



“This false sense that chemistry works...”
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“He can read 100 pages over night!”
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He who invented the gas mask
Meet Nikolay Zelinsky on page 4 >>

Synthesize this!

Through the lack of time, unfamiliar equipment and filtering hardships we're finally there: aldehydes synthesized, viscosity measured, first mission performed. >> see page 2



photo: Filipp Napolskiy

Today is gonna be the day | *Catalyzer's tips*

7.30-9.00 Breakfast	A Russian can be quickly identified by the manner of drinking tea. If other nationalities after stirring sugar take the spoon out, a Russian teadrinker – for some unknown reason – leaves the spoon in the cup and holds it out while drinking so that their finger protects their eye from being poked out... When you see Russians doing it, don't try to repeat, it's dangerous.
10.00 Transfer to Planetarium 11.20-14.30 Excursion to the Moscow Planetarium	Planetarium is a special place to show stars and planets. Moscow Planetarium is one of the oldest in the world (since 1929). In 2011 it was reconstructed and now it's one of the trendiest places in Moscow. Getting there is not easy, there's always a queue. Must-see: the world's most powerful projector in the Star Hall. Must-do: try and guide the giant robot arm in the interactive hall. Look through the largest public telescope in Moscow. Note that the building of the Planetarium is built in the shape of a giant egg which makes it a world-class architectural monument.
14.30 Lunch in Planetarium	Well... Hard to say. None of us has ever eaten in Planetarium.
15.30-17.30 Moscow Zoo	Moscow Zoo is one of the biggest in the world and it's already 150 years old. Must-see: a red panda that looks just like the "Kung Fu Panda" (a unique species in Russia), Father David's deer (they don't exist in the wild). Say hello to the suricates. Taste Moscow ice-cream (for some reason in the Zoo it's incredibly delicious).
17.30 Transfer to Planernoye	Taste the beetroot salad or "винегрет" [win-a-grate]. It's a Russian national salad with a French name (comes from "vinai-gre" – vinegar), made of simple vegetables: beetroot, potatoes, carrots, peas. Russians love it so much that the name became a common word for... a mess in one's head. When you see a person doing something stupid like solving glycine in cyclohexane, tell him: "You've got Russian salad in your head" / У тебя в голове винегрет! [Ooh tea-birth-f-goal-of-hay win-a-grate!]
19.00-21.30 Dinner	

Synthesize this! >> from page 1

Yesterday the olympians had to endure a five-hour marathon of the experimental exam. The work consisted of three tasks: organic chemistry, analytical chemistry and macromolecular chemistry.

The first task required to synthesize and identify two aldehydes. For that carbonyl compound mixture in question were added to the solution of 2,4-diphenylhydrazine. The mixture was heated on a water bath and, after cooling, beautifully colored crystals of 2,4-dinitrophenylhydrazones precipitated, which could be identified by their melting points.



Abdullah Alotaibi,
Kuwait

I prepared only theory, studied a lot of advanced books, but I didn't do any experimental things. The tasks were really very challenging; I think that they are quite useful in our daily lives.

Jela Nociarova,
Slovakia

I enjoyed doing this work, although I didn't have time to finish everything. I feel tired but happy to have done it here in Moscow University.



In the analytical chemistry part Olympians had to study a water sample to measure and calculate a number of parameters: hardness, acidity, etc. The challenge here was working with a pH meter and especially with a titration burette.



Roli Elia, Israel

I've prepared since March. We've done a lot of practice in labs. Still I was a little surprised, mostly by the equipment. I've never used paper to check the amounts of ions in the water. But it's fine, my secret is having a good nap the night before.

Gadam Muratgeldiyev,
Turkmenistan

The only challenge was that I had to work with equipment I'd never used before. We had to grasp the way it works very quickly.



Finally, in the third task Olympians were given samples of polymers in solvents. Using a viscometer they were supposed to define the time it takes the solution to go through a sensor capillary, and the recorded time was used to define certain parameters of the polymer, i.e. degree of polymerization. Working with the viscometer was new for most participants, which resulted in the loss of part of the viscometers park of the MSU Chemistry Department.



Arturo Martinez-Flores,
Mexico

The viscosity task is of real industrial use. If you measure the viscosity, you can easily define what polymer is it.

Jean Michalland,
France & **Nicolas Remiche,**
Belgium

It was so short and we also had to draw some curves! The filtration was a bit difficult, because we'd never done it before. And the viscometer was very unusual.



What's chemistry coming to?

Catalyzer regularly talks to mentors about how they see the present and the future of chemistry, chemical education and the role of their country in the world scientific progress.



Andrew Dicks

Kenneth Charles Hoffman
Canada

Chemistry education trends

Kenneth: I'd say the focus is becoming less on the content and more on the context, on **why** are we learning chemistry. There's even a bit of tension between academic and educational sides over that separation, about what's the real purpose of teaching chemistry at school.

Andrew: There's also the greenification of chemistry in higher education, showing its potential in sustainability to high school students and undergraduates – because they are the people who will be making big decisions in that area...

About Russian Chemistry

Kenneth: Until I saw the bust of Markovnikov today I didn't realize how central Russian chemistry really was. It was powerful to see him and remember. He was a real person.

Andrew: I've again noticed the impact the Chemistry faculty building has on me. Our chemistry departments are nothing like here, yours are all huge and impressive, you're representing the accomplishments and the people, that doesn't exist in North America.

Canada's future role in world chemistry

Kenneth: We used to be leaders in carbohydrate chemistry back in 1970s.

Andrew: We did spectroscopy, got a Nobel Prize for electron transfer reactions in chemical systems in 1990s and dynamics of chemical elementary processes back in 1980s.

Kenneth: But I think Canadians are not the people to take over the world in anything. Apart from hockey.

There are just certain things we want to do well and make a meaningful contribution into. I really hope we'll become leaders in alternate fuels, i.e. hydrogen based. I'd rather the world stopped focusing so much on fossils.

The new generation of chemists

Andrew: They know a little about a lot of things. We used to be more focused, tended to know something deeply rather than a lot but superficially...

Kenneth: Yes, for sure, there's a tendency towards superficial interaction with things. I guess, it's because of the quantity of information kids have access to, it's overwhelming. The way they socialize is also dominated by the social media type of interaction. And it also extends to learning... Although you know what, every older generation at any times says the current young one is different and somehow wrong... I'm sure back then when the first people were learning to read and write, parents must have been saying: "Oh, that's gonna be the downfall of society! Kids are writing all the time, they're reading books!"

What makes a good chemist

Kenneth: Kids today have this false sense that chemistry works. But the reality is that you can do the reaction 20 times and it will work the 20th time...

Andrew: So yes, perseverance – and open-mindedness. And the ability to take principles from other sciences and apply here.

A Country in Brief

Czech Republic

Every day Catalyzer picks a random delegation and goes to meet the team.

The Czech team is four very cheerful and talkative guys. They are different but get on really well and form a very harmonious group.



Team about Kamil Maršálek:

Kamil lives in South Moravia, he is going to study chemistry at Masaryk University in Brno. His main hobby is reading. Can read more than 100 pages over night. Loves listening to Pink Floyd. Enjoys tourism and walking at long distances.

Kamil on his country's inventions in chemistry:

"The most important discovery is the invention of pharmaceuticals that help cure lots of illnesses".



Team about Roman Beránek:

He has a beautiful girlfriend. He is going to study medicine. Roman is a DJ! He also enjoys programming. Such a versatile guy!

Roman chooses the most typical czech of his team: "Adam Přáda. He likes pork meat, he is a bit lazy and relaxed".

Roman explains why he loves chemistry: "It describes everyday life and helps understand how diverse our world is. Chemistry is difficult and demanding, but I'm good at it".



Team about Kryštof Březina:

He is an amazing piano player. He can speak German, French and English.

Kryštof invents something special:

"I want to invent something that works against illnesses that kill people all over the world".

Kryštof chooses his favorite substance: "Azurin because it has nice deep blue color and interesting structure".



Team about Adam Přáda: This guy is a fantastic mathematician.

He is really very talented. Does athletics and can run very fast.

Adam Přáda on how chemistry is studied in Czech Republic:

"We start studying chemistry at the age of 14, and it's compulsory. We have practical classes every 2 weeks".

Loving Chemistry in Czech

Mild version: Miluji chemie

Tough version: Nenávidím vše kromě chemie

What's in your bag?

Dilshoda Artikbaeva,
Uzbekistan



National Uniform

(elegant dark blue jacket and a skirt trimmed with the national emblem)

Sunflower seeds

(In Russia you can often see «babushkas» (old ladies) eating the seeds in the streets. Here we learnt that Asians like these seeds too. These are from sunny Uzbekistan, she was sure Uzbek seeds are tastier.)

Uzbekistan flag

(the tricolor with red lines symbolizes peace in the world, innocence and power in each person of Uzbekistan)



Catalyzer investigates IChO participants' bags and tries to find a national zest there. This time we're rummaging in suitcases together with Uzbek delegation.

Bread «Patyr»

(a round piece of bread with flat center is Uzbek national dish)

Books

(Dilshoda is very serious, so the first thing she showed us were textbooks on nanotechnology. Still, the biggest misbelief about young Olympians is that they are fond of nothing but chemistry. Dilshoda likes reading the poems by Abdulla Aripov and Pirimqul's Qodirov historical novels)



Exam photos by Filipp Napolskiy

Burn after reading, part 2

Chemical weapon

In the previous issue we saw the way innocent industrial chemicals like diodiglycol, pseudoephedrine, isopropanol or γ -lactone can be turned into dangerous substances like mustard gas, methamphetamine, sarin and GHB.

Imagine how easily, by just buying relatively innocent components and slightly modifying them, one can produce actual chemical weapon or hard drugs. Sadly, this is exactly what some countries do, setting up the whole lethal machinery, while other countries supply the necessary components, unaware of what they're used for – or sometimes intentionally.



Some of the greatest personalities in the history of chemistry are known to have used their skills against their fellow men. Fritz Haber, the “father of chemical weapon”, developed the usage of chlorine gas, Victor Grignard worked on phosgene. These substances, as well as tear gas and hydrogen cyanide, were used for mass destruction in the 1st World War between 1914 and 1917. This was when most warring countries got engaged in a chemical arms race, which resulted in horrific chemicals affecting lungs, skin, eyes. Some were specially designed for homicide at the battle field.

As a reaction to these atrocities in 1925 several European states initiated the so-called Geneva Protocol “For the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare”. By 2013 there are 138 states having ratified, acceded to or succeeded to the treaty.

For the same reason there exists a special Or-

ganisation for the Prohibition of Chemical Weapons, briefly named OPCW with headquarters in Hague. It monitors the production, import and export of certain types of chemicals.

At present, the direct threat of chemical weapons is low, although several countries still are suspected of possessing them. They can also be used by radical groups within society.

You are the chemists of the future. We put hopes on you as the soon-to-be decision makers. We want you to be aware of the risk posed by the dual use nature of chemicals. Please, whatever you do for the science, keep your eye on the combined purchase of chemicals that may be dangerous when mixed.

On behalf of the OPCW I wish you good luck at the Olympiad.

Jan Apotheker, member OPCW Temporary Working Group on education and outreach, chair organization IChO 2002, Groningen, specially for Catalyzer

Meet Russian Chemists



Nikolay Zelinsky
(1861-1953)

First steps in chemistry

Known to have been conducting chemical experiments at the age of 10.

Contribution to chemistry

Synthesized cycloalkanes with number of atoms 3 to 9 in cycle (1901–1907), and then even with 40! Completed the dehydrogenation of cyclohexane and its homologues in the presence of aromatic hydrocarbons in the platinum and palladium catalysts (1911) and used this reaction as an industrial method to produce the aromatic hydrocarbons from oil. One of the discoverers of the organic catalysis. Discovered the reaction of producing the α -amino acids from aldehydes or ketones (1906).

Fact

Zelinsky invented the gas mask with coal filter in 1915. For that he got a special appointment with the Russian Tsar Nicholas II to demonstrate the gas mask effectiveness. In 1916 gas masks have been included in the inventory of Russian Army.

Quote: “Working in a group requires the ability to accept criticism and the ability to criticize the others...”



So they wish him all the best:
Nicholas: “Successfully entering the Unicamp University!”
Victoria: “Benefit from the Olympiad experience”
Altogether: “Meet a cutie and fall in love with her!”

Happy birthday!



Maurocélío Rocha Pontes from Brazil is 16 today!

No wonder Brazilian team loves Maurocélío. He's a man of principle, always knowing what to do and how to behave. He is a real gentleman and – coincidentally – a crazy party-goer.



150 Years
Science For A Better Life



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