 * N \text{ US\$}$$

(N = number of years of participating or number of years elapsed since being a host of an IChO)

Apart from that a registration fee of US\$ 1500 will be charged for every person accompanying the official delegation. See the payment form.

**Health Insurances** Participants, mentors, observers and guests are obliged to have a health insurance. When you register at the IChO-Secretariat we will check that your delegation is sufficiently insured. If you are not insured you will not be admissible to the Olympiad. Please remember to bring the necessary documentation.

The organizers will arrange for accident insurance for all participants in connection with the organized program. They will also be provided with a public liability insurance (third party insurance).

**Academic conduct** During the opening session we will ask one of the students to pledge a code of academic conduct on behalf of all the participants:

*On behalf of all participants I solemnly pledge*

- *To uphold the Code of Academic Conduct which establishes and provides a system in which high standards of integrity, fairness, equal opportunity, and professionalism in the conduct of academic pursuits.*
- *To participate in this event in an honorable and fair fashion in accordance with the code of academic conduct.*
- *To uphold the regulations of the International Chemistry Olympiad.*

**Communication Devices** These include mobile phones, laptop computers with communication devices, palm-size computers etc. Neither students nor mentors nor any of the observers are allowed to have access to or to attempt to have access to such communication devices. This means that you must deposit all your communication devices from Saturday afternoon to Wednesday evening and that the phone lines in and out of your hotels will be disconnected during the same period.

**Computers and Software** The computers to be used during the translation period will have an international version of Windows 2000 and Office installed. It will not be possible for us to supply all the different delegations with keyboards matching their specific languages, but you are allowed to bring your own keyboards and laptop computers for use during the translation period (provided they are approved by the organizers). If you need to install your own software, we would like to know in advance. In that case please indicate this on the Mentors' registration form, and send the necessary software **two months before the olympiad** to us.

**Calculators** for the examinations will be provided by the organizers (TI-83+). No other aids are allowed.

The **Preparatory Problems** are being sent to you with this issue of Catalyzer. They are also available on the official website of the 34th IChO.

# Travel and Accommodation

## Visa and Immigration

When travelling to the Netherlands citizens of a number of countries need to apply for a visa for a short stay. You can apply for a visa at any Dutch embassy or consulate.

We have included information about visa in the mail sent to the head of the delegation. This information will also be available as a PDF-file on the website.

## Arrival in the Netherlands

When you arrive on Friday, July 5, at Schiphol International Airport Amsterdam, you will be met at the airport. A guide will accompany you to Groningen Central Station. From there you will be transferred to the university building ("Academie Gebouw").

## Early Arrival and Late Departure

If your delegation arrives before July 5, or leaves later than July 14, we are able to help you with accommodation before and after the olympiad. Please indicate on the Travel details form how many nights and how many rooms you will need. Notice that we will only provide transportation from/to the airport or Groningen Central Station on July 5 and 14. However, it is very easy to travel by train from Schiphol Airport to Groningen.

## Accommodation and Meals

Students will be staying at the Van der Valk Motel-Zuidbroek, and mentors, observers and guests will be staying most of the week at 'It Wiid'-Eernewoude and a few days at hotels in Groningen. *Further information follows in Catalyzer 3.* If you have any special dietary needs, we would like you to specify these in the different registration forms.

## The IChO-Secretariat

The secretariat will be located at the University Groningen, location Zernike, Nijenborgh 4 – 9747 AG – Groningen, the Netherlands. Phone +31-50-363 4615. Fax +31-50-363 4500.

## Communication

Telephone calls from the Netherlands can be made from pay phones using either coins, special telephone cards (which can be bought in convenience stores) or credit cards. In case

of an emergency, call 112 from any phone (no payment required).

# General Information about the Netherlands

The **Official Language** in the Netherlands is Dutch. However, you will find that most people speak English and are usually quite willing to help you.

## Currency and Banking

The currency in the Netherlands is the Euro (€). It is available in denominations of 500, 200, 100, 50, 20, 10 and 5 €. Coins of 1, 2, 5, 10, 20 and 50 Eurocent, 1 and 2 €. 10 € is equivalent to approximately US\$ 10,80.

Traveller's Cheques can be cashed in any bank where you can also exchange foreign currency. Banks are usually open Monday through Friday from 10 am to 4 pm. The easiest way to obtain cash, is by using your bank or credit card such as Visa or Mastercard. You can also use cash machines outside of the opening hours.

## Climate

The olympiad takes place in the middle of the Dutch summer. It is difficult to predict the type of weather however. It may rain, with temperatures around 15 degrees Celsius, or even lower. On the other hand we may have a heatwave with temperatures way up in the 30s. As a rule it is often pleasant and sunny with temperatures around 21 °C.

## How to dress

Dressing is very relaxed in the Netherlands, and you can usually dress the way you like best. The students must remember to bring running/training shoes and a swim-suit. The opening and closing sessions are formal affairs in which more or less formal clothing is desirable.

## Medical services

There are no health problems in the Netherlands. No special measures are needed. If medical care should be needed during the olympiad you can ask for help at the hotel lobby. Medical care will then be provided.

## What's on today's menu?

### Kale stew with Polish sausage and bacon

During winter, when the blizzard is howling outside and snow is piling up, this dish is served in Holland.

#### Ingredients (4 servings)

- 2 lbs potatoes
- 1 lbs kale (stripped, without the hard nerves)
- 8 ounces bacon (not to lean)
- selection of Polish and Frankfurter sausages
- If you prefer a vegetarian variety you can choose tofu
- cup milk
- cup vinegar
- 1 onion
- salt, pepper, brothcube

#### Preparation

Peel the potatoes, wash them and cut them in inch sized cubes. Boil the potatoes in a closed pan with a little water until done (20 minutes).

Wash the kale. Put it in a large pan, with the sausages and a little water. Bring to boil and simmer for about 20 minutes.

Cut up the bacon and fry in its own fat until crisp.

Drain the potatoes, add the milk and crush the potatoes to a not to fine puree.

Stir in the kale, bacon and bacondrippings.

Bring to taste with salt and pepper.

Serve with the sausages, the vinegar, the shredded onion and some pickles.

Enjoy!!!!!!!!!!



## Spectacular Holland tour

Whilst in Europe and Groningen combine your stay with a few days in Holland, or a combination of Holland and Belgium, before or after the 34th Chemistry Olympiad. The organisers of the 34th Chemistry Olympiad have made arrangements with the Destination Management Company **Amstour Holland** in Amsterdam, who are specialists in creating wonderful tours through Europe.

Besides the fact that more arrangements are possible, you will find below a short description of one example:

*The Spectacular tour of Holland in 2 days:*

**Day 1) Monday** – After leaving Amsterdam, a full day's drive around the southern part of the IJsselmeer (former Zuiderzee) with its dreamy 16th century old cities and fishing villages. A stop at the Zaanse Schans Open Air Museum, with windmills still in operation. Via Edam and Hoorn our coaches takes you to Enkhuizen where you visit the Zuiderzee museum, a splendidly reconstructed old Zuiderzee village. Along the dike right across the IJsselmeer to Lelystad and along the old Hanseatic town Harderwijk. For dinner we take you to Arnhem-Oosterbeek and over-night at the hotel De Bilderberg or similar.

**Day 2) Tuesday** – This day begins with a visit to the National Park De Hoge Veluwe, with the Kröller Müller Museum, well known for its Van Gogh collection and sculpture park. Along to Gouda, known for its cheese, candles and pipes. Here a visit will be made to the St. Jans church. Then to the Hague for a tour around this Royal City, home of the Queen and seat of the Dutch Government. Your tour terminates on Tuesday upon arrival in Amsterdam. (estimated time 18.30h.)

### Departures and prices:

Collection: Passengers will be collected from Hotel Sofitel Amsterdam at 08.00h on Mondays. Departures every Monday are guaranteed!

### Prices:

- 2 days, twin room from € 272,00 per person
- 2 days, single room from € 306,00 per person
- 2 days, triple room from € 266,00 per person

including accommodation in a first class or superior tourist class hotel, breakfast and dinner, multi-lingual tourguide and entrance fees.

Due to the fact that departures and arrivals are from/in Amsterdam, we strongly advice you to arrange a pré or post night in Amsterdam.

Please direct all your requests, also for alternative toursuggestions and pré & post nights to:

### Amstour Holland

Stromarkt 5

1013 SW Amsterdam

the Netherlands

Tel.: +31 20 530 4430 Fax: +31 20 427 7665

E-mail: [book@amstour.com](mailto:book@amstour.com)

## Company profile AVEBE

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34<sup>th</sup> International  
**CHEMISTRY OLYMPIAD**

Groningen | The Netherlands | 5 - 14 July 2002

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