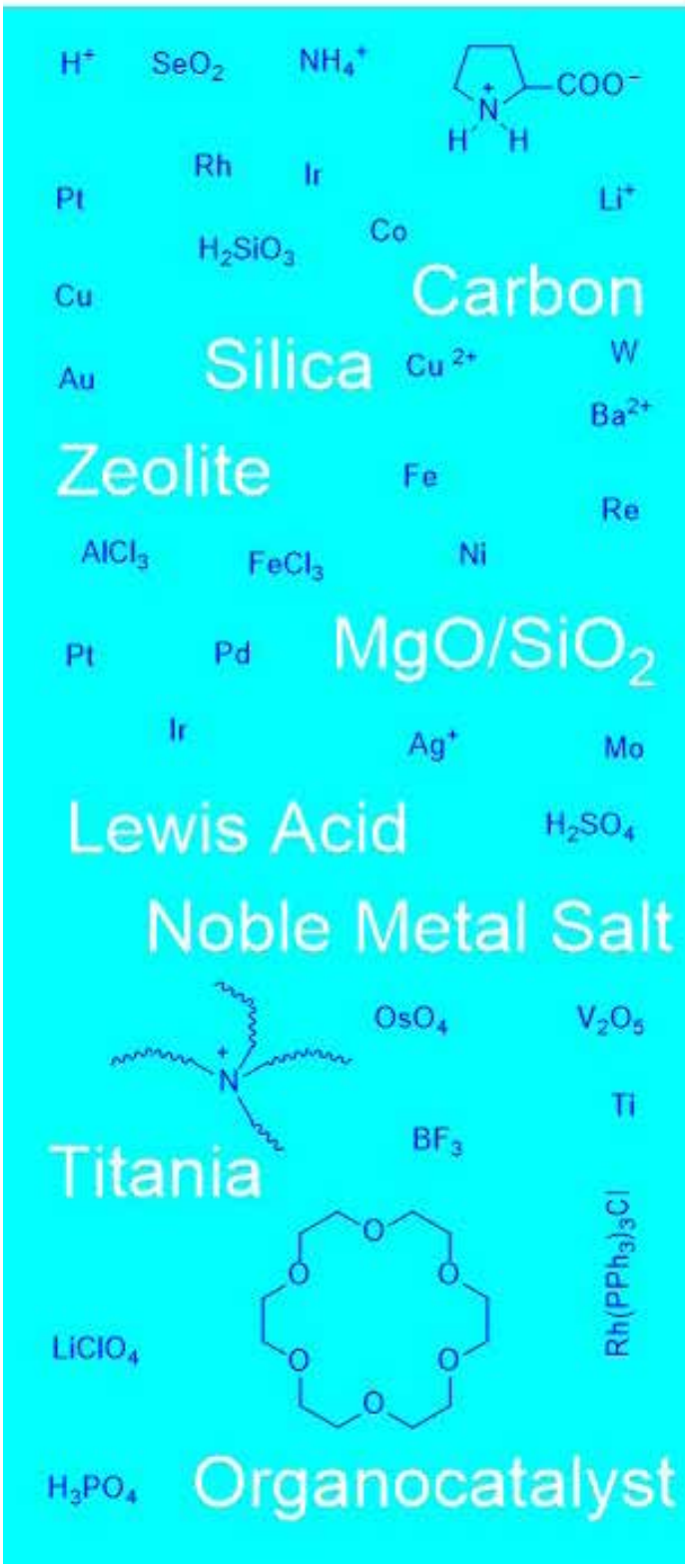
52nd IChO 2020
INTERNATIONAL CHEMISTRY OLYMPIAD

CATALYZER

THE NINTH ISSUE OF CATALYZER MAGAZINE 23/07/2020



CATALYZER FOR THE NOBEL PRIZE

Did you know? The Nobel Prize in Chemistry was awarded 7 times and to 16 people in the 119 years of its existence for their pioneering contributions to the development of organometallic chemistry and their role in creating methodologies in organic chemistry.

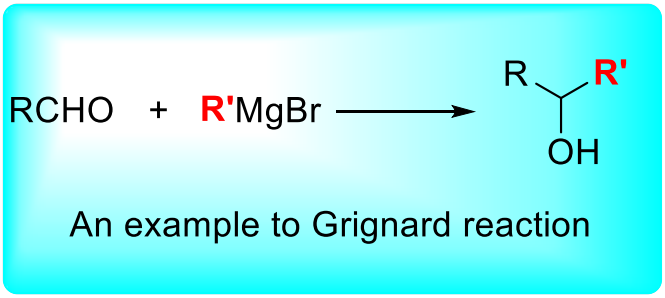
Organometallic compounds are widely used both stoichiometrically and as catalysts to increase the rates of organic reactions, where target molecules include polymers, pharmaceuticals, and many other types of practical products.

The catalytic organometallic chemistry field has resulted in carbon/carbon and carbon/heteroatom bond formation in many new ways that are not possible by conventional methods.

The following list shows the Nobel Prizes in Chemistry for contributions to organometallic chemistry and metal catalysis:

1912 Nobel Prize: Victor Grignard and Paul Sabatier

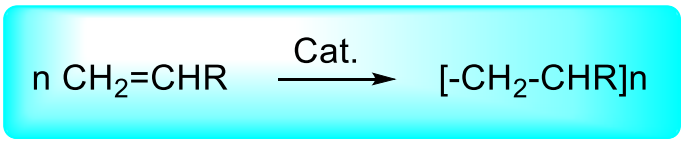
Victor Grignard was awarded the prize for the discovery of the so-called Grignard reagent, while Paul Sabatier received it for his work improving the hydrogenation of organic compounds in the presence of finely disintegrated metals.



An example to Grignard reaction

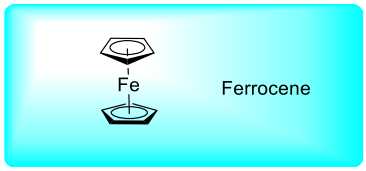
1963 Nobel Prize: Karl Ziegler and Giulio Natta

For their discoveries in the field of the chemistry and technology of high polymers. Ziegler and Natta discovered and developed heterogeneous and homogeneous catalysts (Ziegler–Natta catalysts) for the polymerization of 1-alkenes.



1973 Nobel Prize: Geoffrey Wilkinson and Ernst Otto Fischer

For their pioneering work, performed independently, on the chemistry of the organometallic, so-called sandwich compounds (e.g., ferrocene).



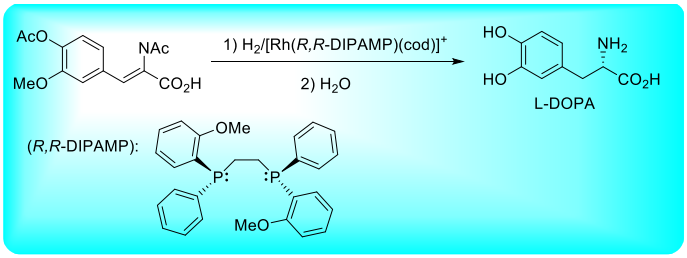
1981 Nobel Prize: Roald Hoffmann and Kenichi Fukui

For their theories, developed independently, concerning the course of chemical reactions, including organometallic reactions.

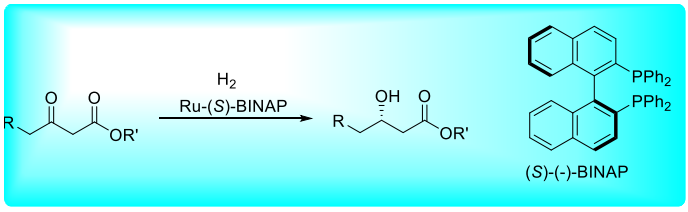
2001 Nobel Prize: W. S. Knowles, R. Noyori, and Karl Barry Sharpless

The Nobel Prize in that year was divided, one half jointly to William S. Knowles and Ryoji Noyori "for their work on chirally catalyzed hydrogenation reactions" and the other half to K. Barry Sharpless "for his work on chirally catalyzed oxidation reactions".

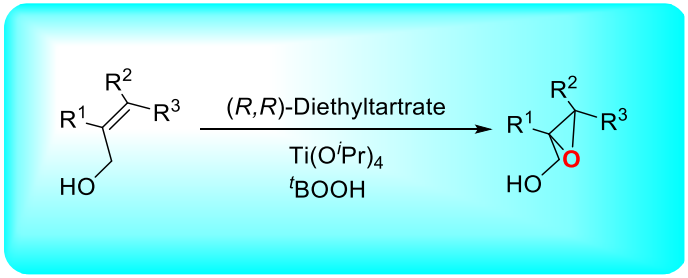
Knowles developed an enantioselective hydrogenation step for the production of L-DOPA—a naturally occurring compound, a psychoactive drug—utilizing a chiral rhodium complex, when he was working for the Monsanto Company. This was the first application of enantioselective metal catalysis to industrial-scale synthesis.



Noyori enabled asymmetric reduction of ketones over optically active rhodium and ruthenium complexes.



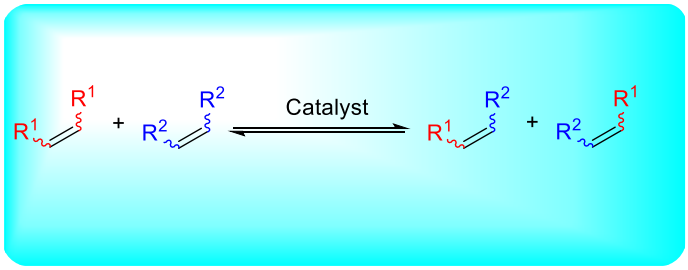
One of Sharpless's most groundbreaking discoveries is named after him, Sharpless epoxidation, in which it is possible to synthesize enantiomerically pure epoxides from allyl alcohols.



2005 Nobel Prize: Yves Chauvin, Robert Grubbs, and Richard Schrock

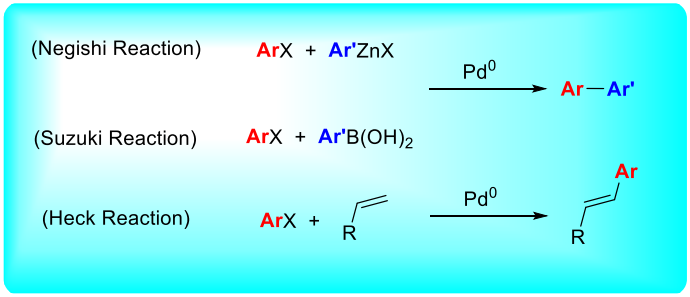
For the development of metal-catalyzed alkene metathesis.

Olefin metathesis allows the redistribution of fragments of alkenes by the scission and regeneration of carbon–carbon double bonds.



2010 Nobel Prize: Richard F. Heck, Ei-ichi Negishi, and Akira Suzuki

For palladium-catalyzed cross couplings in organic synthesis.



Levent Artok

"THE SECOND TEACHER", AL-FARABI (870-950)

"My table mates are ink bottles. My instrument is their tune."
Al-Farabi

Al-Farabi portrait from a Kazakh banknote

The 1150th anniversary of the birth of the scientist and philosopher Al-Farabi, who was called "the second teacher" after Aristotle, who was regarded as the "first teacher" in the Middle Ages, was included in the UNESCO Memorial and Celebration Anniversaries Program.

Al-Farabi proposes a scientific journey from concrete to abstract as a method. He stands by science and encourages experiment, and rejects prophesy and astrology. He believed so strongly in causality and necessity that he resorts to reasons, even for outcomes that had no apparently obvious reason, because, to him, to know something is to know its reasons. He collects concepts, makes generalizations, organizes, harmonizes, and analyzes them for composition, and divides them into sections and subsections to summarize and classify the subject.

Abu Nasr Al-Farabi Al-Turk was born in 870 in the town of Vesic, a military fortress attached to Fârâb (Otrar). The commander of this castle was his grandfather. His grandfather's name was Tarhan. Tarhan was a military rank among Turks.

He started his education by learning Arabic and religious knowledge in his own country, and then went to Belh, Bukhara, Samarkand, Baghdad, and Harran to learn science, art, and philosophy. After visiting various cities, he came to Damascus and taught there. He died in Damascus in about 950 A.D.

Al-Farabi, as well as writing about a hundred and sixty explanatory and interpretive books, also wrote valuable works that reveal his views and thoughts like Kitabu'l-Akl / The Book of Intellect, Ihsâü'l Ulûm / Enumeration of the Sciences, Meratibu'l-Ulum / Degrees of Science, Tahsilü's Saade / Achieving Happiness, Tenbih âla Sebili's Saade / Ways to Achieve Happiness, Fusulü'l Medeni / Aphorisms of the Statesman, El Medinetü Fazl / The Ideal State, Siyasetu'l Medeniyye / Civil Politics, Kitabu'l Mille / Book on Religion, Kitabu'l Huruf / Book of Letters, and Kitabu'l Burhân / Book of the Demonstration. Since most of his works were translated into Hebrew and Latin, the Latin world certainly knew about him. For this reason, the Medieval Latin world called him "Alfarabius" or "Avennasar".

Ibn Sab'in in his work Budd al-'arif says" "Al-Farabi is the most understanding of Islamic philosophers and the most knowledgeable about the most ancient sciences. Among them, he is the only one worth counting. Before his death, he became perfect and arrived at reality."

Al-Farabi, who deserves the nickname "Mu'allim-i Sani / Second Teacher" following the nickname "Mu'allim-i Evvel / First Teacher" given to Aristotle in the world of philosophy, is the founder of the Peripatetic school in the Islamic world of thought. Al-Farabi expresses his love for philosophy and science in a poem:

"*Seeing that time was fractious, love useless; all leaders weary and all individuals ill; I preferred to stay at home and protect my honor. I drink the wine of wisdom that I keep with me, gleaming in my hand. My table mates are ink bottles. My instrument is their tune. In the meantime, I cheer up with the conversation of the wise who left this world..*"

According to Al-Farabi, the highest virtue is knowledge. Therefore, he considered spiritual and moral cleanliness above all else. Although the monarch, who was very fond of him, provided him with great financial support, he did not accept any money other than the amount that would meet his daily needs, and had no possessions or property. While working as a gardener in Damascus during the day, he studied science, art, and philosophy books with a guard lantern at night. Al-Farabi, who wrote books entitled Kitabu'l Musiki el- Kebir / Great Book of Music and Kitab el Eğani / Book of Songs on music, and composed on an instrument called a kanun, would wander along shores and in gardens with his musical instruments and meet up with his students there when he had the opportunity. He said that "the consummation of happiness is through moral virtues as the fruit is the consummation of the tree."

Al-Farabi, who truly deserves the title of "second teacher", did not forget his advice to students who want to progress as a person competent in science, philosophy, and art in his Achievement of Happiness:

"*The student must endure the difficulties faced during his education, possess a superior intelligence and understanding, must love righteousness and the truth, justice and just ones, and have an honorable personality. He should not value gold, silver, or similar things, he should not be greedy about food and drink, and should not be fond of his desires, and his determination and willpower should be found to achieve the truth. He should consider science and scholars great, and not value anything other than science and scholars. He should not make philosophy a means of earning either.*"

Al-Farabi explains his aim in writing the book Enumeration of the Sciences with the following sentences:

"*The person who wants to learn from one of these sciences learns what he is attempting, what he is examining and what this will benefit him, what he will gain, and what values he will gain. As a result, the desire to learn should not be blind and naive, but with knowledge and consciousness.*"

Al-Farabi understood the philosophical heritage referred to as "Ancient Greek Philosophy" as a common heritage of humanity without any condition. He revived the philosophy of politics, especially through translations, analysis, and reinterpretation of the works of Plato and Aristotle.

Again Al-Farabi proposes a scientific journey from concrete to abstract as a method. He stands by science and encourages experiment, rejecting prophesy and astrology. He believed so strongly in causality and necessity that he resorts to reasons, even for outcomes that had no apparently obvious reason, because, to him, to know something is to know its reasons. He collects concepts, makes generalizations, organizes, harmonizes, and analyzes them for composition, and divides them into sections and subsections to summarize and classify the subject. According to him, "It is necessary to know right first; if right is known wrong is also known, but if wrong is known first right cannot be known."

Again, Al-Farabi made great contributions to humanity by observing societies and the nature of politics well, by staying outside of society, especially without being involved in politics based on heated, daily, unproductive conflicts, and by writing works on political philosophy and intellect as mentioned above.

Ebül Fereç, another scholar of that time, tells us that the Turks have raised true philosophers from beyond the ages: "Farabi's books on logic, nature, theology, and politics have been his highest and ultimate goal."

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Zübeyir Saltuklu

A remote view of Roman Aspendos Amphitheater in Antalya, Turkey

Cultural Heritages

ASPENDOS THEATER

Hüseyin YURTTAŞ, Esra HALICI, Burak Muhammet GÖKLER, Muhammed Emin DOĞAN

The ancient city of Aspendos was founded by the Achaeans in the 10th century BC in Köprüçayı, 8 kilometers east of the Serik district of Antalya. It is an ancient city famous for its theater. Aspendos has maintained its importance during every period as it is on a trade route and is connected to a port through Köprüçay River.

Inside view of Roman Aspendos Amphitheater

The most important structure of Aspendos Ancient City is its theater. Designed by the famous architect Zenon during the reign of Roman emperor Marcus Aurelius (161-180), the theater was presented to the city's guardian gods and the emperor family. The theater remains largely original. The building, which was restored by the Anatolian Seljuks especially in the 13th century, was used for their needs.

A perspective from Roman Aspendos Amphitheater

Marble was used for the seats and coverings. The historical building has survived to the present day because of the high quality material used. The cavea (the section where the audience sits), consisting of 42 rows of seats, is divided into two with a horizontal passage in the middle. There are 59 arched galleries in the upper part of the seating. The stage building, which is the most important part of the theater, is long and narrow with multiple floors. The artists enter the stage through five different doors. In addition, it attracts the attention of many people due to its impressive story and legends. The theater has a capacity of about 7500 people.

Famous for its acoustics, this theater is the only solid example from the Roman period still in existence.

DID ARABLE AND LIVESTOCK FARMING BEGIN AT GOBEKLI TEPE?

Göbekli Tepe, located near the city of Şanlıurfa, contains the first structures built in the world by hunter-gatherers just before settled living. Even in this sense alone, the food remains and grinders found at Göbekli Tepe, which deserves the title of "ground zero in the history of civilization", suggest that the driving force for the development of arable and livestock farming is here.

Göbekli Tepe, located in Şanlıurfa, is included in UNESCO's World Heritage List.

Göbekli Tepe is an archaeological site in Şanlıurfa, Turkey

The temples at Göbekli Tepe, which are dated to 12 thousand years ago, are not built close to water sources, unlike similar structures in other settlements dating back to the Pre-Pottery Neolithic Age. Instead, the central area, where the cluster of temples is located, is visible from kilometers away at the highest point of the archaeological site, which is about 12 football fields in size.

Another element that is thought to have played a role in the selection of the location of these temples that dominate the surrounding area is that the region has a limestone dense soil. The limestone surface of Göbekli Tepe suggests that obelisks, sculptures, and reliefs as well as food and drink vessels were made in the quarries within the site. Limestone is a building material mostly preferred in human history because it is light and easy to cut and process compared to other stones in nature. As the limestone food and beverage vessels reveal, Göbekli Tepe is the first known center of social organization and mass food consumption in history. Many people who came here moved T-shaped obelisks and food vessels, which they cut and removed in single pieces weighing tons from nearby limestone beds, within the framework of a specific program, division of labor, collective consciousness, and engineering calculations, and they placed them in their locations in the architectural plan of the designated place of worship.

It is impossible to fully reveal the geographical origins of the people who came to the region in order to build temples at Göbekli Tepe or to worship at the temples built. However, seven different materials that are not found in the Göbekli Tepe region but were detected among the heaps of soil can give clues about the geographies that the hunter-gatherer communities who came there lived in. For example, the closest that obsidian rock is found in that area is in Bingöl.

On the other hand, as a result of research conducted, the communities that came to Göbekli Tepe for the construction of temples, worship, and feasts are thought to have been there only at certain times. Analysis of the seasonal frequencies of game animals in the region and the presence of remains related to high-calorie foods such as cereals, peanuts, almonds, and animal fat indicates that the cluster of temples was more active after the harvest of wild crops, that is, in the fall.

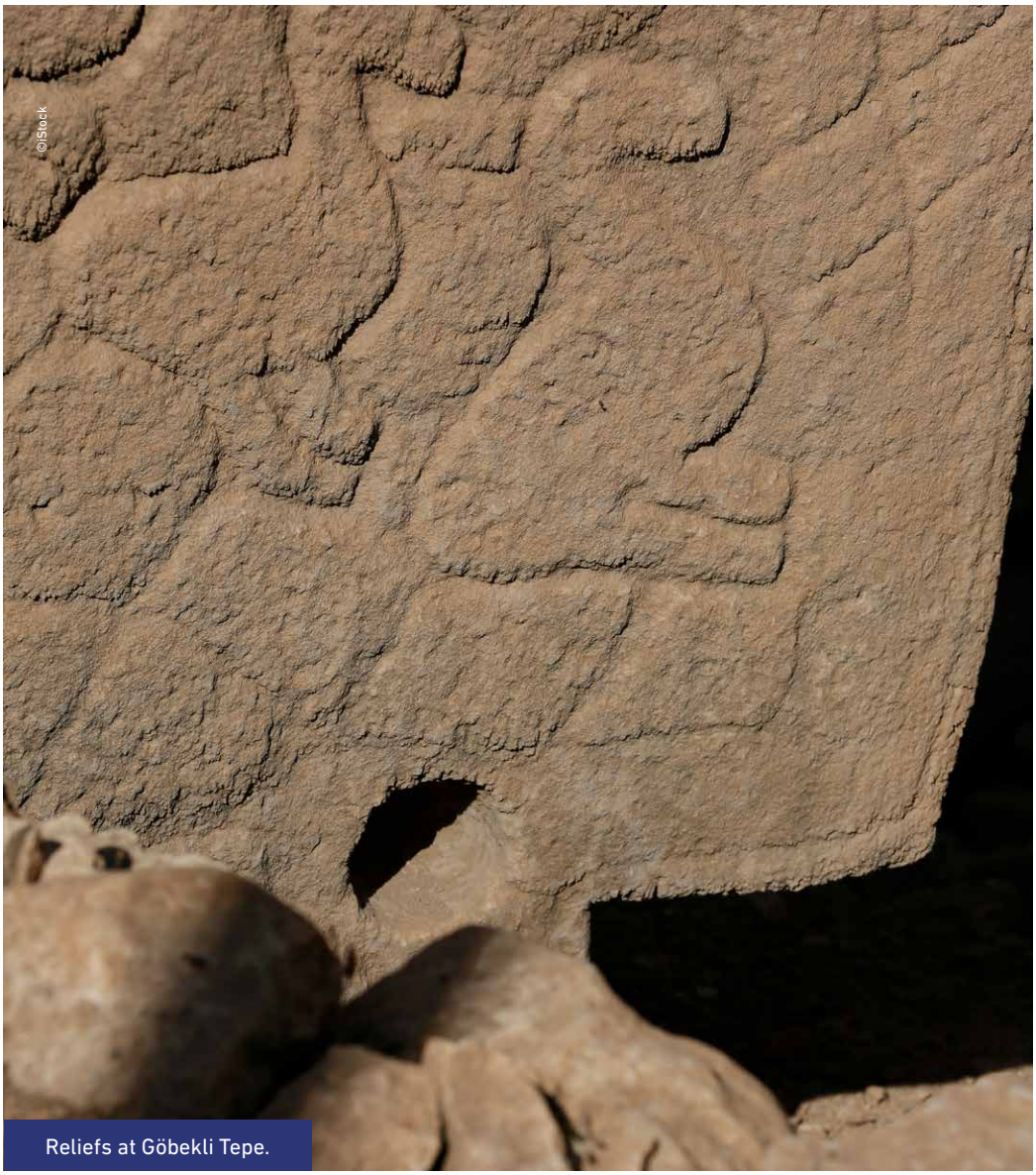
According to scientists' evaluations, these crowded groups of people that gathered at Göbekli Tepe for worship, as well as exhibiting advanced social activities such as socializing, organizing, exchanging information, and exchanging goods, created the first food production and storage needs in the history of humanity with the feasts they organized. Thus, the people of Göbekli Tepe started looking for ways to control food, that is, grains and animal foods. In other words, hunter-gatherer communities, whose beliefs found common ground, built monumental structures and organized feasts that apparently consumed plenty of food, and may have developed the idea of raising all this food under their control, rather than spending lots of time searching for difficult to find wild grains scattered in nature or spending hours, days, or maybe even weeks following and hunting wild animals.

Since the excavations began in 1995 at Göbekli Tepe, many wild animal bone remains; over ten thousand grinding stones; remains of a large variety of grains, vegetables, and fruit seeds; and some large vessels/pots, some with spouts and grooves, were dug up. Research on the animal bone remains found that they belonged to wild animals hunted. These region-specific animals display a wide variety.

Although nearly half of the animal bone remains belonged to wild oxen, the animal whose meat was eaten the most in terms of numbers was the gazelle. However, the meat of animals such as the wild donkey, wild boar, fox, rabbit, partridge, pigeon, raven, and crow was also eaten.

It is thought that the wild donkey shoulder blade found in the Göbekli Tepe excavations, at the bottom of one of the vessels/pots made of monolithic limestone, was used to mix the contents in the pots or to remove foam. Dark gray deposits were found at the bottom of some of the vessels/pots that may be indicative of cereal fermentation and thus beverage production.

During excavations in North Mesopotamia, in almost all Pre-Pottery Neolithic settlements, squares where common activities were carried out were



Reliefs at Göbekli Tepe.

Göbekli Tepe is a prehistoric site dating from roughly 12,000 years ago, near Şanlıurfa, Turkey.

encountered. These common areas, which are thought to have been used for social events, religious rituals, and similar purposes, also indicate that there was a common feast tradition in the region.

The fact that Göbekli Tepe is the founding site in the transition from hunting and gathering to arable and livestock farming is closely related to the climate and geographical location of southeastern Anatolia. Göbekli Tepe is located in the center of the Fertile Crescent, which is the natural home of what are is known by scientists as the "eight founder crops", consisting of the eight earliest cultivated cereals, legumes, and plants (flax, vetch, chickpeas, peas, lentils, barley, einkorn wheat, and emmer wheat), and the first domesticated prey animals (goats, sheep, pigs, and cattle).

However, the relationship between Göbekli Tepe and wheat is of special importance. About 20 years ago, as a result of the genetic analysis carried out by Norwegian researchers, it was revealed that the single-grained einkorn wheat growing on the side of Karacadağ near Göbekli Tepe overlooking Diyarbakır was the ancestor of around 350 cultivated wheat species and therefore the oldest known wheat in the world.

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Emine Sonnur Özcan

TODAY'S PROBLEM AND YESTERDAY'S AND TODAY'S ANSWER

Problem 9.

Organic Pheromones

The use of chemical methods to eliminate insects that damage plants and fruits during agricultural production is both economically more burdensome and has negative effects on humans and the environment due to residues of the chemicals used. Therefore, many biotechnical methods are being studied today to reduce the use of pesticides. One of these methods is the use of pheromones on agricultural land.

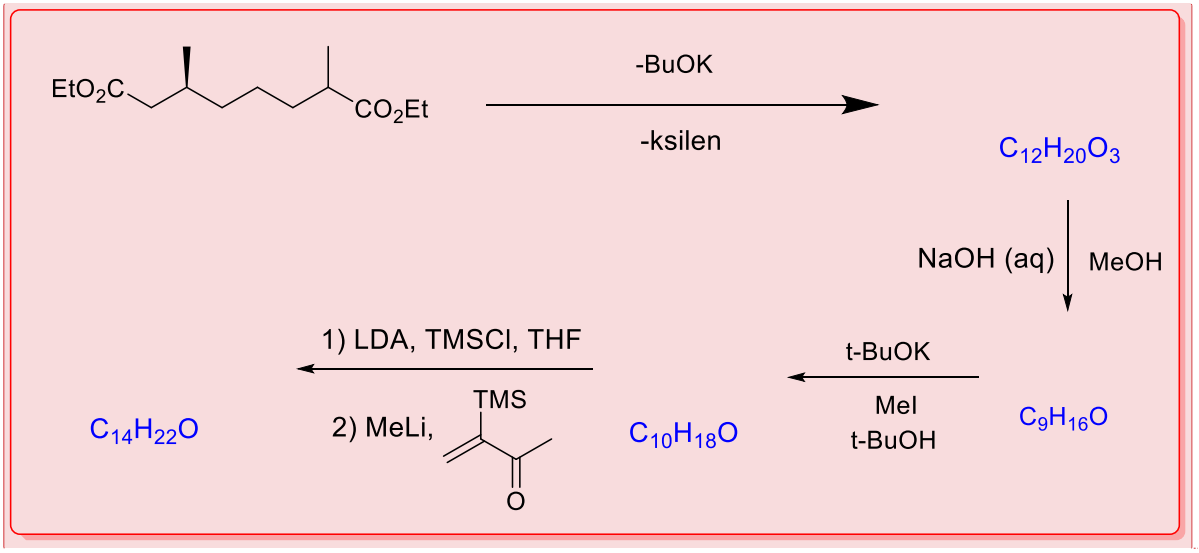
Pheromones are chemical scents that insects use for communication. They are organic compounds with a different structure for each type of insect that are secreted by female insects to allow the male to find the female. We can also describe pheromones as perfumes that females secrete in order to attract males. These scented compounds are carried by air circulation and are detected by the antennae of male insects.

These special compounds, which are natural products, can now be synthesized in laboratories. For this, first of all, the pheromone of an agricultural pest is isolated from the relevant pest, and the structure of the organic compound specific to each insect species is determined and these molecules are synthesized on a large scale under laboratory conditions. In the fight against damage to crops, pheromones that will attract agricultural pests are placed in agricultural areas and the pests are caught using a trap. In this method, a large number of pheromone-releasing emitters are placed in the production area that needs to be protected. In this way, by providing a high pheromone concentration in the traps on agricultural land, the natural pheromone smell secreted by the pest is masked, and thus the insects are prevented from breeding because one of the reproducing sexes is destroyed or the opposite sexes are prevented from meeting. By using this technique, it is possible to produce many crops on fruit farms and other agricultural land with high efficiency without using any pesticides.

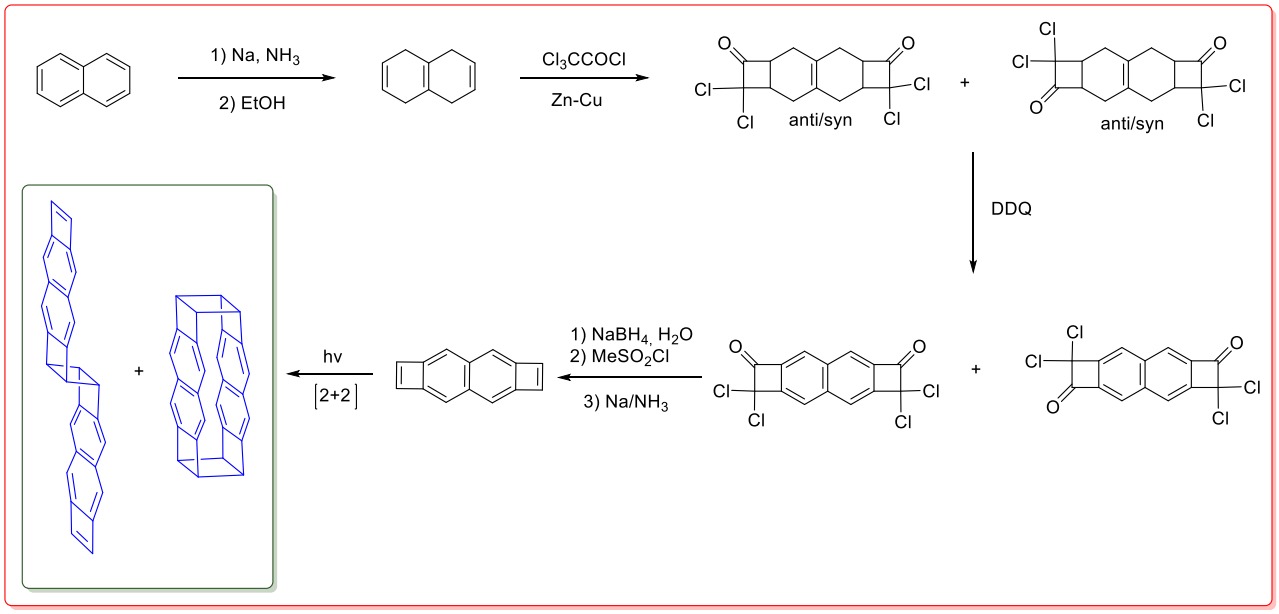
Arif Daştan

Problem

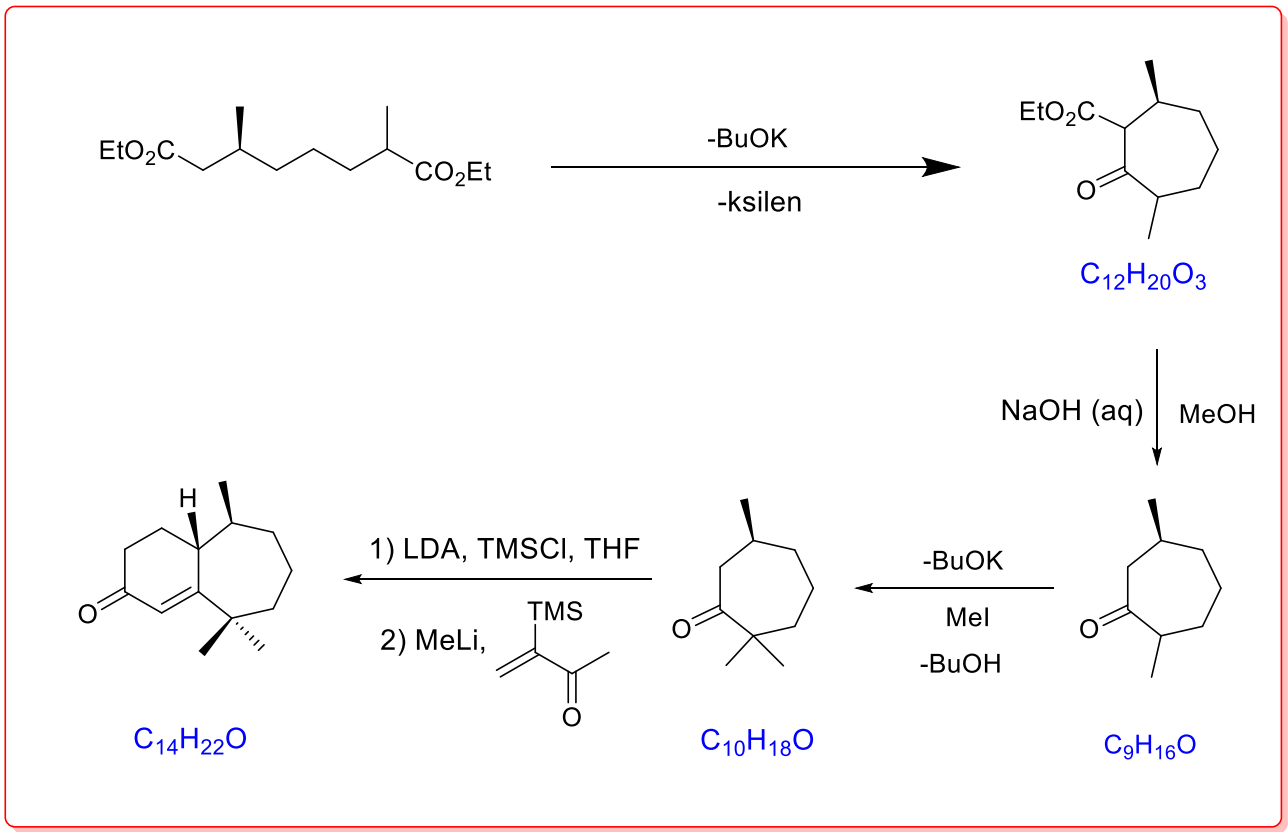
The molecule shown below with the symbol **E** is the pheromone of the *Aphthona flava* vegetable pest from the beetle class. The total synthesis of this natural product, isolated from the female of *Aphthona flava*, in the laboratory with molecule **A** consists of the reaction steps shown below. Draw open structures of molecules **B-E** that are left blank in the diagram



Solution Problem 8.



Solution Problem 9.



NEWS FROM NATIONAL TEAMS OF COUNTRIES

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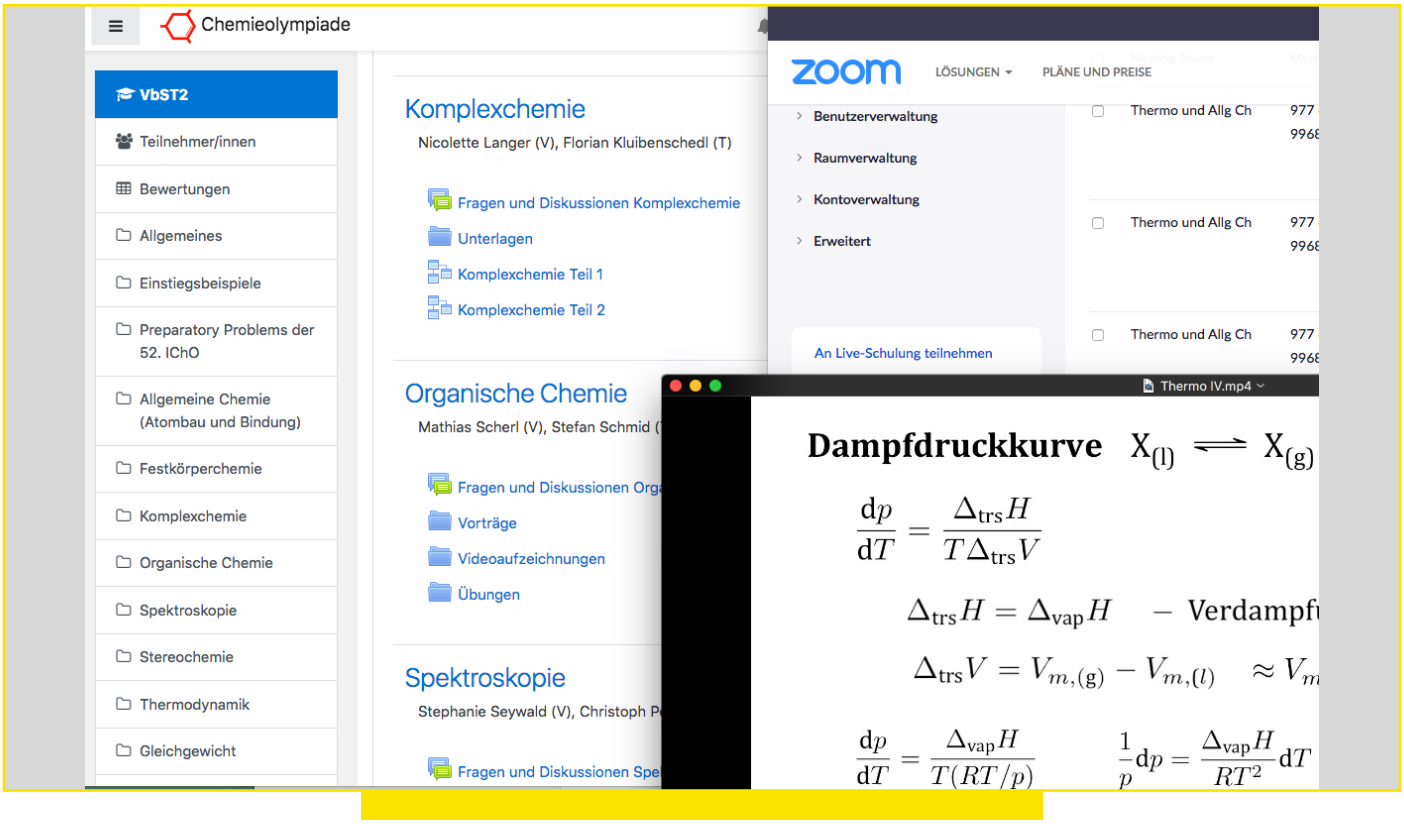


AUSTRIA

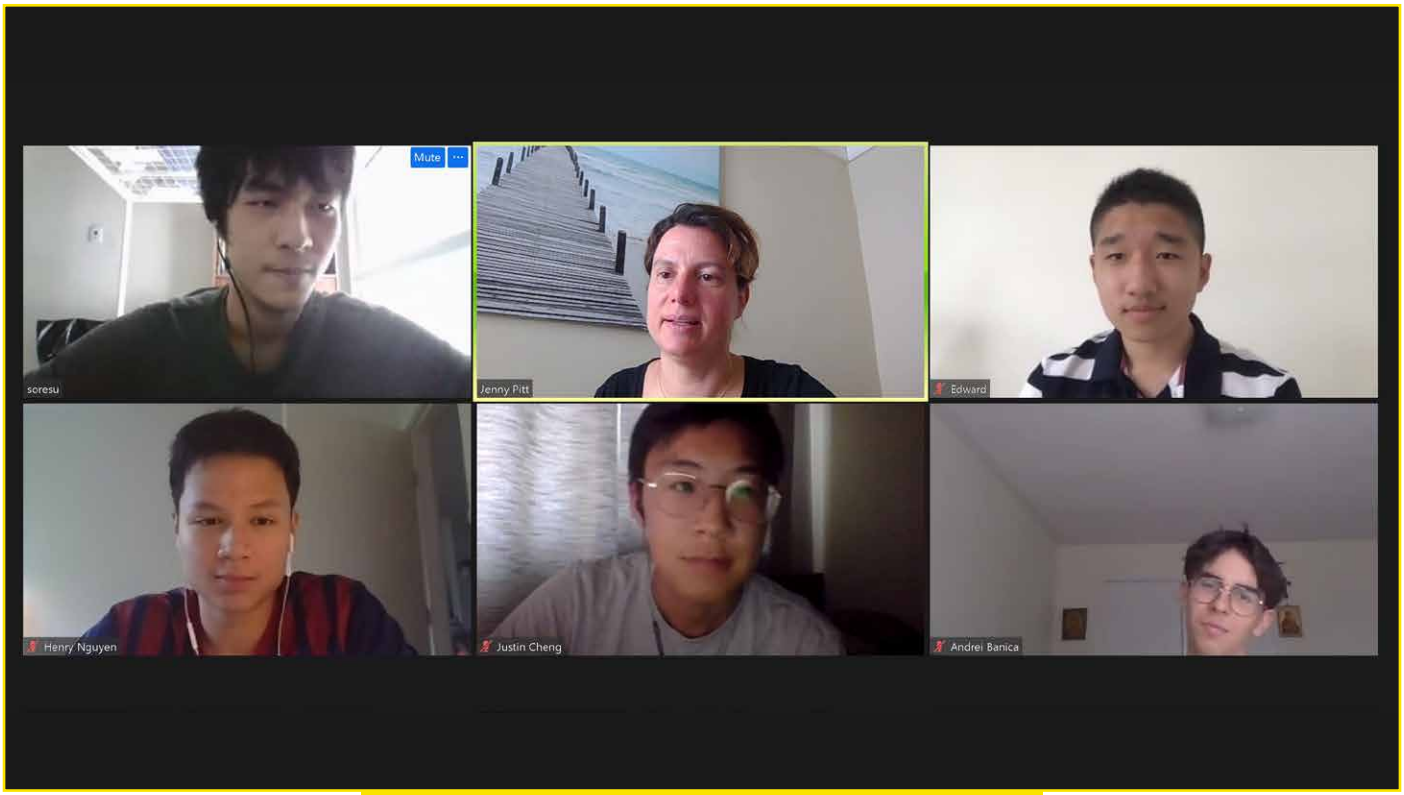
Moodle, Zoom and mp4 - Austrian Preparation with COVID 19

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

BULGARIA

Georgi, Teodor, Pavel, Damyan

NEWS FROM NATIONAL TEAMS OF COUNTRIES



CANADA

The National Team Zoom tutorials

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

CZECH REPUBLIC

ChO national round finalists at the summer camp Běstvina

NEWS FROM NATIONAL TEAMS OF COUNTRIES

DENMARK

A day in lab

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

ESTONIA

Estonian mascot is ready for the IChO but sad because he cannot meet his friends

NEWS FROM
NATIONAL TEAMS OF
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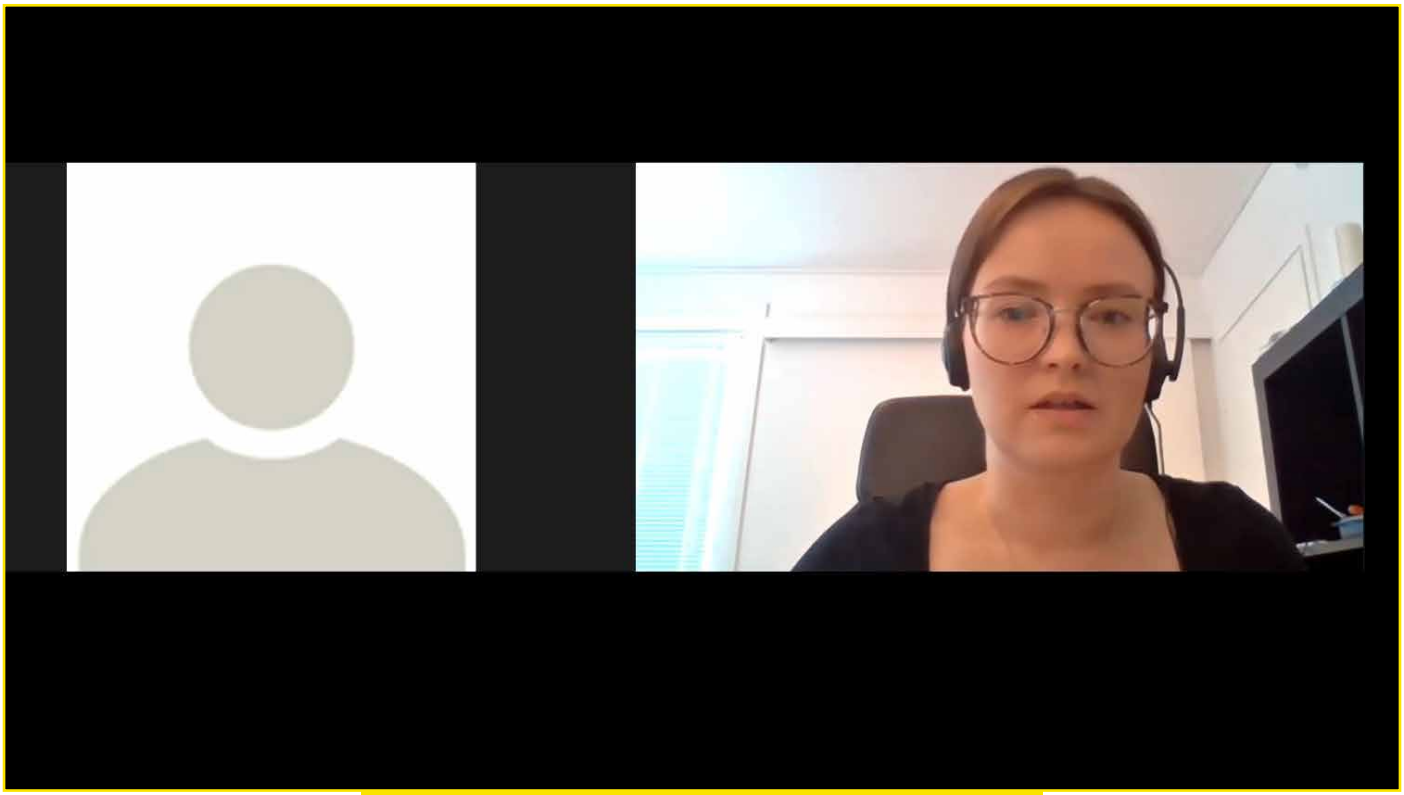


FINLAND

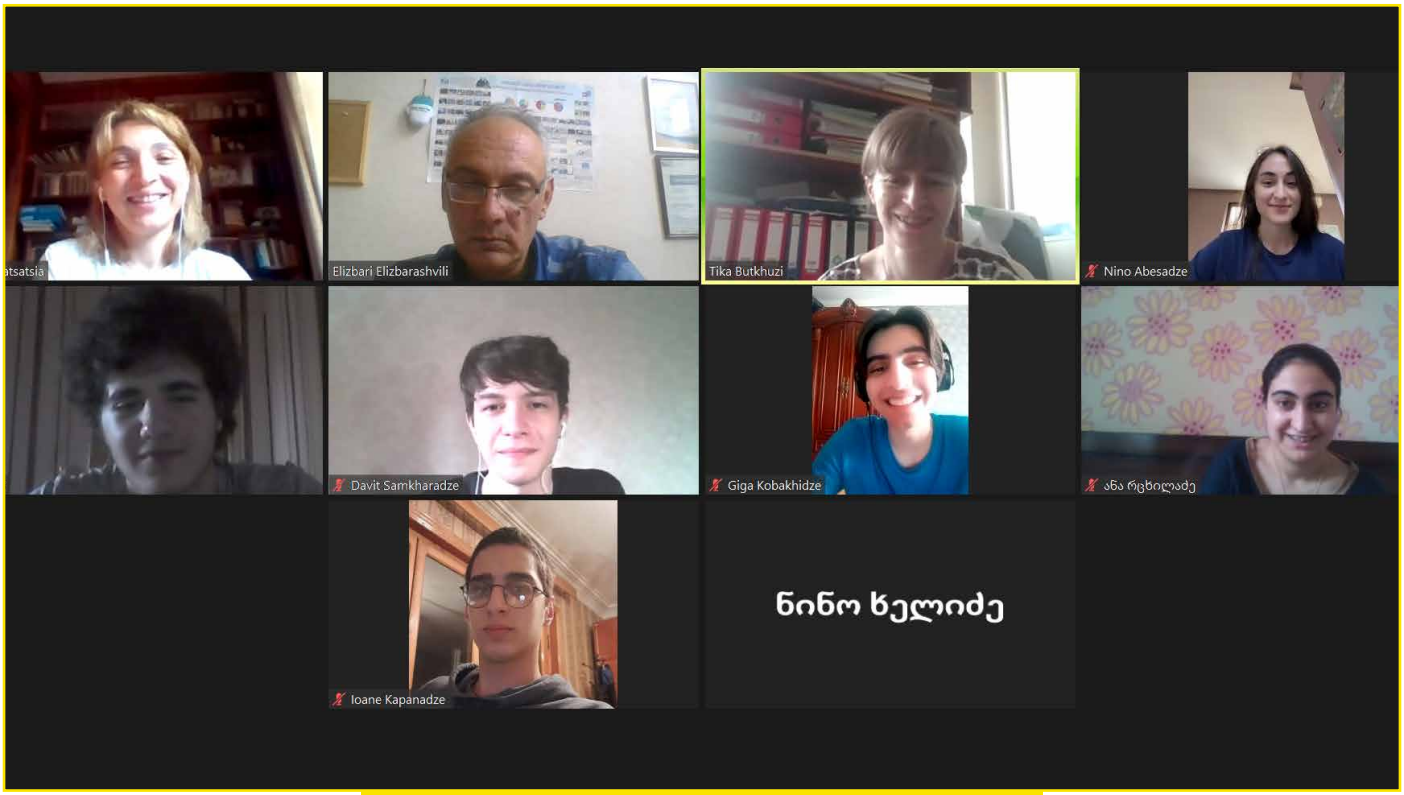
National preparations for IChO in Finland 2020

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

FRANCE

French preparation in 2019, without any lockdown

NEWS FROM NATIONAL TEAMS OF COUNTRIES



GEORGIA

Team of Georgia during online training.

NEWS FROM
NATIONAL TEAMS OF
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GERMANY

Participants at the 3rd round meeting in Göttingen for a seminar week.

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

GREECE

the 4 heroes

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

IRAN

Online preparations of Iranian students

NEWS FROM NATIONAL TEAMS OF COUNTRIES

IRELAND

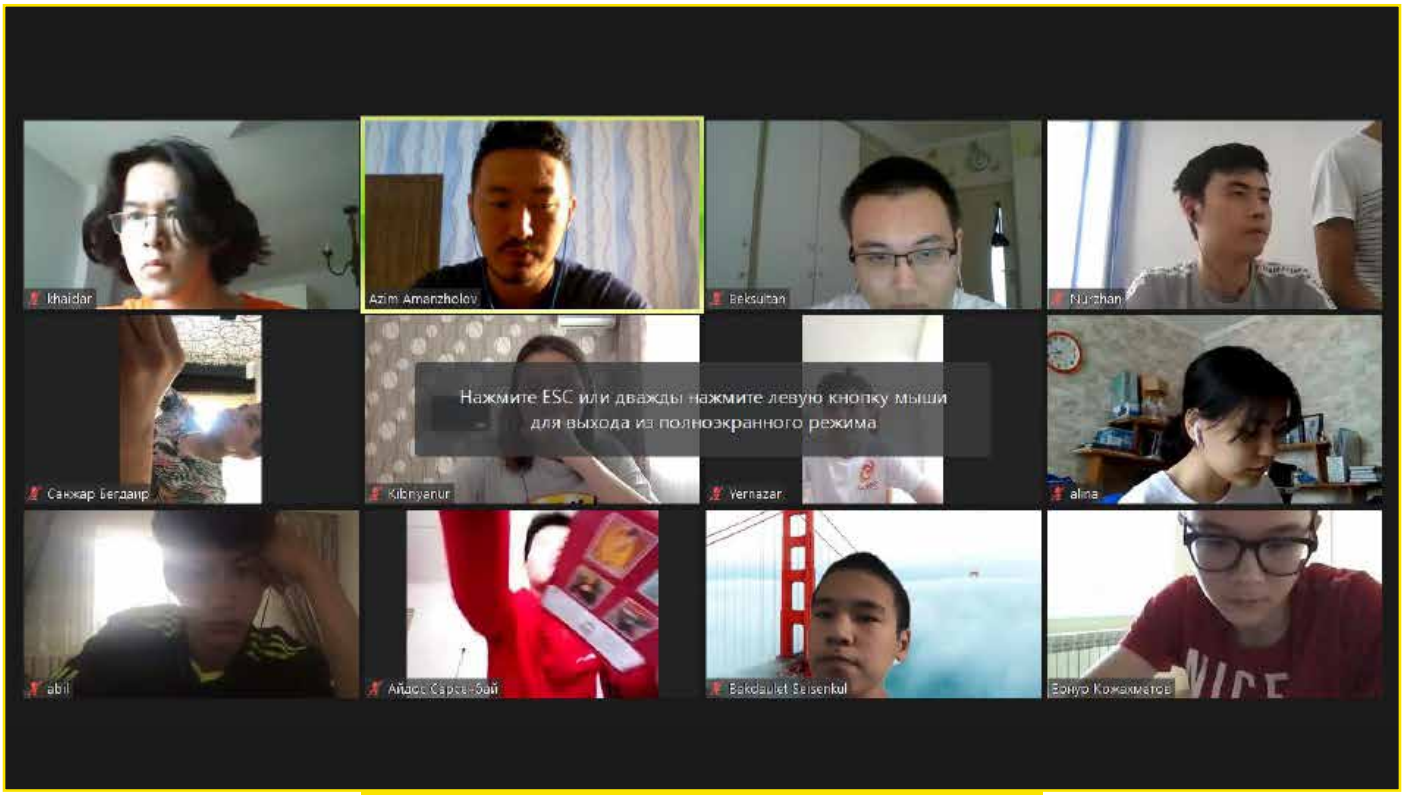
A quick coffee break between the Round 1 examinations!

NEWS FROM NATIONAL TEAMS OF COUNTRIES

JAPAN

Scene of domestic qualifying.

NEWS FROM NATIONAL TEAMS OF COUNTRIES



KAZAKHSTAN

Candidates to national team and was prepared in too strong condition

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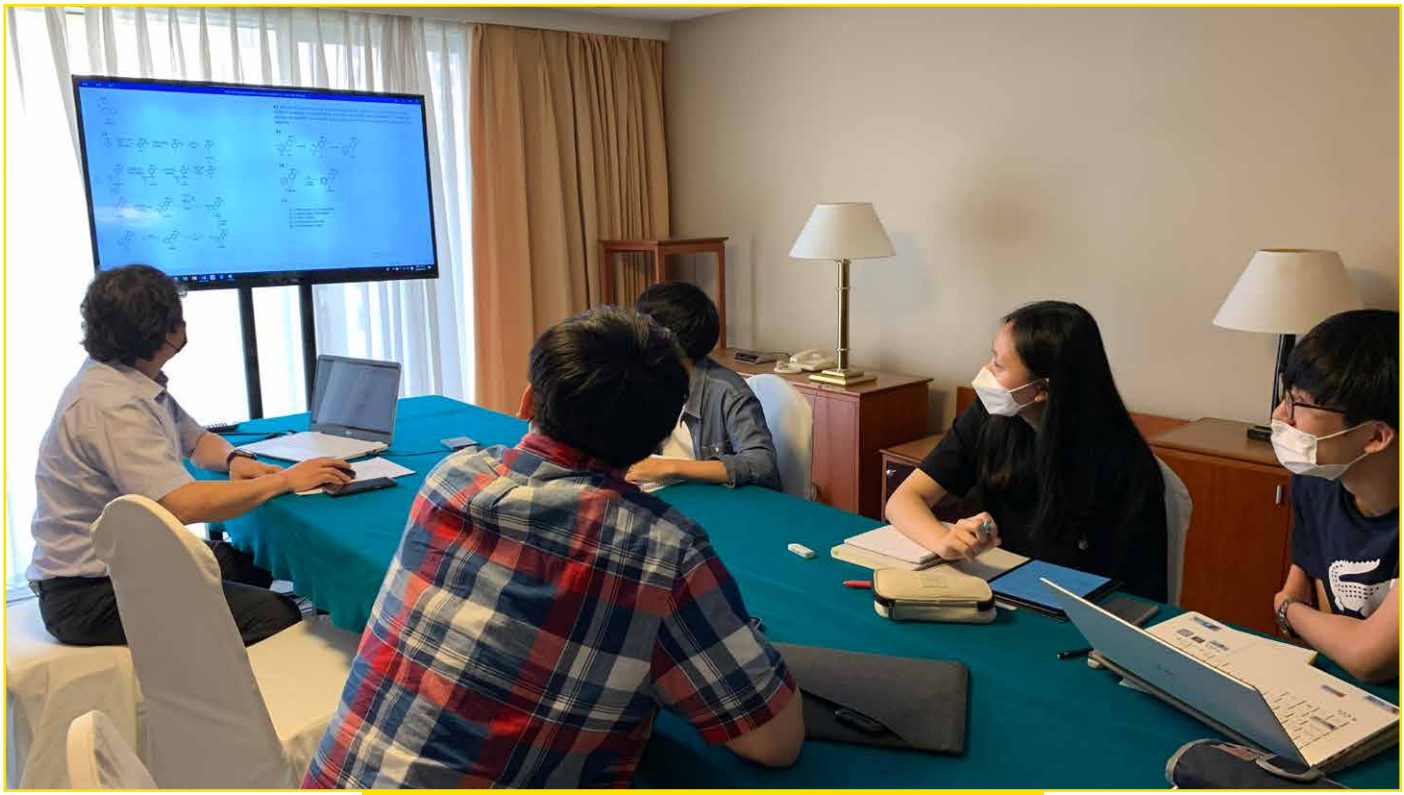
COUNTRIES



KOREA

This is a photo of intensive training for IChO.

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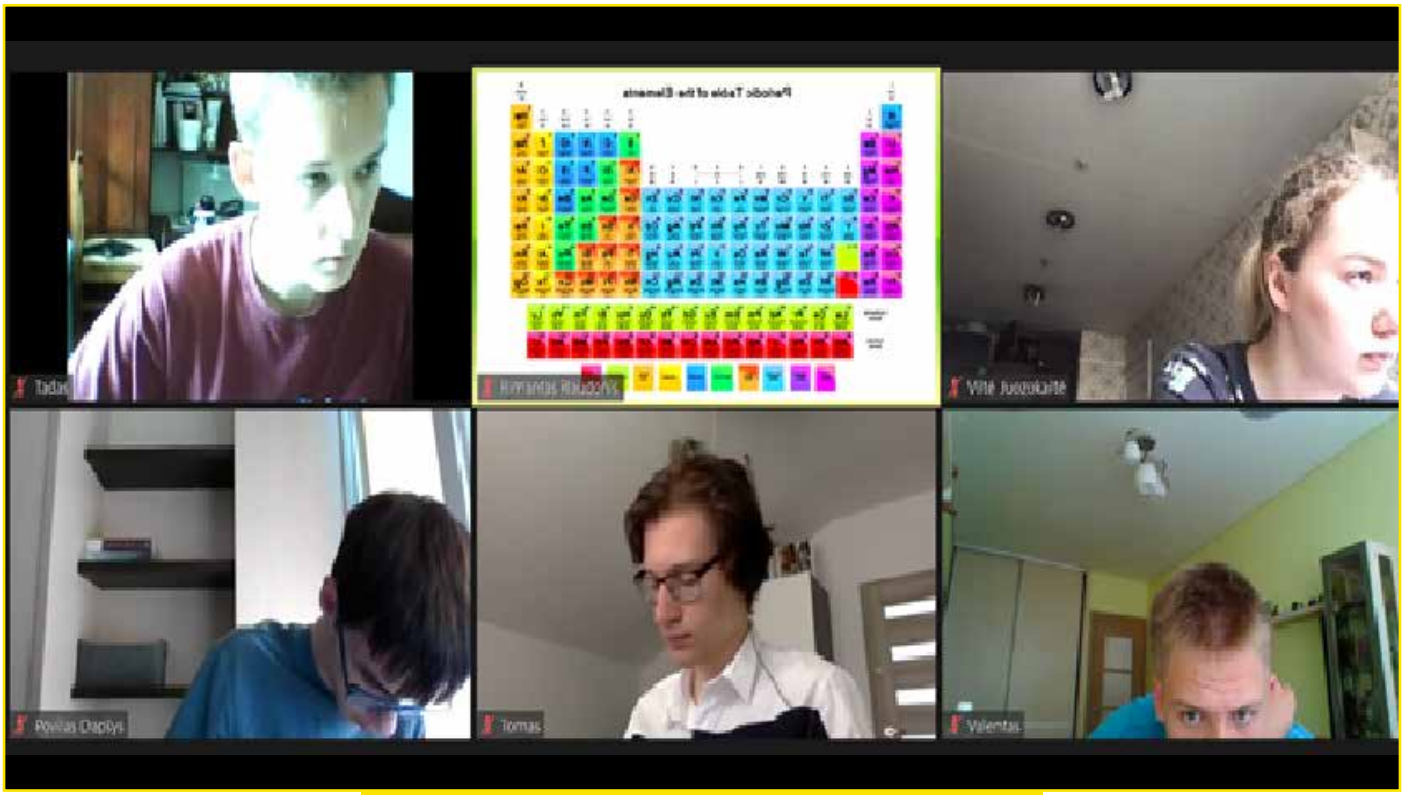

LITHUANIA

Olympiad during pandemic

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MEXICO

Mexican selection training

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

PHILIPPINES

Philippine National Chemistry Olympiad

NEWS FROM
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POLAND

Preparations were theoretical, but enthusiasm was as huge as in previous years!

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

SAUDI ARABIA

Saudi Team preparation for IChO 2020

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

SERBIA

Serbian IChO team, a short break during the preparations in Niš.

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

SRI LANKA

Chemistry Olympiad Sri Lanka 2020 finalists with the organizing committee

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

TAJIKISTAN

Preparation for online IChO2020

NEWS FROM NATIONAL TEAMS OF COUNTRIES

THAILAND

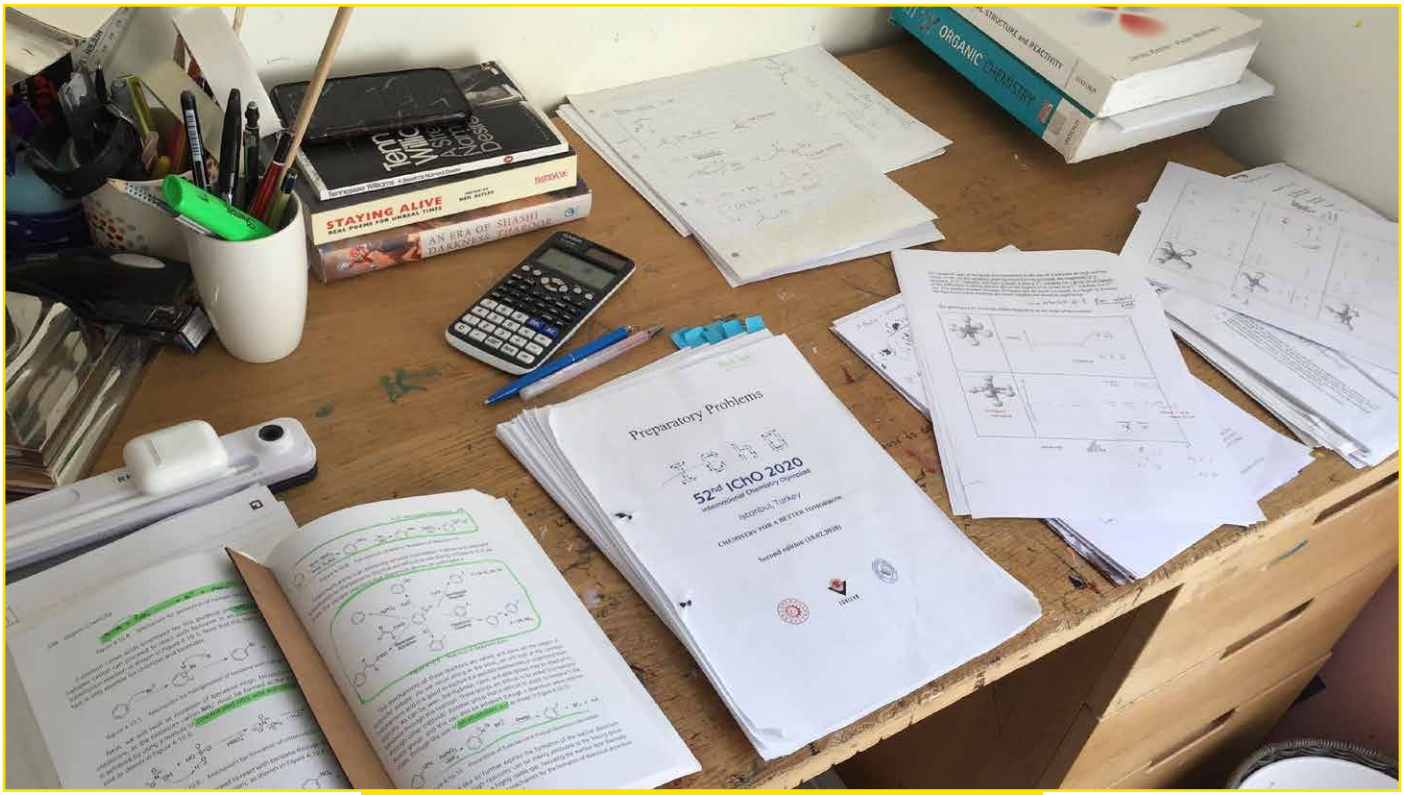
Ready for the Competition. Thailand Fighting.

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

TURKMENISTAN

Friendly, assiduous and a hopeful Team.

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES



UNITED KINGDOM

Preparing from home!

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

UNITED STATES OF AMERICA

Dr. John Warner presenting on our first day of virtual study camp.

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

URUGUAY

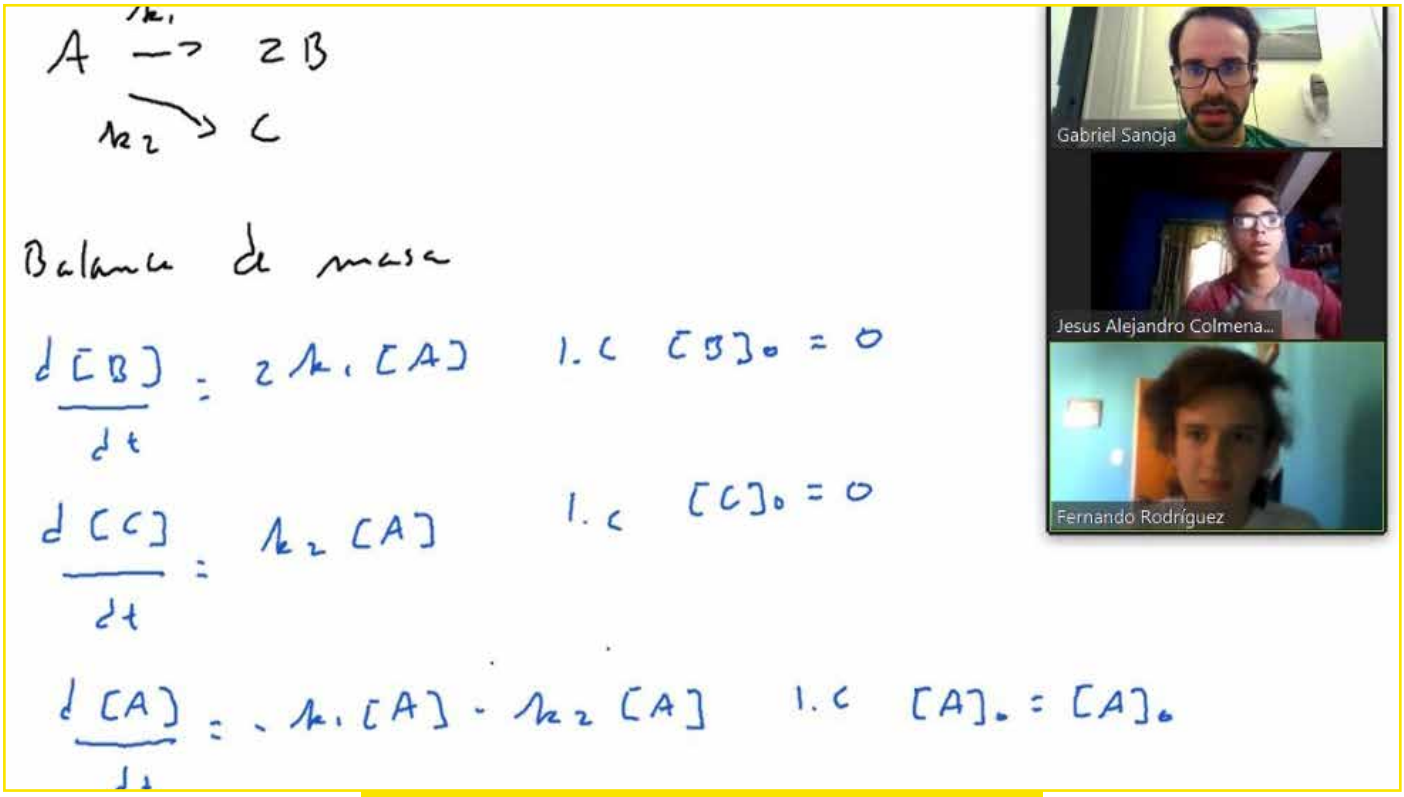
This the Uruguayan delegation which has been preparing for IChO by a digital way

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

UZBEKISTAN

It was hard however they were able to reach the top

NEWS FROM NATIONAL TEAMS OF COUNTRIES



VENEZUELA

Venezuelan team training: online session of chemical kinetics.

NEWS FROM
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COUNTRIES

VIETNAM

Right to left: Quoc Anh, Hoang Duong, Hai Dang, Minh Trang

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