Welcome Messages

Mustafa Varank

Republic of Turkey Minister of Industry and Technology

Dear Participants of IChO 2020,

It gives me great pleasure to welcome you all to the 52nd International Chemistry Olympiads (IChO) in Istanbul. I hope you will enjoy your stay in Turkey and take back nice memories with you. Chemistry as a science has been studied and applied for centuries in these lands; therefore, holding such an important event in İstanbul makes it even more meaningful.

You are all welcome in Istanbul, the beautiful city of two continents. As you all know, Istanbul is the only city in the world lying across continents, with one arm reaching out to Asia and the other to Europe. For more than 1500 years, it has been the capital of three Empires: Roman, Byzantine and the Ottoman Empires. Setting aside its magnificent historical heritage thanks to its glorious past, Istanbul is the international center of finance and economy offering services in banking, telecommunications, industry, technology, marketing, engineering and tourism. There are more than 60 universities in Istanbul and thousands of international students prefer to study in these universities.

In international competitions such as IChO, the contestants' achievements are striking in two respects. Firstly; it builds up our hopes for the future through their performance, demonstrating what mankind is capable of intellectually. Secondly, it is striking to witness that the universality of chemistry reasoning is reflected in the work of the students despite the wide cultural diversities prevailing among them. I consider it as the reaffirmation of the fact that chemistry reasoning is one of the highest and most universal values that the human intellect has created so far.

Needless to say; fostering and promoting friendly relations among young chemists in the world would contribute to the establishment of multi-dimensional scientific cooperation, which we value very much as the Ministry of Industry and Technology of Turkey. I sincerely believe that IChO 2020 will serve as a platform where participants from all over the world could establish long-lasting friendships, which – in the end – will result in the creation of a more peaceful world as well as mutual understanding between our countries.

I am very honored by your presence in my country and wish you success in the Olympiads.

Prof. Dr. Hasan Mandal

President of The Scientific and Technological Research Council of Turkey

It is a great honor for Turkey to host the 52nd International Chemistry Olympiad (IChO) in Istanbul Technical University (ITU). ITU is one of the oldest technical universities in the world. As ITU provides an international environment, it offers many opportunities for students to gain international experience. I am very happy to express that the Scientific and Technological Research Council of Turkey (TUBITAK) is coordinating the organization of this event. I would like to extend my warm welcome to all participants from every part of the world!

Chemistry is commonly referred to as the central science not only due to its connections with other scientific disciplines but also owing to its impact on our lives. The knowledge derived from chemistry allows us to appreciate the world we live in, as well as understand how to change and improve it. Therefore, it is very exciting to host the most talented young chemists who will take part in shaping the future of chemistry as well as our world. More than 300 IChO contestants from nearly 80 countries on five continents believing in "chemistry for a better tomorrow" will have ten days of magnificent experiences.

In addition to scientific experiences, our guests will also enjoy various activities and experience amazing opportunities in Istanbul, which is a city of fantastic history, culture, and beauty. Istanbul is the financial center of Turkey and it retains its metropolitan status: the city's population is more than 14 million people, making it one of the largest cities in the world. The days you will spend in Istanbul will be unforgettable in all – scientific, cultural and educational terms. The city of Istanbul, where most activities will take place, will surely offer you fascinating perspectives and memorable experiences. So please enjoy your time here.

We look forward to welcoming all participants of the 52nd International Chemistry Olympiad to participate in this great scientific event. Let's meet in Istanbul where the continents and cultures "Bond".

Prof.Dr. Aziz Sancar

Nobel Laureate In Chemistry

It is my great pleasure to greet you all at this special science summit in Istanbul, a beautiful city and a historical crossroads between continents and civilizations. This is also the city where I fell in love with chemistry and I received my fundamental chemistry education that many years later led to a Nobel Prize in Chemistry. You have come together from different backgrounds to spend time with one another and compete to earn one of the medals in recognition of your love for chemistry. I know you have worked very hard to achieve the honor of representing your home country at this Olympiad. However, you are not representing just your homeland but you are also representing the hope of humanity for a better world where science is supreme and is used to help build a just and prosperous world for all people regardless of national origin, ethnicity, or personal beliefs. If you choose to pursue this scientific journey, this will be just the beginning. You must continue to work hard as I believe strongly that hard work is the most important key to success. I also believe that the honor of being an Olympian, which all of you share, goes hand in hand with the responsibility of serving humanity. You are our hope for a better and a just future for mankind.

Chemistry defines the way a substance changes and reacts with other substances. Thus, learning chemistry helps you better to contribute to the well-being of humanity and to a better world.

I wish you all good luck at the Istanbul Chemistry Olympiad.

Mehmet Karaca

Rector of Istanbul Technical University

Dear Honorable Chair, Esteemed Delegates and Distinguished Guests,

As Istanbul Technical University, it gives us great pleasure to host such an important scientific event, International Chemistry Olympiad 2020.

As you know, Istanbul is geographically the only city linking two continents in the world. It is the cultural, industrial and financial capital of Turkey. With its approximately 15 million inhabitants, Istanbul is at the heart of Turkey's education scene. Istanbul hosts 61 out of Turkey's 207 universities, 762.503 students and 34.235 academicians today. This makes the city a center for academic studies.

Founded in 1773, the Istanbul Technical University is very much like the city of Istanbul itself: a diverse and multicultural community bridging a vast number of opportunities and resources. ITU, the fourth oldest technical university of Europe and the World is devoted to developing a community of scientists, engineers, architects and artists who can make a difference beyond borders. Like Istanbul, ITU acts as a hub bridging international cooperation with leading institutions, and creates the necessary environment for economic and technical growth.

We will be very pleased to be able to welcome you to The International Chemistry Olympiad 2020 in Istanbul.

Sincerely, with many thanks,

Visa Information

To check the visa policy of Turkey please visit the following website: www.evisa.gov.tr/en/

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52nd IChO 2020
International Chemistry Olympiad

Catalyzer

01 October '19

CHEMISTRY FOR A BETTER TOMORROW

52ND ICHO 2020 / 6-15 JULY 2020 ISTANBUL, TURKEY

ICHO2020.TUBITAK.GOV.TR

Istanbul Airport Transportation Information

Public transport

A.Istanbul Airport

Istanbul Airport is located on the European side, between Tayakadın, a neighborhood on the Black Sea coast, and Akpınar villages. Istanbul Airport is 35 km from the city center. Havaist buses go to many central, easy-to-reach spots, such as Taksim, Beşiktaş, Yenikapı, Bahçeşehir and Kozyatağı. For more information on schedules take a look at our Havaist page. You can also reach the city center from the airport with İETT buses. You can find more information on bus lines on our İETT page.

B. Sabiha Gökçen International Airport

Istanbul Sabiha Gökçen Airport is 46 km from the city center Sultanahmet, where you can find Havataş buses, metro, and tramway. By Havataş bus, it costs TRY 9 from Sabiha Gökçen Airport from Kadıköy and TRY 14 from Taksim. You can reach Kabataş via Taksim by taking the Kabataş funicular for TRY 2.40. It would take around 2.5 hours for you to reach Sabiha Gökçen Airport from Sultanahmet. You can then transfer from Kabataş with tram for TRY 1.45. Average time from airport: A: 120 minutes | B: 150 minutes
Distance from airport: A: 35 km | B: 46 km

Taxi

A. Istanbul Airport

It takes around 30 minutes to reach the city center from Istanbul Airport by taxi, and costs around TRY 100-110. There are taxis in front of the international and domestic terminals.

B. Sabiha Gökçen International Airport

There is a 24/7 taxi service from Istanbul Sabiha Gökçen Airport to Sultanahmet. It takes about 1 hour, and costs around TRY 100

Transportation to ITÜ Ayazaga Campus

İTÜ Ayazaga metro station is located in front of the Ayazaga İTÜ campus in Ayazağa. (Metro Station is signed on Transportation Lines Map)

Metro Network
www.metro.istanbul/YolcuHizmetleri/AgHaritalari

Location
@41.1084793, 29.0178551

Organizers

Ministry of Industry and Technology

Ministry of Industry and Technology is a government ministry office of the Republic of Turkey, responsible for industrial and technological affairs in Turkey. Minister of Industry And Technology is Mustafa VARANK.

www.sanayi.gov.tr/?lang=en

The Scientific and Technological Research Council of Turkey

TÜBİTAK, The Scientific and Technological Research Council of Turkey is a national agency of Turkey whose stated aim is to develop science, technology and innovation, to support and conduct research and development, and to "play a leading role in the creation of a science and technology culture" in the country. President of The Scientific And Technological Research Council Of Turkey is Prof. Dr. Hasan MANDAL.

www.tubitak.gov.tr/en

Istanbul Technical University

Istanbul Technical University (ITU) is one of the oldest technical university dedicated to engineering sciences as well as social sciences recently, and is one of the most prominent educational institutions in Turkey.

global.itu.edu.tr

Turkey

Turkey, officially known as the Republic of Turkey, is a transcontinental Eurasian country located mainly in Western Asia, with a smaller portion on the Balkan Peninsula in Southeast Europe. Istanbul is the largest city, but more central Ankara is the capital. Turkey is a vast peninsula, covering an area of 780,000 sq km and linking Asia to Europe through the Sea of Marmara and the Straits of Istanbul and Çanakkale.

Turkey's economy and diplomatic initiatives led to its recognition as a regional power while its location has given it geopolitical and strategic importance throughout history. Turkey is also one of the world's top ten destination countries.

The total population of Turkey is 82 million people as per 2018 estimate.

As of 2019, there are 207 universities in Turkey. Turkey is a member of the European Higher Education Area and actively participates in the Bologna Process. According to the Times Higher Education World University Rankings, the top universities in Turkey are Bogaziçi University, Middle East Technical University, Bilkent University, Koç University, Istanbul Technical University, Sabancı University.

Turkish Lira is official currency in Turkey.

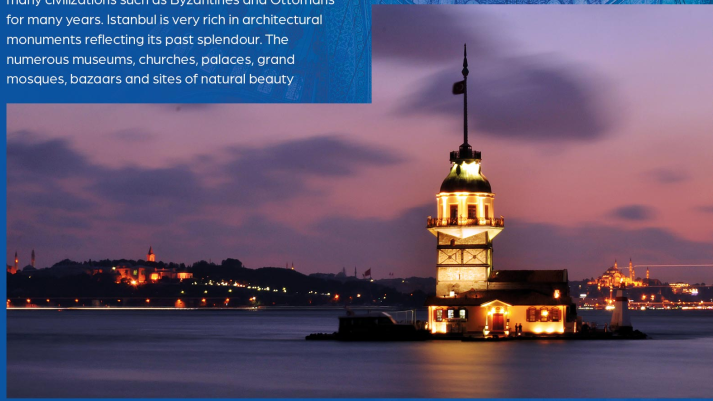
Surrounded by seas on three sides, it is placed in the temperate climate zone. The climate varies considerably from region to region, however: a temperate climate in the Black Sea region, a Mediterranean climate on the southern coast and the Aegean, a continental and arid climate on the central plateau, and a harsh mountain climate in eastern Turkey. Because of these variations in climate, the fauna and flora are some of the richest in the world.

The official language of Turkey is Turkish.

Let's meet in the city of two continents!

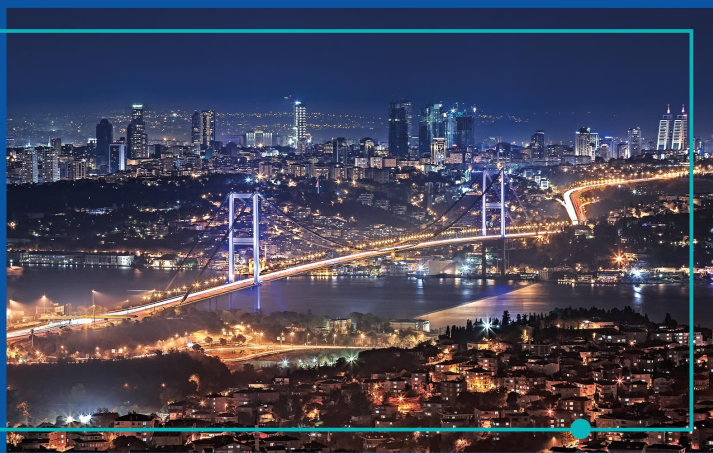
Istanbul, built on two continents where is a bridge between Europe and Asia. Thus, trances of modern western cities combined with a traditional eastern cities may be observed clearly. Furthermore, many civilizations come together that forms a "melting pot" in Istanbul.

Istanbul is a prominent multicultural city as it hosted many civilizations such as Byzantines and Ottomans for many years. Istanbul is very rich in architectural monuments reflecting its past splendour. The numerous museums, churches, palaces, grand mosques, bazaars and sites of natural beauty mesmerize visitors. As both modern and traditional values are exhibited together, Istanbul is truly one of the most glorious cities in the world. Indeed, glorious treasures that remind the cultural heritage of past civilizations and especially the Bosphorus during sunset are an experience of a lifetime.



Istanbul, Turkey

"Istanbul, built on two continents where is a bridge between Europe and Asia. Thus, trances of modern western cities combined with a traditional eastern cities may be observed clearly. Furthermore, many civilizations come together that forms a 'melting pot' in Istanbul."



Istanbul Technical University

Istanbul Technical University (ITU) is one of the oldest technical universities. Istanbul Technical University is a prominent and pioneering university of engineering and architecture with many innovative studies in science, technology, research and development. İTÜ, as a university mainly composed of graduate engineering schools and research laboratories, works in close collaboration with enterprises and other economic and social partners. Our university facilitates the knowledge and technology transfer to industries, management centers, briefly to all society. ITÜ has created many Techno-Science parks, incubation centers, entrepreneurship and innovation center and technology transfer office to make this happen.

History of İTÜ

1773 Imperial School of Naval Engineering

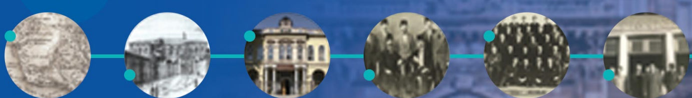
1795 Imperial School of Civil Engineering

1883 Imperial Collage of Engineering

1909 Collage of Engineering

1928 School of Senior Engineering

1944 Renamed as Istanbul Technical University



Website
global.itu.edu.tr

Tentative Program

Date		Student	Mentor & Observer	Guest
Mon, July 6	Whole day	Arrivals and Registration	Arrivals and Registration	Arrivals and Registration
Tue, July 7	Morning	Opening Ceremony	Opening Ceremony	Opening Ceremony
	Afternoon	Recreation/Excursion	Lab Inspection	Excursion
	Evening	Free Time	1st Jury Meeting	Excursion
Wed, July 8	Whole day	Excursion/Lab Safety Instruction	Translation of Practical Exam	Excursion
Thu, July 9	Morning	Practical Exam	Excursion	Excursion
	Afternoon			
	Evening	Free Time	2nd Jury Meeting	
Fri, July 10	Whole day	Excursion	Translation of Theoretical Exam	Excursion
Sat, July 11	Morning	Theoretical Exam	Excursion	Excursion
	Afternoon			
	Evening	Reunion Party	Reunion Party	Reunion Party
Sun, July 12	Morning	Free Time	Grading the Exam	Excursion
	Afternoon			
	Evening		3rd Jury Meeting	Free Time
Mon, July 13	Whole day	Free Time	Arbitration/4th Jury Meeting	Free Time
Tue, July 14	Morning	Free Time	Free Time	Free Time
	Afternoon	Closing Ceremony	Closing Ceremony	Closing Ceremony
	Evening	Farewell Party	Farewell Party	Farewell Party
Wed, July 15	Whole day	Departures	Departures	Departures

52nd IChO 2020
INTERNATIONAL CHEMISTRY OLYMPIAD

CATALYZER

THE FIRST ISSUE OF CATALYZER MAGAZINE 15/07/2020

AZIZ SANCAR: "WHATEVER YOU DO, DO IT WELL AND WORK HARD!"

Aziz Sancar shared the 2015 Nobel Prize in Chemistry with Tomas Lindahl and Paul Modrich.

Aziz Sancar was influenced by a chemistry teacher in high school and it was at that time his relationship with the subject began. Prof. Mehmet Öztürk says that Sancar gets his work discipline from his father and his intelligence from his mother. While he had his heart set on studying chemistry, at the insistence of his friends he enrolled in the medical faculty, where he was afraid of failure as a student from the southeast. For this reason he studied day and night and took part in no social activities and even though he loved football he didn't go to a single match.
Sancar says that the three key qualities a successful scientist should have are knowledge-based creativity, industriousness, and perseverance in the face of failure.

Sancar says there may be two reasons when the Nobel Prize in Medicine or Chemistry is shared among people. The first is that these people have made indistinguishable contributions to the same subject.

The second is that they contributed to the same subject, but each independently to its subfields. Aziz Sancar belongs in the second category, because there are five important mechanisms of DNA repair: direct repair (repair with photolyase), nucleotide excision repair, base excision repair, repair of interstrand cross-links, and double-strand break repair.

The fifth mechanism previously received a prize, while the other four received the 2015 Nobel Prize. Sancar was deemed worthy of the Nobel Prize for his work on direct repair and nucleotide excision, Lindahl for his work on the base excision mechanism, and Modrich for his work on the mechanism of DNA mismatch repair.

Sancar was frequently asked if he had expected to receive an award. He answered that his work deserved a Nobel Prize and he'd thought that if a Nobel Prize were to be given one day for DNA repair then they would give it to him, adding that what he cared about was his contribution to science rather than winning a prize, and that he had always trusted himself and his work.

Sancar donated the prize money to Carolina Türk Evi (Turkish House), where young people visiting from Turkey can stay and that also functions as a Turkish cultural center. He donated his Nobel medal to Anıtkabir, the mausoleum of Atatürk, the founder and first president of the Republic of Turkey. He stated that this was completely natural and the medal was in the right place, because it was given not to him but to the Republic of Turkey and Atatürk and it was won due to them.

Bilim ve Teknik (Science and Technology magazine), June 2016

Özlem Ak

NOBEL PRIZE IN CHEMISTRY 2019: LITHIUM-ION BATTERIES

Akira Yoshino

M. Stanley Whittingham

John B. Goodenough

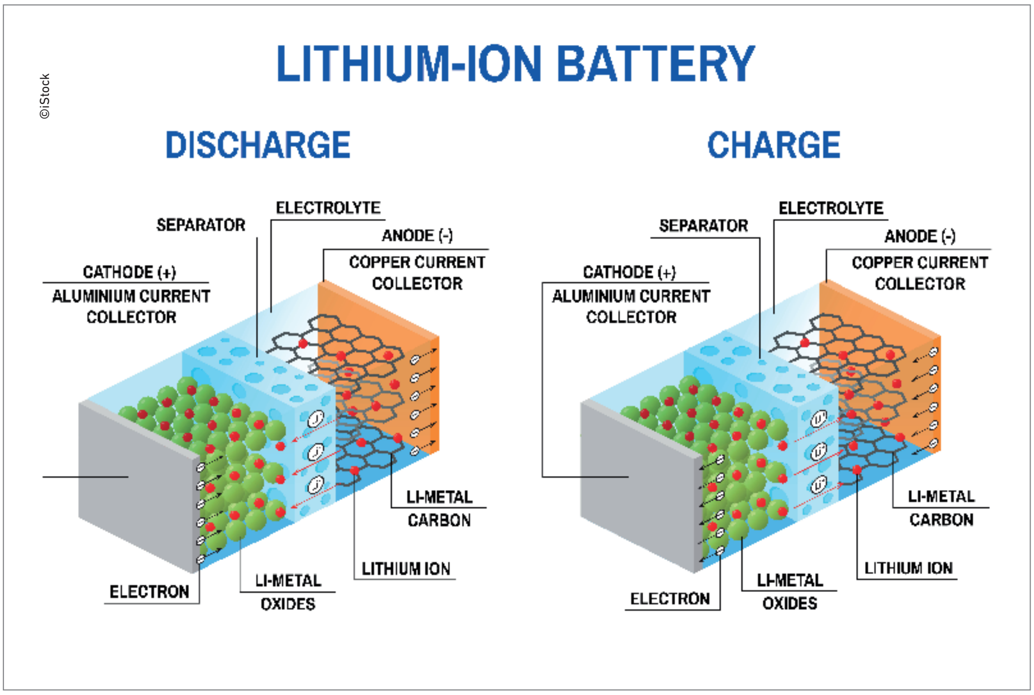
John B. Goodenough, M. Stanley Whittingham, and Akira Yoshino were awarded the 2019 Nobel Prize in Chemistry for developing lithium-ion batteries, used worldwide to power everything from portable electronics to electric cars. The development of these batteries is the basis of our 'new rechargeable world' and has the greatest impact on the modern life of every one of us on the planet. More powerful, safer, and lighter rechargeable batteries are key to the growth of the electric car industry in the future. Many people hope that lithium-ion battery technology will not only meet our energy storage needs for this type of application but also reduce climate change by replacing burning fossil fuels as an energy source. These batteries also possess the ability to store significant energy from renewable sources such as solar, wind, and hydroelectric.

The charge and discharge cycles in lithium-ion batteries, which were first proposed by Whittingham, simply depends on the movement of lithium ions back and forth between the anode and cathode to produce energy. Conventional batteries are based on reversible/irreversible chemical reactions that quickly deteriorate in capacity over time. Whittingham used lithium metal at the anode, which has the greatest electrochemical potential and provides the largest specific energy per weight. The cathode was made of layered titanium disulfide material, with gaps between the layers at the molecular level that can host (intercalate) lithium ions. A battery with a potential slightly larger than two volts was constructed using a permeable membrane separator between anode and cathode. However, the charging/discharging cycles produce unwanted needle-like whiskers or dendrites on the anode that could penetrate the separator and cause the battery to short circuit. These failures can lead to fires and even explosions, making their use in many applications impossible.

Based on Whittingham's work, Goodenough tried to develop a better cathode material to create powerful lithium-ion batteries that would have a higher potential. By using cobalt oxide as the layered material in place of the titanium disulfide cathode, he doubled the potential difference between the two electrodes, making them far more practical for real-world applications.

Yoshino replaced the highly reactive lithium metal in the anode with petroleum coke, a material having naturally occurring layers within its structure that could provide high enough stability for a battery by housing lithium ions. He used cobalt oxide as a cathode material, which also has a layered structure and could house lithium ions. With this design on the market since 1991, Yoshino created the first safe and stable lithium-ion batteries. The rechargeable battery he developed had a high capacity and was remarkably stable; it could be charged and recharged for many cycles before its performance deteriorated. Today, a typical lithium-ion battery consists of lithium cobalt oxide ($LiCoO_2$) or lithium iron phosphate ($LiFePO_4$) as the cathode material, a graphitic carbon electrode as the anode, and lithium salt in an organic solvent between them as the electrolyte.

Lithium-ion batteries are currently considered to be the best type of rechargeable battery. However, there is still a lot of ongoing research focusing on finding ways to improve their performance. Smaller, safer, and lightweight batteries with higher energy and fast-charging capacity have been essential for the miniaturization of portable electronics and the growth of the electric car industry. Most battery experts think that perfect energy storage is yet to come. Some approaches to improving the current lithium-ion battery technology include replacing lithium in the Li-ion technology with magnesium or sodium. In addition, there are many great innovative ideas such as Li-air or Zn-air batteries on the horizon.



Ümit Demir

A BRIEF HISTORY OF ORGANIC CHEMISTRY

In 1807, the Swedish chemist Jöns Jakob Berzelius (1779-1848) called substances that melt and substances that burn, when heated, inorganic and organic, respectively. Although it was recognized that new compounds could be produced from organic sources, until as early as the beginning of the 19th century it was widely thought that organic compounds could not be synthesized from inorganic sources. It was astonishing when Friedrich Wöhler (1800-1882) heated a classified inorganic compound, ammonium cyanate, and obtained an organic substance, urea, in 1828. Although it is now widely accepted that ammonium cyanate is not purely inorganic, Wöhler is generally regarded as the first chemist to synthesize organic material from an inorganic source.

Thus, the vitalists were proved wrong. Moreover, there was a clear distinction between organic and inorganic substances. One important thing was that some organic chemicals seemed to be the same but behaved differently. In 1815, Jean-Baptiste Biot (1803-1873), who discovered the benzyl radical, observed that tartaric acid produced by grapes and tartaric acid produced in the lab behaved differently. While the former polarized light, the latter did not. Furthermore, both acids had the same chemicals in the same proportions. Justus von Liebig (1803-1873) and Wöhler encountered some similar situations. Their analyses of various organic compounds revealed that different substances had the same chemical formulas. It was Berzelius who named these pairs isomers.

As a young chemist, Louis Pasteur (1822-1895) unraveled the mystery of the two types of tartaric acid that behaved differently in 1844. He painstakingly separated the two crystals and discovered that while one group polarized light the way tartaric acid from grapes did, the others polarized it in the opposite direction. He realized that the two types of polarization canceled each other out in the lab-made compound. He also noticed that two different organic molecules might have the same formula but different properties.

In 1861, Friedrich August Kekulé (1829-1896) used diagrams based on bonding in organic chemistry and proved that Pasteur was correct; the shape (position in space) of an organic compound determines its properties.

Even before basic concepts of organic molecules were understood, chemists had begun to synthesize new organic molecules having important properties. Adolph Wilhelm Hermann Kolbe (1818-1884) was the first chemist to make an organic compound, acetic acid, from chemical elements. Nitrocellulose, also known as guncotton, was synthesized by accident by Christian Schönbein (1799-1868) in 1846. This very explosive chemical was discovered when his wife's apron, with which he was wiping up a spilled mixture of acids, exploded and vanished in a puff of smoke. When people tried to manufacture it in quantity, there were many fatalities. In the same year, a marginally safer explosive, nitroglycerine, was discovered. Eventually both chemicals were tamed into cordite and dynamite. Thus, the modern age of high explosives started.

Ten years later William Perkin (1838-1907) accidentally started another industry. He was trying to synthesize quinine, but he produced the first synthetic dye, mauve, which made him rich. Later, he initiated his second industry by making the first synthetic perfume ingredient, coumarin. Perkin was British, but in the second half of the 19th century most of the organic chemists were German, and Perkin's teacher was a German scientist, August Wilhelm von Hofmann (1818-1892), teaching in Britain. He synthesized his first dye, magenta, in 1858, and after returning to Germany he developed several violets. Other chemists in Germany produced natural dyes from easily available chemicals, obtaining a red dye called alizarin in 1869 and indigo in 1880. These dyes form the basis of the German chemical industry. Moreover, these dyes had an important impact on biology, leading to the discovery that coloring bacteria/cells with dyes made invisible structures visible.

Another British chemist, Alexander Parkes (1813-1890) succeeded in converting nitrocellulose to a nonexplosive but still quite flammable material, celluloid, in 1865, which was the first plastic. This was improved by an American inventor, John Wesley Hyatt, who was searching for a replacement for ivory billiard balls.

In the 20th century, British and American organic chemists dominated the plastics industry, producing rayon, Bakelite, nylon, Teflon, Lucite, and polyester, among other synthetics.

In the late 19th and early 20th centuries, raw materials for most of these materials were coal, water, and air. Later in the 20th century, petroleum replaced coal.

Turan Öztürk

TODAY'S PROBLEM

Problem 1. There are 1001 gold coins on the table. Alaaddin and the monster play the following game. In each move Alaaddin takes a number of coins from the table, puts them into a new empty pouch, and after that the monster, depending on the number of coins in the pouch, either takes this pouch or gives it to Alaaddin. The game ends if either Alaaddin or the monster gets 12 pouches. In this case whoever got less than 12 pouches also takes all the coins remaining on the table. The game also ends if no gold coins remain on the table. The monster tries to minimize the total number of gold coins that Alaaddin will get. Determine the maximum possible number of gold coins that Alaaddin can get with certainty.

Azer Kerimov

TURKEY: A COUNTRY BETWEEN THREE CONTINENTS

Zeki Koday

Turkey is located in the northern hemisphere. It lies east of the prime meridian (Greenwich) between 36 and 42 degrees north and 26 and 45 degrees east. The territory of the country in the Asian and European continents is separated by the Bosphorus and the Dardanelles. Turkey's territory in Asia (97%) is known as Anatolia, while the territory in Europe (3%) is known as Thrace. The country's territory is located where the old lands of Africa, Asia, and Europe are closest to each other. The area of the country is 780 thousand square kilometers and as of 2020 its population is 83 million. Turkey is surrounded by sea on three sides, allowing higher diversity of climate and agricultural products grown.

The Meriç Bridge; It was built to connect Edirne and Karaağaç on the River Meriç. The foundations were laid in 1833, during the reign of Mahmud II, but construction did not start until 1842 and it was completed in 1847, during the reign of Abdulmejid. The bridge rests on 13 abutments, is 7 meters wide and 263 meters long, and is still in active use. The River Meriç is 480 km long and is the 10th largest river in Turkey in terms of amount of water discharged.

The Bosphorus Bridge; On July 26, 2016, the official name of the bridge was changed to the July 15 Martyrs Bridge. The bridge, the construction of which started on February 20, 1970, was opened on October 30, 1973 by the 6th President Fahri Korutürk. The bridge connects Asia and Europe over the Bosphorus and is the first bridge in the world connecting two continents. On the European side of the bridge is the district of Ortaköy and on the Anatolian side is Beylerbeyi. The bridge is 64 meters high, 33.40 meters wide, its middle span, that is the distance between the two towers, is 1074 m, and its total length is 1560 meters.

Kurşunlugerme viaduct; It is located in Çatalca, İstanbul. It was built in the 2nd century to meet the water needs of Istanbul from the streams in the Stranca Mountains. This water system, which is 212 km in length, has been repaired several times after damage due to earthquakes and wear and tear. This structure has survived in part to this day. The photograph was taken from the valley, whose slopes are covered with lush forests, where the aqueduct is located in the village of Gümüşpınar in Çatalca district.

The stone bridges in Çamlıhemşin, Rize, in the Eastern Black Sea Region are located in deep and narrow valleys. There are many bridges built in this way in this region where the country's lushest forests are located, and although the construction dates of the bridges are not known exactly, they go back to 600-800 years ago. Some of these bridges are still in active use today. Before the current Black Sea coastal road was built, transportation in the region was of great strategic importance as it was achieved via these bridges.

The Temple of Trajan in Pergamon. UNESCO world heritage site in Turkey

Pergamon ancient city; It is the most outstanding settlement of the Hellenistic Period and is located in Bergama, İzmir. The ancient city of Pergamon was the capital of the Kingdom of Pergamon for 150 years between 281 and 133 BC, and it was a spectacular structure on a hillside overlooking the plain in front of it with its palaces, social and commercial areas, magnificent library, large theater area, and aqueducts and it is included in the world cultural heritage list.

A view of the coast of Kemer district in Antalya province. The Mediterranean and Black Sea coastlines are generally straight. However, the western parts of Antalya and the Muğla coastlines are very indented and caused many small peninsulas and gulfs. This type of coast offers unbeatable views on both boat and road trips.

Turkey covers 785,347 sq km and the population is 83 million. Turkey ranks 37th in the world in terms of area and 18th in terms of population. It is the country with the largest population among European countries after Russia (about 146 million). As previously mentioned, Turkey's geopolitical position is one of the world's most important. It has territory in both Europe and Asia and is in the heart of Eurasia. It is located at the crossroads where Africa, Asia, and Europe, known as the old lands, are closest to each other. It cannot be separated from the political and economic developments here due to its location between the Balkans, the Caucasus, and the Middle East. It is the only country in the Turkic World (Azerbaijan, Kazakhstan, Kyrgyzstan, Uzbekistan, and Turkmenistan) that has a coast and is a window for the Turkic World that opens up to the world by sea. These lands have hosted the establishment of two great empires, the Roman and Ottoman empires.

The settlement of Anatolia dates back 8-10 thousand years. Climate has played a major role in the settlement history being so old. In fact, historical settlements belonging to ancient civilizations are very common in all countries that have a Mediterranean coast, because the subtropical Mediterranean climate was the most suitable climate according to human needs in times before a certain level in terms of science and technology had been reached. Çatalhöyük in Konya Province is an ancient settlement dating back approximately 10 thousand years and is considered to be the first settlement in the world in some sources. There are also many other ancient settlements such as Ephesus, Miletus, Bergama, Troy, Göbekli Tepe, and Zeugma.

About 90% of Turkey's population live in cities and 10% in villages. Although the average altitude of the country is 1132 meters, the majority of the population live near sea level. Ankara, the capital, is a modern city with a population of about 4.5 million. Istanbul, which is the largest city, with a population of approximately 16 million, is one of the largest cities in the world. It is also the only city with land on two different continents.

As previously mentioned, Turkey is one of the world's most productive countries in terms of agricultural activities and products. The main fruits grown in the country include olives, citruses (oranges, lemons, tangerines, and grapefruit), bananas, grapes, apples, pears, cherries, figs, pistachios, apricots, and hazelnuts. Of these, Turkey ranks first in the world in hazelnut, fig, apricot, and cherry production; fourth in olive production; and fifth in apple production. In short, Turkey is like the world's fruit paradise. Growing tea in the country started to gain importance after 1940 and it is ranked sixth in world tea production today. Tea production is carried out along the Black Sea coast in the northeast of the country. That area receives an average of 2000 mm of precipitation all year round and there is no dry period. In summer the weather is generally overcast and foggy. Since snow falls on the leaves in winter there is no infestation or disease, and so no pesticides are used in the tea plantations. For those reasons, Turkish tea is one of the best known and most popular teas in the world in terms of quality.

Amasra used to be one of the important coal-mining areas. Today, it is a quiet Black Sea town known for tourism.

Fairy Chimneys; Their fascinating appearance has always attracted interest. The lava from Mount Erciyes, Güllüdağ, and Hasandağ, located around Cappadocia, spread out. Lava and tuff erupted at different times from these mountains and spread over a wide geography in this region. In the formation of fairy chimneys formed on slopes and in valleys, erosion by flood waters and winds played the major role. As volcano ash and tuff are easily dug into, caves and churches have been built as numerous shelters.

Turkey also produces grains such as wheat, barley, corn, and rice. In addition, tobacco, cotton, sugar beet, chickpeas, lentils, peanuts, melon/watermelon, and potatoes are the other main products grown. Vegetables are grown in large quantities throughout the year due to the favorable climatic conditions. Turkey ranks second in production in greenhouses after Spain. Countries in the Mediterranean basin such as Turkey, Italy, and Spain meet the demand for vegetables from northern European countries covered by snow in winter.

Cattle, sheep, goat, and poultry breeding and beekeeping are among the important activities in animal husbandry. Turkey ranks second in the world in honey production, with 81 thousand tons, after China.

Turkey does not have significant underground resources such as oil, natural gas, and coal. However, due to its geographical location it is close to Middle Eastern countries rich in oil and natural gas reserves, and so they can easily be supplied through pipelines or by tankers by sea. In terms of minerals, boron and chrome are the most important underground resources of the country. Approximately 70% of the world’s boron reserves are in Turkey.

Turkey is a bridge that connects Asia to Europe in terms of transport. For this reason, the country is a very important junction in terms of highways, railways, and airways. Anatolia played an important role in transportation and trade in the past due to its location on the historical Silk Road. The Bosphorus is the strait with the heaviest maritime traffic in the world after The Sound. An average of 50 thousand ships pass through this strait annually. The Bosphorus is not only important for Turkey; it is also important for other countries on the Black Sea, namely Georgia, Russia, Ukraine, Romania, and Bulgaria. Those countries can access other seas and oceans using this strait. Three bridges have been built over the Bosphorus, greatly easing Istanbul’s road traffic.

The Yavuz Sultan Selim Bridge; The bridge built on the north side of the Bosphorus overlooking the Black Sea is also known as the Third Bosphorus Bridge. The bridge was named after the ninth Ottoman sultan and the first Ottoman caliph Selim I. The bridge joins Sarıyer's Garipçe district on the European side with Poyrazköy in Beykoz on the Anatolian side. This bridge ranks first in the world due to its width of 59 meters and it is also a rail crossing. The central span of the bridge, i.e. between the two towers, is 1408 m, and the total span is 2164 meters. Its construction began in May 2013 and it was opened by the 12th President Recep Tayyip Erdoğan in August 2016.

İstanbul Airport; Its foundation was laid on June 7, 2014 and it came into service on October 29, 2018. The airport, which has two terminals and six independent runways, is intended to serve 200 million passengers annually.

In the establishment of industrial facilities in the country, as factors such as raw materials, transportation, and labor play a role, they are mostly located at or near the coast. There are many industrial facilities in the country such as iron/steel, sugar, cement, textiles, oil refineries, and thermal power plants. White goods production and the automobile assembly industry are among the leading lines of business.

The oil refinery in Kocaeli has an annual crude oil processing capacity of 10 million tons and constitutes one of the largest industrial facilities in the country.

The Karaburun Peninsula in İzmir is located in a very windy region. For that reason, many wind turbines have been installed for electricity generation.

The country is one of the world's holiday paradises. Around 40 million tourists visit Turkey every year. Attempts are made to reduce the country's balance of payments deficit via tourism revenues. Turkey's clean seas and beaches and hot and dry summers make it a favorite country for tourists. It is also a popular destination in terms of winter tourism, with famous ski resorts such as Uludağ, Kartalkaya, Erciyes, and Palandöken. It is a country where people are skiing in one place while others are swimming in the sea somewhere else. It is important to highlight the advantages Turkey's tourism has in terms of climate. Other than these, there are natural riches such as caves, waterfalls, forests, and 'fairy chimneys'. It also has great potential in terms of cultural tourism as it has hosted different civilizations. Ancient settlements, historical churches and mosques, castles, and walls are among the most important examples.

Turkey does most business with European countries and neighboring countries. Agricultural products, cars, ready-to-wear clothing, textiles, and white goods are the leading products exported. Imports comprise oil, coal, natural gas, and electronics. In this country with a national income of about 10 thousand dollars per capita, the people are happy, peaceful, and friendly.

Derinkuyu; It is located 30 km from Nevşehir in Cappadocia. By digging down into the volcano ash and tuff 7-8 level underground cities were built. These structures built to hide in are barely noticeable.

One of the important winter tourism centers in Turkey, Palandöken ski resort, is 7 km from the city of Erzurum and about 20 km from the airport.

The country's only ski jumping towers are located in the city of Erzurum. In some countries it is necessary to travel more than an hour to reach jumping towers, while in Erzurum they are 15 km from the airport and a 10-15 minute walk from the city center. The jumping towers hosted the Erzurum 2011 World University Winter Olympics.

Uludağ National Park; It is located in Uludağ, south of the city of Bursa, and can be reached from the city center by cable car to the top of the ski center. The national park is covered with forests formed mostly by black pine and fir trees.

Uludağ ski center; Although it is in the city of Bursa, it is important in terms of its location close to big cities such as İstanbul, Ankara, and İzmir.

One of Turkey's most important tourism centers, Bodrum, according to the famous historian Herodotus, was founded in 2000 BC. Besides being a center of attraction in terms of yacht tourism and beach tourism, it is also important in terms of being a place where you can have a vacation in summer and winter. The winter population of Bodrum is 180,000, while the summer population exceeds one million.

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INTERNATIONAL CHEMISTRY OLYMPIAD

CATALYZER

THE SECOND ISSUE OF CATALYZER MAGAZINE 16/07/2020

Litmus paper as pH indicator.

CHEMIST PLANTS

A major part of the chemical industry today is based on the production and use of sulfuric acid, nitric acid, acetic acid, and hydrochloric acid. For this reason, whether solutions are acidic or basic is of great importance. These days this characteristic is determined by electronic instruments called pH meters. However, until recently, this measurement was made with special dyes called litmus obtained from plants.

Up to the 20th century, many scientists formulated various hypotheses for acids and bases, but in 1923 Johannes Nicolaus Brønsted established that, regardless of the solution, substances suitable for releasing hydrogen ions are acids and those suitable for receiving hydrogen ions are bases.

Acids and bases produced industrially are used in the fertilizer, plastics, paint, explosives, perfume, pharmaceutical, and food industries. The vast majority of acids are easily distinguishable due to their sour taste. However, because some acids and bases are poisonous, they cannot be determined by taste.

For this reason, substances that change color called indicators are used to determine whether solutions are acids or bases. The substance most commonly used in laboratories for this purpose is a mixture of blue-purple dyes from lichens called litmus. Papers coated with these dyes become red when immersed in acidic solutions and blue when immersed in basic solutions. Thus, it is easily understood whether the solution is acidic or basic.

Litmus was first discovered in the 13th century by a scientist named Arnaldus de Villa Nova. Born in what is now Spain and interested in alchemy, physics, astronomy, and philosophy, he shed light on medieval science with his work in chemistry.

With his in-depth knowledge of chemistry, he used a lichen-derived powder to distinguish solutions such as acids and bases. The powder, which was obtained from a lichen of the genus Roccella for the first time, turned red when it came into contact with acids and turned dark blue when it was applied to basic solutions. Thus, the chemical structure of poisonous or caustic solutions could be determined easily without the need for tasting.

Litmus was obtained only from lichen initially but later started to be obtained from plants as well. The lichen named *Roccella tinctoria*, from which the first litmus was obtained, is yellowish gray and short, branching in the shape of a fork. It is found especially on sea-facing rocks and islands. It was collected and placed in wooden containers containing urine, lime, and potassium. Lichens, when kept in this mixture for a few weeks, rot and ferment. During this process, they turn red and then blue. Blue lichen pieces were obtained by filtering through the wooden container and then dried in brass or steel containers. Lichens were kept in these metal containers for some time and were used as litmus after being turned into powder. The litmus products produced only from the lichens in the Netherlands until the 1500's were started to be produced from plants with the discovery that some dye plants had the same characteristic at that time. The most important of these are the marshmallow, alkanet, hibiscus, elderberry, and violets.

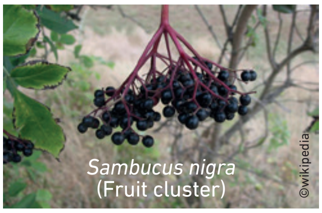
Alcea rosea

Alcea rosea, also known as the common hollyhock, is a tall, thin plant. This plant, which belongs to the mallow family, grows in a wide variety of soils. It produces pink flowers from early to late summer and is grown as an ornamental plant in gardens. It is used as litmus thanks to the color substances called anthocyanins, obtained by drying the flowers.

Another member of the mallow family, the common mallow, is used for the same purpose. With the scientific name *Malva sylvestris*, this plant is common in west Anatolia. In spring, especially on the Aegean coast, its leaves are consumed as a vegetable and it spreads on the ground or climbs and has many leaves. The flowers are 5-petaled and magenta with purple lines on them. The cream, yellow, and green colors from the dye obtained from the flowers of this plant are used as litmus.

Alkanna tinctoria

Alkanna tinctoria, which is a member of the family Boraginaceae, also known as alkanet, is another important litmus plant. This plant, which was used instead of henna and used in the dyeing of carpets as a root dye in Turkey, creeps on the ground. Its small round flowers are dark blue and its leaves are covered with small and dense hairs. While the dye obtained from the roots of this plant is used as litmus, it is also used in thermometers and the staining of marble and wood.



Sambucus nigra
(Fruit cluster)

The elderberry *(Sambucus nigra)*, particularly common in the Black Sea region of Turkey, is another important litmus plant. This plant, which can become a small tree, has cream flowers with five petals. A blue dye is obtained from the ripe berries of the sharply fragrant elderberry.

The most important plants that litmus is obtained from are violets. Yellow, green, and blue dyes are obtained from the flowers of the sweet violet *(Viola odorata)*, frequently used in perfumery, and of the wild pansy *(Viola tricolor)*, used as an ornamental plant in gardens. Methylene blue, which is one of the best known and most widely used litmuses commercially, is also obtained from these violet flowers.

Today, litmus dyes and litmus papers prepared with these dyes are gradually losing their importance, but these dyes are still used, apart from for pH measurement, to determine in practice whether electronic goods have malfunctioned due to a technical error or due to user error, because if you tamper with electronic items, the trace left changes the color of litmus paper.

Bilim ve Teknik (Science and Technology magazine), December 2007

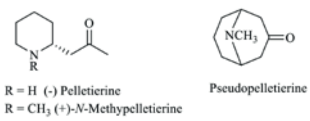
Cenk Durmuşkahya

CYCLOOCTATETRAENE IS ONE OF THE MOST PROMINENT HYDROCARBONS

Pomegranate (*Punica granatum* L.) is a tree of Iranian/north Indian origin and it can be grown in many regions with a mild climate. Today, it is widely cultivated throughout north and tropical Africa, the Indian subcontinent, and Central Asia, as well as parts of Arizona and California. The pomegranate was known in early English as the "apple of Grenada" [1].

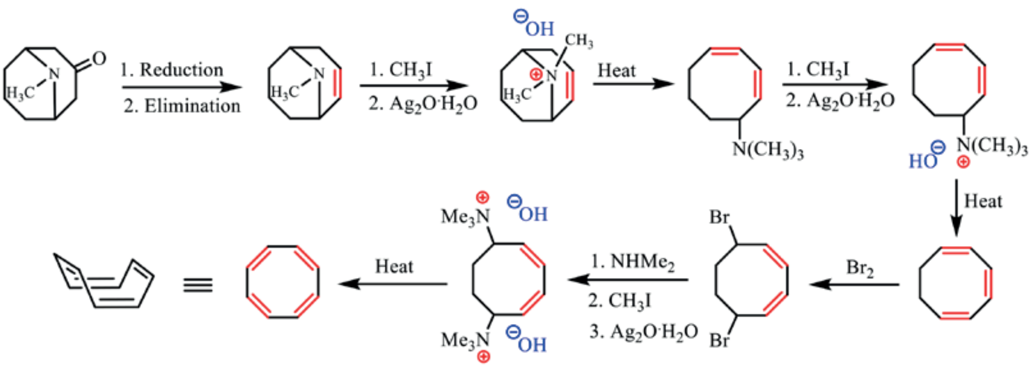
The pomegranate tree, whose fruit we eat with pleasure, is a source of some alkaloids. These alkaloids are pelletierine, *N*-methylpelletierine, and pseudopelletierine, which are deposited in the bark and especially in the root bark. These compounds were named in honor of the pioneer of plant chemistry Pierre J. Pelletier. It was recognized that pelletierine and *N*-methylpelletierine were useful for fighting worm diseases well into the 20th century.

The structure elucidation of pseudopelletierine took less than 20 years, a remarkably short period in the pre-spectroscopic era. Ciamician and Silber [2] investigated the structure of pseudopelletierine. They confirmed the empirical formula $C_9H_{15}NO$ using numerous transformations. Piccinini [3], a colleague of Ciamician's, found the correct connection of the atoms in pseudopelletierine in 1899 when he managed to oxidatively break down the skeleton of the alkaloids to suberic acid (octane-1,8-diacid) by further steps. Finally, it was recognized that pseudopelletierine is an aza-bridged cyclooctatetraene.

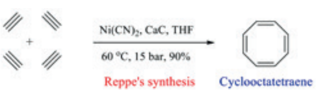


Richard Martin Willstätter (1872-1942) was awarded the Nobel Prize for his research on plant pigments, especially chlorophyll, in 1915.

Willstätter recognized its potential as a wonderful starting compound for a carbocyclic eight-membered ring. Furthermore, he expected that a cyclooctatetraene would have similar properties to benzene as COT is vinylogous with benzene. Willstätter synthesized 1,3,5,7-cyclooctatetraene in 1905 using pseudopelletierine as the starting material and the Hofmann elimination as the key transformation as shown below [4]. After the successful synthesis of cyclooctatetraene, unfortunately, the product did not show the properties of benzene; it behaved like a polyolefin. Some groups started to suspect that Willstätter had synthesized COT. These groups began to repeat Willstätter's experiments. However, when they could not achieve the same results, they began to take a more suspicious approach to COT synthesis.

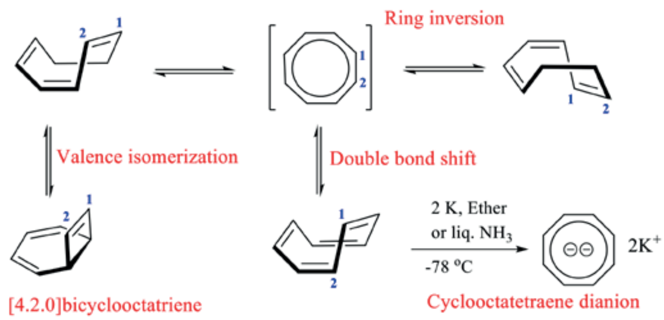


However, the fact that reduction of the molecule formed cyclooctane was much more confusing. Cope and Overberger [5] repeated Willstätter's COT synthesis in 1948 and they demonstrated its accuracy. The problems were not solved until the synthesis of the molecule by BASF (Badische Anilin & Soda Fabrik) chemist Reppe [6] as a result of tetramerization of acetylene under Ni catalysis. This made COT accessible in any quantity and confirmed Willstätter's historical achievement. Reppe's synthesis of cyclooctatetraene involves treating acetylene at high pressure with a warm mixture of nickel cyanide and calcium carbide, with chemical yields near 90%. As mentioned above, unlike benzene, COT is a nonplanar but tub-shaped molecule.



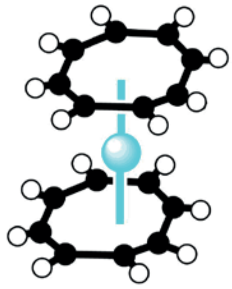
COT undergoes three fundamental structural changes. The first of these processes is termed ring inversion and the second one is the double bond shift. Both of these processes take place presumably via a planar transition state. The ring inversion barrier has been measured by various methods and was found to be 10-13 kcal/mol, while the barrier for the double bond shift is 2-4 kcal/mol higher than the inversion barrier. The third process is valence isomerization to [4.2.0] bicyclooctatriene, which does not require a planar COT for the transition state.

According to Hückel's theory, the cyclooctatetraene dianion, which has 10 p-electrons, should be aromatic if it has a planar structure. Katz reacted cyclooctatetraene with potassium metal (a good electron donor) in ether or liquid ammonia and obtained an aromatic dianion [7]. The structure of the potassium salt of a 1,3,5,7-cyclooctatetraene dianion has been determined by X-ray analysis. The eight-membered ring is planar, with C-C bond lengths of 1.407 Å without significant bond alternation. Spectroscopic and structural studies show that the cyclooctatetraene dianion is stabilized by the delocalization of the p-electrons and it is aromatic.



Why is cyclooctatetraene not antiaromatic? Cyclooctatetraene must have a planar structure to be antiaromatic. The reason for this lack of planarity is that the internal angles in a regular planar octagonal structure are 134°. To avoid angle strain, the molecule adopts a nonplanar tub-shaped conformation. Furthermore, if cyclooctatetraene has a planar structure, the p-electrons will delocalize due to the parallel orientation of the orbitals.

Therefore, the energy level of the molecule will also increase because of the negative resonance energy. Antiaromaticity and angle strain will make the molecule very unstable. That is the reason why cyclooctatetraene does not have a planar structure and tends to have a tub-shaped conformation.



Organometallic complexes of cyclooctatetraene with some metals, including yttrium and lanthanides, are commonly known. The COT ring behaves as an effective π-type ligand in metal complexes and very often in such complexes it adopts a planar structure, which is not the most favorable conformation. Such planarization is usually considered an effect of COT ring aromatization due to charge transfer from the metal center into the COT ligand and reorganization of the π-electron structure from 4n to 4n+2. Eu–COT sandwiches have been described as nanowires [8].

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Metin Balcı

A rotary evaporator (or rotavap/rotovap) is a device used in chemistry laboratories for the efficient and gentle removal of solvents from samples by evaporation under a partial vacuum.

HISTORY OF THE VACUUM

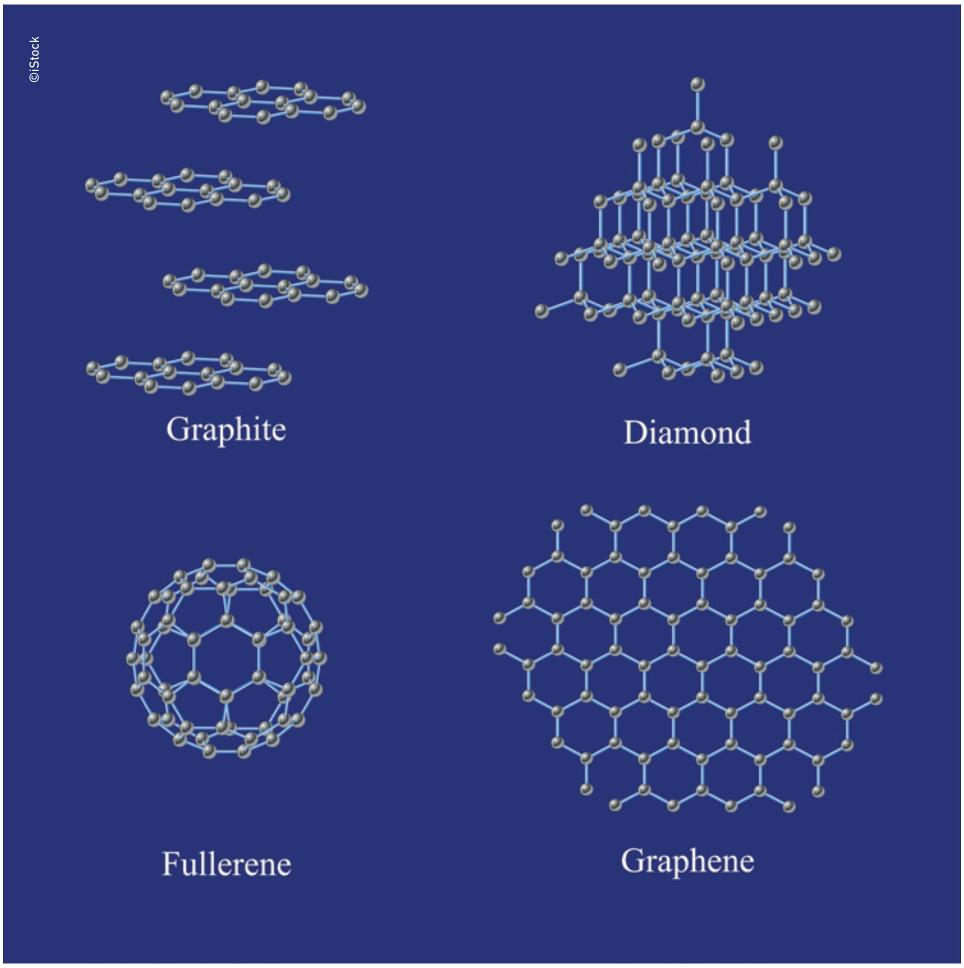
In Ancient Greece, Aristotle believed that in a vacuum an object could go at infinite speed. However, he did not believe that infinite speed could exist. Thus, a vacuum could not exist.

Although artisans proceeded to make pumps, scientists generally agreed that a vacuum could not exist in nature. These pumps had a cylinder tightly fitted in a tube. The water moved upward in the tube when the cylinder was raised. Aristotle explained this phenomenon saying that water had to rush into the tube because nature did not like a vacuum.

Galileo was told by a workman that they could not raise water more than about 10 m. He found it odd that nature did not like a vacuum up to 10 m and then changed its mind. He asked his assistant Torricelli to investigate this phenomenon, who soon realized that a real vacuum could be there. Shortly after Galileo's death, Torricelli produced a near-vacuum with his mercury barometer, which was the first vacuum known to science. Pumps could not exceed the limit (10 m) as their action depended on air pressure, which could lift water 10 m. Above 10 m, a partial vacuum can exist because air pressure will not lift the water to fill it.

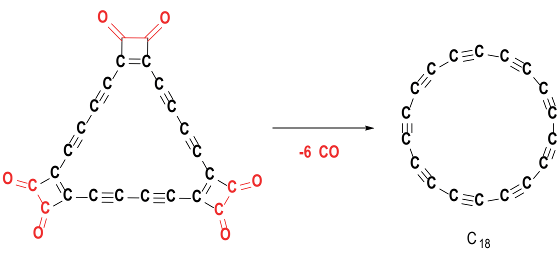
In the second half of the 17th century, the interest in vacuums continued. Otto von Guericke (1602-1686) developed an air pump more powerful than 50 men or two teams of horses. More importantly, he showed that sound could not travel in a vacuum, flames could not burn, and animals could not live. Boyle (1627-1691) demonstrated that a feather and a lump of lead fall at the same speed in a vacuum. On the other hand, the production of a good vacuum was difficult until the 19th century. In 1854, a hard vacuum was produced in a glass tube, which led to the discovery of X-rays, the electron, and, indirectly, radioactivity. In the first half of the 20th century, vacuum tubes powered radios and televisions, computers, and some other electronic devices, which were then displaced by solid-state devices, such as transistors and chips.

Turan Öztürk



A NEW ALLOTROPE OF CARBON: CYCLO[18]CARBON (C_{18})

A new allotrope of carbon was synthetically obtained by a collaboration between two research groups. The new allotrope, cyclo[18]carbon or cyclooctadeca-1,3,5,7,9,11,13,15,17-nonayne, is an sp-hybridized molecular carbon allotrope with the molecular formula C_{18}.



In 1989, Diederich's research group at the University of California, Los Angeles reported evidence for the generation of cyclo[18]carbon via laser flash heating of a stable organic precursor [1]. Despite of the fascinating efforts by several research groups to obtain carbon allotropes built from rings of two-coordinate atoms, cyclo[n]carbons could not be isolated or structurally characterized because of their high reactivity for long years. In 2019, two research groups from IBM and the University of Oxford reported the synthesis of cyclo[18]carbon (C_{18}) as the first cyclic carbon allotrope using atom manipulation on bilayer NaCl on Cu(111) at 5 Kelvin on-surface decarbonylation from a cyclocarbon oxide molecule, $C_{24}O_6$ [2]. This spectacular molecule has a circle of 18 sp-hybridized carbon atoms, held together by alternating single and triple bonds.

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Nurullah Saraçoğlu

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TURKISH CULINARY CULTURE

Culture comprises all kinds of material and spiritual characteristics produced by a society during the historical process that have been passed on from past to present and will be passed on from the present to the future. Culinary culture, as a dimension of culture, is the nutritional habits shaped by the lifestyles of societies. Turkish culinary culture was born in Central Asia, developed during the Seljuk period, and reached its peak during the Ottoman period. It has attained its current form through the effects of globalization and industrialization.

Turkish cuisine is of considerable importance among the world's cuisines. The Turks' long history, their traditions and culture, and the possibilities of the geographical region they live in have had an impact on the development of Turkish culinary culture. Furthermore, the interaction of Turks with many cultures around the world is regarded as a factor enriching Turkish cuisine.

When the characteristics of Turkish cuisine are examined from the perspective of historical development, it can be concluded that Turks settled on the steppe between the Ural and Altai mountains in Central Asia during the Neolithic period and the culinary cultures formed in that region. Livestock breeding suitable for the climate of the steppe is one of the opportunities offered by this geography. For this reason, their diet was mostly animal products, and they benefited from the meat of sheep, goats, camels, cattle, and especially horses. In addition, milk and dairy products, which are secondary products obtained from animals, were important food sources. Another reason for their meat-based culinary culture was the fact that a large part of Central Asia is not suitable for growing crops. In Central Asian culinary culture, horse milk, which was consumed as well as horse meat, was fermented and turned into a light alcoholic drink called "kımız". Due to the influence of the new cultures, climates, and geography that the Turks encountered over the centuries, the culture of kımız is not part of the cuisines of those who settled in Anatolia and Rumelia. When the Turks migrated to Anatolia, they brought their food cultures with them and also started to grow crops and included cereal products in their diet. During the

Figure 1. Doner kebab is a very popular food in Turkey.

period of the Great Seljuk and Anatolian Seljuk states (1037-1308), with the effect of Islam, horse meat consumption was reduced and sheep and goat meat became dominant. The crops can be divided into grains and vegetables; of the former wheat, barley, and millet were consumed, and of the latter spinach, radish, courgette, carrot, onion, garlic, and cabbage.

During the period of the Ottoman Empire (1299-1922), there was a palace cuisine in addition to folk cuisine in the Turkish culinary culture. The most vibrant period of food culture occurred in palace cuisine especially during the rule of Sultan Mehmed II. The continuous expansion of Ottoman territory, the existence of many different ethnic origins within that territory, marriages of the sultans with women from other nations, and relations with Europe led to enrichment of the palace cuisine. In general, in the Ottoman palace cuisine, sheep, chicken, and goose meat, fish, milk, eggs, yoghurt, tripe, sheep's head and foot soup and other soups, all kinds of dried and fresh fruits and vegetables, kebabs, salads, pickles, and various sherbets were consumed. The difference of the folk cuisine from the palace cuisine was that there was only a small variety of products, including, in general, cereal products, milk and dairy products, and beef.

The most prominent elements of today's Turkish cuisine include every type of bread as the main food ingredient on the table; the predominant consumption of pastries; the preference for kebabs, including doner kebabs (Figure 1), and juicy meat dishes such as stew; the great importance given to oils such as olive oil, butter, and fat from the sheep's tail; the consumption of yoghurt and ayran (a drink made of yoghurt mixed with water) as important foods; the addition of small amounts of meat to vegetable dishes; the consumption of wild greens; and the common use of bulgur as a filling ingredient in vegetable dishes, meatballs, and soups.

Figure 2. Keşkek is a traditional Turkish dish.

Turkish cuisine is known not only for its variety of dishes, but also for its dinner table culture. Table manners have an important place in Turkish cuisine, being regarded as an important tool of social life. The main examples of the customs of Turkish cuisine are the father being at the center of the family table, the older family members sitting cross-legged and the women and children kneeling and eating at a floor table, the table cloth spreading onto the floor to stop pieces of food falling on the floor and a round serving tray being placed on it, finishing all the food on the plate, washing hands before and after the meal, being serious while eating and not speaking much, everyone eating from their own bowl in front of them, and hospitality. In addition to these, meals have symbolic roles on important days such as births, circumcisions, engagements, marriages, deaths, Bairams, and nights of religious importance. For example, as a tradition in many regions of Anatolia today, keşkek is made at weddings (Figure 2), and halva is served between meals distributed to neighbors and guests in memory of family members who have died; during the circumcision ceremonies for boys, pilaf is cooked, and Kandil simits are made and given out on nights of religious importance (Figure 3).

Keşkek is an important Anatolian dish that has many varieties and is associated with some symbols. Birth, circumcision, soldier, wedding, pilgrim, death, Ramadan and Sacrifice Bairams, Nevruz, Hıdırellez, Christian feast, devotional, charity, and festival are among the types of keşkek. Moreover, the keşkek varies according to the ingredients, for example, red meat keşkek, chicken keşkek, turkey keşkek, pastrami keşkek, corn keşkek, fake keşkek, and ground meat keşkek. In this case, the keşkeks differ in terms of both the ingredients and the method of cooking. In Anatolia especially in keşkek made at weddings meat is used. Since making it is long and involved, the work is divided between men and women. While women usually boil and shred the meat and boil the wheat, men help to mix these two ingredients over a dung fire and serve. In general, keşkek is made as follows: meat and wheat are washed, salt is added and they are usually cooked in a pressure cooker. The cooked meat is separated from the bone and shredded, wheat is added, and they are mashed together with a spoon. During this long process, when the ingredients turn into a paste, powdered pepper is burned in butter and poured lightly on top, and then the dish is eaten.

Figure 3. Sesame seed simit.

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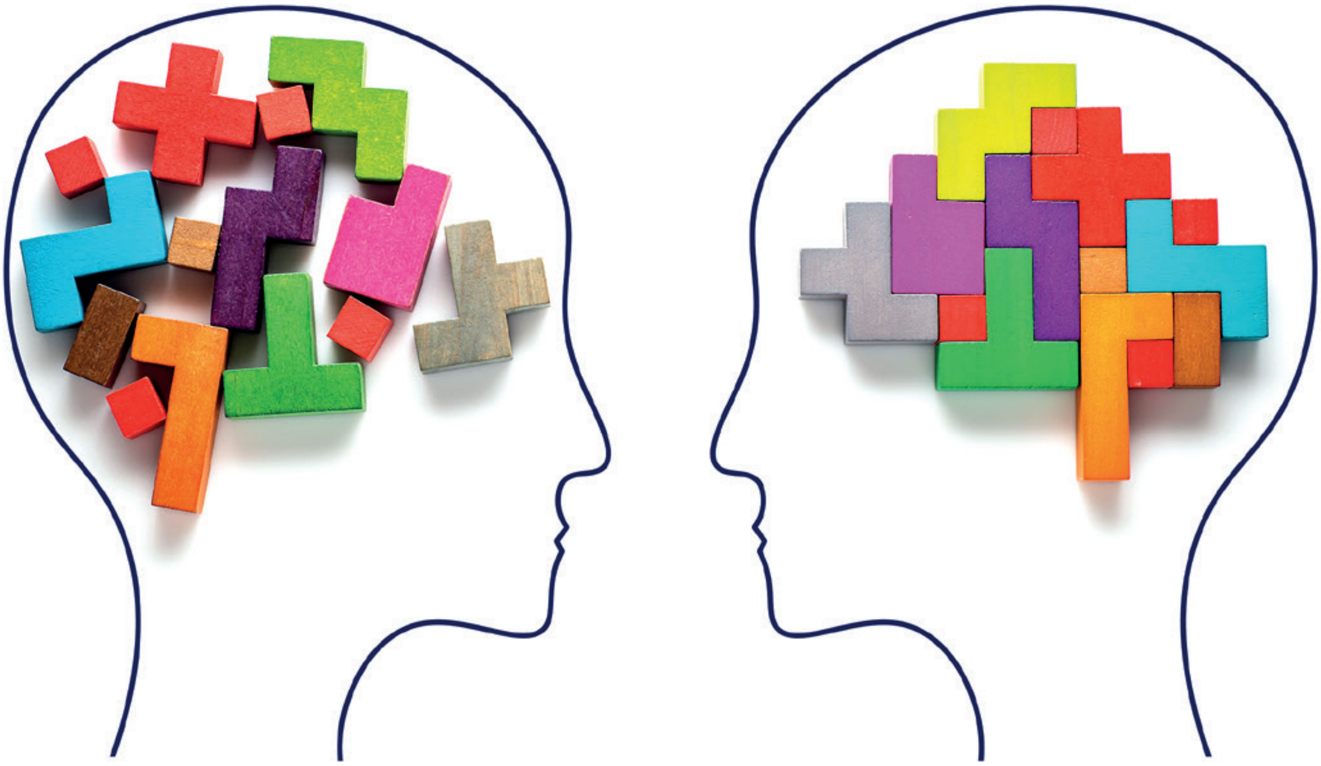
Neslihan Çetinkaya

TODAY'S PROBLEM AND YESTERDAY'S ANSWER

Problem 2.

There are 7 students in the class numbered 1,2,...,7. For each student the instructor chooses 99 problems from the exercise book. It turns out that for each k=1,2,...,7 there are at least k problems from the book not assigned to student number k. What is the minimum possible number of problems in the exercise book?

Azer Kerimov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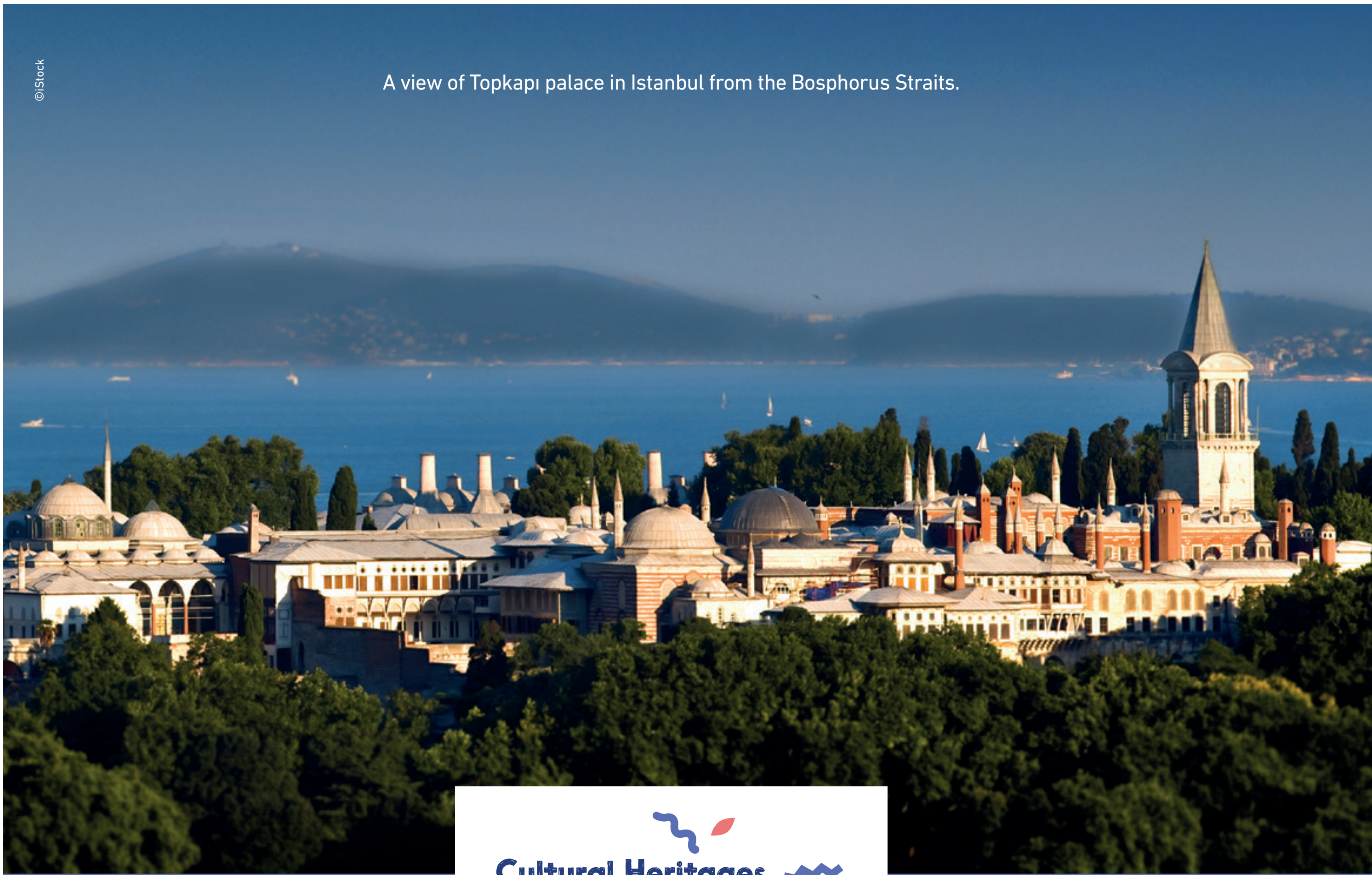
Answer of yesterday's problem :

Alaaddin can take 497 coins with certainty. In each move Alaaddin puts 42 gold coins into the new pouch. Since 1001 = 42 · 23 + 35 after several moves one person will get 12 pouches. If Alaaddin has 12 pouches then he gets 12 · 42 = 504 gold coins; otherwise he gets 1001 - 12 · 42 = 497 gold coins. If the monster takes all pouches containing at least 42 gold coins and gives all pouches containing less than 42 gold coins to Alaaddin then Alaaddin will get either 1001 - 12 · 42 = 497 or 12 · 41 = 492 gold coins.



A view of Topkapı palace in Istanbul from the Bosphorus Straits.

Cultural Heritages

TOPKAPI PALACE MUSEUM

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

Topkapı Palace was built on the Byzantine acropolis in the Sarayburnu area between the Bosphorus, the Sea of Marmara, and the Golden Horn. Its construction was started by Sultan Mehmed II in 1460 and it expanded with structures added by many monarchs up to the 19th century. The palace is surrounded on the seaward side by Byzantine walls on the land side by walls named Sûr-ı Sultâni constructed by order of Sultan Mehmed II.

Topkapı Palace consists of four courtyards, which are entered through three monumental gates. The first gate, which opens to the square where Hagia Sophia and Ahmet III Fountain are located, is called the Imperial Gate, the second is the Gate of Salutation, and the third is the Gate of Felicity.

In the first courtyard of the palace structures surrounded by gardens and squares are Hagia Irene church, a hospital, bakery, mint, firewood store, and wicker craftsmen's house. In the second courtyard are the Divan-ı Hümayun (Kubbealtı) (meeting place of the Divan council) and next to it the treasury, as well the Justice Tower, the entrance to the Harem, and the stables, and in the third courtyard are the Sultan's Audience Chamber, the Enderun Treasure, and the Privy Chamber. In the fourth courtyard, which is the last courtyard, there are the pavilions and hanging gardens of the Sultan. Here are found the Baghdad and Revan Pavilions and the Iftaree Gazebo, the most distinguished and aesthetically advanced examples of Ottoman classical mansion architecture, which were built on the orders of Sultan Murad IV. In the lower part of the fourth courtyard lie the Mecidiye Pavilion and the Wardrobe Chamber.

Topkapı Palace was opened to visitors for the first time as a museum during the reign of Sultan Abdulmecid. The palace later began officially to function as a museum in the full sense on October 9, 1924.

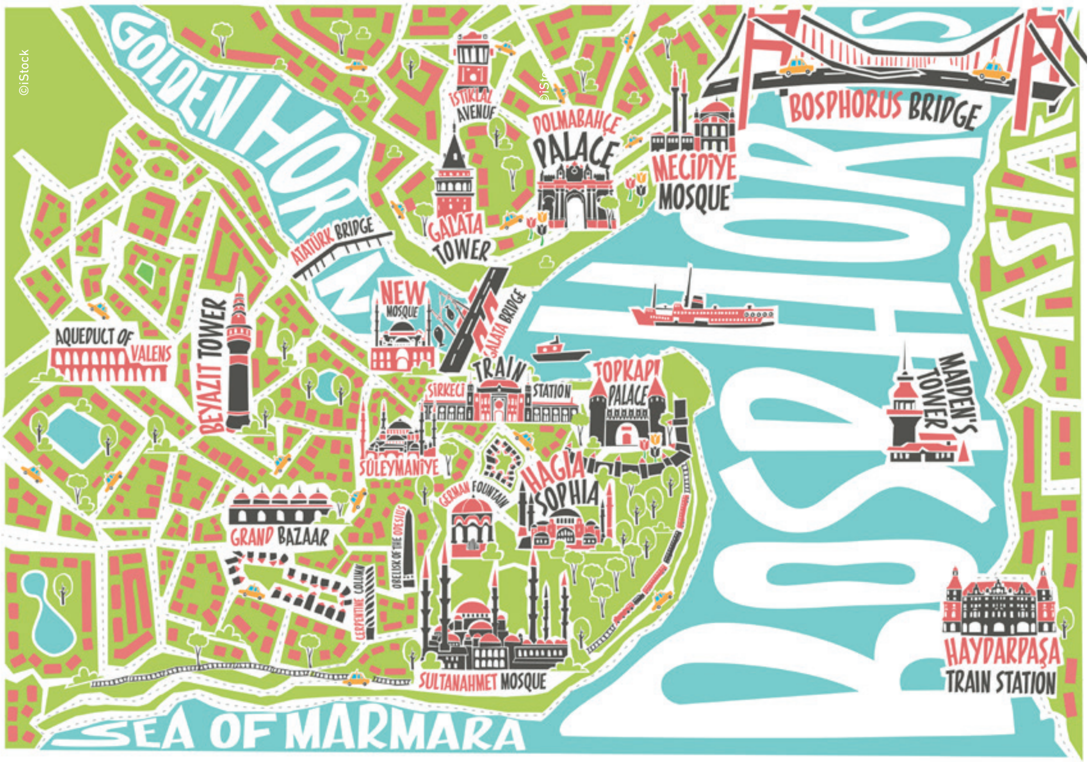
The palace is remarkable due to its extraordinarily rich collections as well as its architecture. Among the valuable collections exhibited in the museum are the Imperial Treasury, European porcelain and glass, Chinese and Japanese porcelain, Istanbul glass and porcelain, Mantle of the Prophet Office, Sacred Relics, Sultans' garments, Sultans' portraits, and weapons.

Topkapı Palace, which was added to the World Heritage List by UNESCO in 1985, is one of the most visited historical sites in "Istanbul's Historical Peninsula".

Topkapı Palace Istanbul, Turkey

Topkapı Palace, or the Seraglio, is a large museum in Istanbul, Turkey. In the 15th century, it served as the main residence and administrative headquarters of the Ottoman sultans.

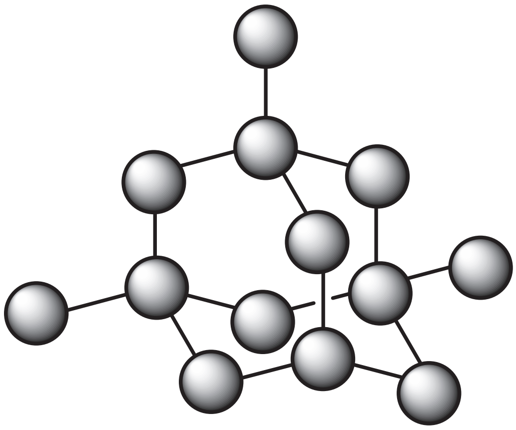
Topkapı Palace, located in Sarayburnu, was used as the administrative center of the state for 400 years of the 600-year history of the Ottoman Empire. It was constructed between 1460 and 1478 by Sultan Mehmed II, the seventh sultan of the Ottoman Empire. Topkapı Palace was converted into a museum in 1924, by the order of Mustafa Kemal Atatürk, the founder of the modern Turkish Republic. Topkapı Palace, which had an area of approximately 700,000 m^2 during its establishment, has an area of 80,000 m^2 today as Topkapı Palace Museum.

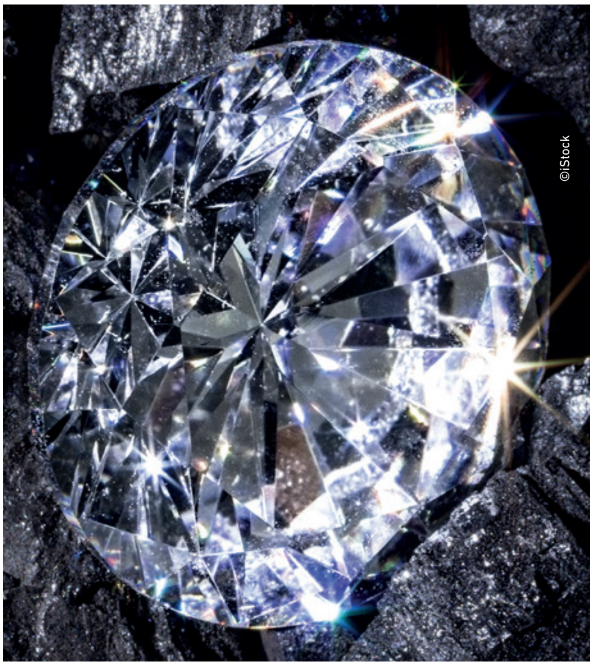


Vector illustration colored Istanbul map with famous landmarks

ONE OF THE MOST FAMOUS DIAMONDS IN THE WORLD IS IN THE TOPKAPI PALACE MUSEUM IN ISTANBUL. DID YOU KNOW?

Diamond





According to the bonding of carbon atoms to each other, the carbon elements have different allotropic structures in which their physical and chemical properties are different from each other. Graphite and diamond are the two most common allotropes in which the properties of carbon are very different.

Each carbon atom in a diamond is covalently bonded to four other carbons in a tetrahedron. These tetrahedrons form a three-dimensional network with a six-member chair conformation. Diamond is the most expensive stone and also the hardest material on earth. The beauty of diamonds comes essentially from their sparkling.

The Spoonmaker's Diamond (Kaşıkçı Elması). The most widely known among the historical diamonds is the Spoonmaker's Diamond, in the Topkapı Museum, Istanbul. It is an 86-carat (about 17.2 g) pear-shaped diamond surrounded by 49 brilliant cut diamonds.

Nurullah Saraçoğlu

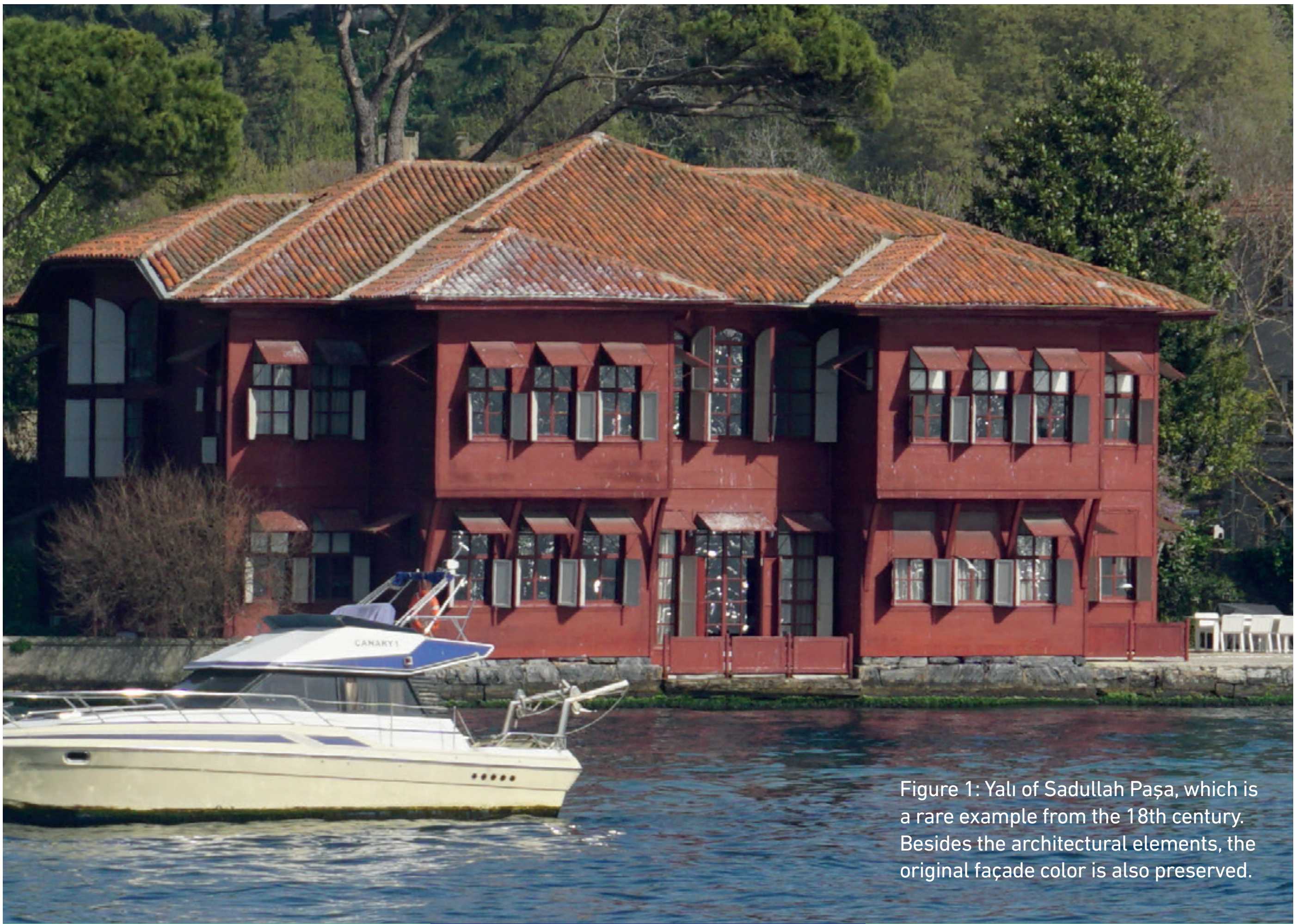


Figure 1: Yalı of Sadullah Paşa, which is a rare example from the 18th century. Besides the architectural elements, the original façade color is also preserved.

Cultural Heritages

WOODEN HOUSES OF ISTANBUL: CONVEYING CULTURE AND HISTORY

S. Feyza ERGÜN

Wooden houses are of special importance in terms of Ottoman architectural heritage. The spatial compositions, relation to nature, and conceptual decisions make the wooden Turkish house unique. Since the earliest examples from the 16th century, the development and transformation continued. The location and the building period contribute to the diversity of the Turkish house. In other words, topographic and climatic conditions, local materials, technical knowledge, the lifestyle of the inhabitants, economic concerns, general architectural trends, and personal tastes have a great impact on the design. As a capital city, Istanbul had the most beautiful examples and a huge variety. Moreover, the houses in Istanbul had always been the precursors of new architectural developments. Timber was a favorite material for construction, especially until the 20th century. Although many of the examples have disappeared due to the changes in socio-cultural structure and urban conditions, there are still plenty of them representing the old style of the city [1]. Wooden structures can be found on the historical peninsula, in former countryside villages, and in the old towns of Istanbul, as well as on the Prince Islands.

Most of the present wooden houses in Istanbul were built after the 19th century. Therefore, they mainly reflect the characteristics of the last period. The influence of European styles became apparent especially between the late 19th century and the early 20th century. Motifs from Art Nouveau and historicism are reflected in the decorations, as well as the architectural decisions like the roof type or façade compositions [2]. Inspirations from diversified styles including empire, neo-baroque, neo-classical, neo-gothic, neo-Ottoman, Victorian, and Swiss chalet-style turn the city into an open-air architectural museum for wooden houses.

The vivid colors of the façades always attracted the attention of many visitors. Although today some of the houses have reverted to the original brown color of the timber due to deterioration, the well-maintained ones are still enlivening their environment. Oriels, sash windows, wooden doors, horizontal cladding boards, narrow street patterns, and the harmonious proportions are the most remarkable elements of the houses in the collective memory. The houses are structured with timber frames without any infill and the wooden skeleton is constructed above a masonry basement or ground floor. Metal nails are used to join the timber pieces.

UNESCO World Heritage Sites

Since 1985, historical areas of Istanbul have been included in UNESCO's world heritage list. Besides the well-known main masterpieces like Hagia Sophia, Topkapı Palace, Süleymaniye Mosque, Hagia Irene, Şehzade Mosque, the Blue Mosque, and the ancient Hippodrome of Constantine, the vernacular settlements in the areas of Süleymaniye and Zeyrek are also mentioned as being of outstanding universal value. The integrity and vulnerability of the timber housing in Süleymaniye and Zeyrek are briefly stated by UNESCO [3].

Bosphorus villages and former summer houses

Yalı is a unique definition for the seaside mansions on the Bosphorus. Owning one of them has always been a symbol of status, because of their location enabling picturesque views and great gardens. Moreover, many of them have an impressive layout and design. They usually reflect the fashionable architectural approach of their period. Arnavutköy, Büyükdere, Tarabya, Kuzguncuk, Kanlıca, Anadolu Hisarı, and Beykoz are among the Bosphorus villages in which beautiful examples of authentic wooden mansions are found. Additionally, several neighborhoods near the Marmara Sea, namely Bakırköy, Yeşilköy, Kadıköy, and Fenerbahçe, were part of the countryside until the mid-20th century. Many splendid residences with gardens were built based on the interpretations of popular western styles according to the personal taste of the owners. Plenty of them are still present but are usually difficult to spot at first glance as they remain in between new constructions and the complex urban landscape.

Largest wooden building in Europe

The Prince Islands have also been a popular location for summer houses. Being away from the crowds of the city, vehicle traffic, and central business districts gives a special status to the islands. Non-Muslims and foreigners constituted a considerable proportion of the population. As they freely expressed their tastes, they brought an intense European influence to the architecture of the islands. Various conserved authentic wooden mansions help to preserve the spirit of the old days. The Greek Orphanage (Prinkipo Palace), which is considered the largest wooden building in Europe, is located on Büyükada. It was designed by Alexander Vallaury as a casino and hotel in 1898 but used as an orphanage between 1903 and 1964. Since then it has been left unused due to political disagreements. In recent years, interest in the building has increased considerably and several types of research have been conducted.

In conclusion, there are still more than 1000 wooden houses in Istanbul, including the islands. They are scattered in a wide range of districts and can be encountered neighboring new concrete construction. Many of the houses are listed as Grade II. Moreover, there are a few Grade I listed structures. Wooden houses are of particular importance in terms of cultural heritage, as each of them represents the lifestyle, domestic life, building technology, and architectural trends of a significant period.

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Figure 2: Neoclassic decorations on the façade of a mansion, which was built in 1875 at Süleymaniye.

Figure 3: Authentic wooden mansion from the 19th century in Arnavutköy.

Figure 4: Wooden ornaments on colorful houses in Kuzguncuk.

Figure 5: A wooden twin house from Büyükada, Prince Islands.

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Figure 6: The Greek Orphanage on Büyükada, Prince Islands.

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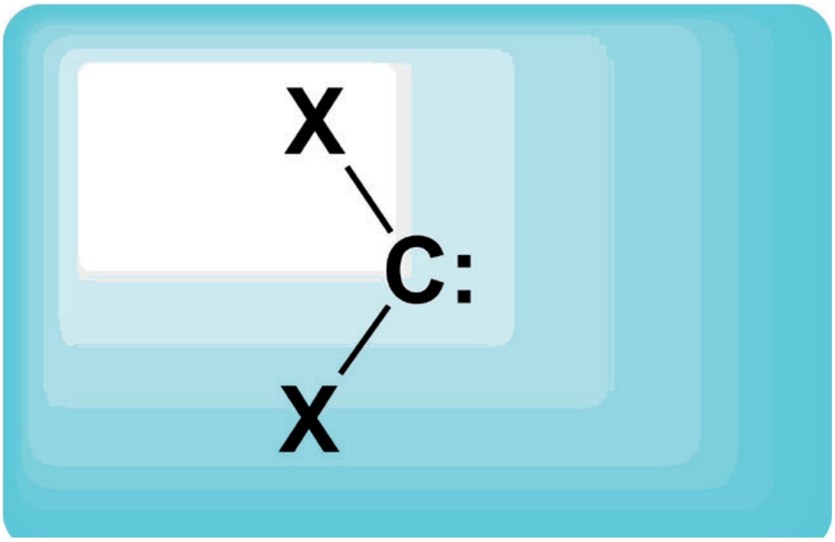
INTERNATIONAL CHEMISTRY OLYMPIAD

CATALYZER

THE THIRD ISSUE OF CATALYZER MAGAZINE 17/07/2020

CARBENES AND METAL COMPLEXES OF CARBENES



Carbenes (:CXY) are highly reactive molecular species comprising divalent carbon atoms bearing diverse substituents X and Y by covalent bonds and possessing two nonbonded electrons. When these two electrons have opposite spins (↓↑), the carbene is identified as a singlet carbene; when they have parallel spins (↑↑), the carbene is a triplet. In the ground state, a singlet carbene has a pair of electrons in a single orbital, whereas the triplet has two unpaired electrons, each occupying a separate orbital (Figure 1) [1].

The relative stability of the p and the σ orbitals is determined by the nature of the substituents (X, Y) adjacent to the carbenic center. This means that we can master the multiplicity of the molecule by choosing appropriate substituents. In practice, it is much easier to use substituents to favor singlet carbenes rather than triplet carbenes. $:CH_2$(methylene or methylidene) has a triplet ground state and is the parent carbene from which all other carbene compounds are derived.

Stability of Carbenes: Carbenes in which the carbon of carbene is attached to two atoms, each bearing a lone pair of electrons, are more stable due to resonance (Figure 2).

Carbene ligands in organometallic chemistry: Carbenes can be stabilized by complexation with transition metals. Metal complexes with the formulae L_nMCRR' are often described as carbene complexes. Two extremes are known (as well as the whole spectrum between): (i) Carbene complexes of low valent/low oxidation state 18 e– metals are ***electrophilic*** at carbon and are called ***Fischer carbenes*** (often behave like a glorified carbonyl group); (ii) Carbene complexes of high valent/high oxidation state <18 e– metals are ***nucleophilic*** at carbon and are called ***Schrock carbenes***.

I received a Ph.D. scholarship from the Ministry of Education (MEB, Turkey) under law 1416, and decided to do my Ph.D. at the University of Sussex under the mentorship of Prof. Dr. MF Lappert in October 1968, in the field of inorganic/organometallic chemistry, because the possibility of exploring the chemistry of all elements in the periodic table was fascinating to me. Lappert told me about transition metal chemistry, about the excitement of creating new, colorful, crystalline compounds, and about their spectroscopic identification. That sounded like what I wanted to do, make new compounds with potential uses.

The subject of my Ph.D. was "Transition metal carbene complexes". Up to 1968, M-C single-bonded compounds were well established, but the number of M=C double-bonded compounds was limited to [(OC)5W=CPh(OMe)] [2]. Initially, I made several attempts to reduce the W=C bond, but the only compound I could

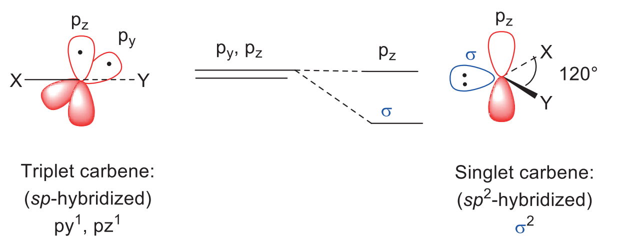


Figure 1

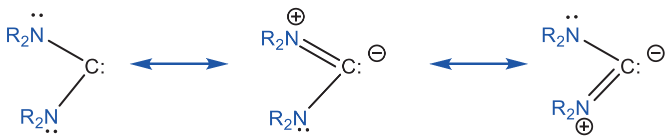


Figure 2

identify was benzaldehyde. However, the main object of my thesis was to investigate whether carbenes can be trapped from neutral carbene precursors onto transition metal substrates. Accordingly, trapping experiments were carried out with bis(trifluoromethyl) diazomethane, $(CF_3)_2CN_2$. The reaction between the diazo derivative and chloro-bridged binuclear platinum(II) indicated that bis(trifluoromethyl)methylene inserted into a Pt-Cl bond. On the other hand, the reaction with tris(triphenylphosphine) platinum(0) afforded a ring compound (Scheme 1). Unfortunately, it became known to the author at this stage that researchers at Bristol University obtained similar results and submitted their manuscript for publication [3].

At the first site, an obvious route, the trapping of carbenes on TM substrates, has proved notoriously difficult and time consuming. While I was struggling with these experiments, I came across an interesting manuscript by Wanzlick [4]. It was in German and so I did not understand a word of it. However, the equation (Scheme 2) was really attractive and as if it was telling me what to do. Therefore, I immediately prepared 1,3-diphenyl-2-trichloromethylimidazolidine and reacted it with dimeric platinum(II) complex and obtained a yellow crystalline solid. The IR, ^1H NMR, and ^{31}P NMR spectra and elemental analysis were compatible with the proposed structure. The ^{31}P NMR spectrum of **1** showed a single signal with platinum satellites, $J(^{195}Pt-^{31}P)$ = 2.44 kHz. This confirmed the *trans* configuration for **1**. Complex 1 was also prepared from the olefin cleavage reaction. I extended the reaction to other olefins and metal substrates [5,6].

The coupling constant was almost the same as the value reported for *trans*-$[PtCl_2(PEt_3)_2]$ (Figure 3). This finding also indicates that the imidazolin-2-ylidene is identical to tertiary phosphines, complexes of which are used as catalysts in various organic reactions. This striking similarity and the diagonal relationship between C and P atoms were at the back of my mind for nearly 20 years. From 1992 onwards we began to investigate the catalytic properties of NHC complexes along with other research groups. We have published interesting results. From time to time, other groups were faster than us. The majority of stable carbenes that are commonly used today are NHC of the type first isolated by Arduengo in 1991 [7]. Unfortunately for Wanzlick and me, we were never able to isolate a monomeric carbene and we obtained electron-rich olefins instead. Today, these compounds are called Arduengo carbenes. No one else can understand the position we were in. What we gathered from these observations when doing experimental research was that we have to keep three points in mind. First, we must follow the literature carefully and comprehensively. Second, we need to be conscious that other researchers are thinking about the same things that we are. Third, we have to be prompt in publishing our results.

Now when I look back, setbacks are an inevitable part of academic life. I would like to conclude with a quote from William Ramsay, winner of the Nobel Prize in Chemistry in 1904: *"Progress is made by trial and failure; the failures are generally a hundred times more numerous than the successes, yet they are usually left unchronicled."*

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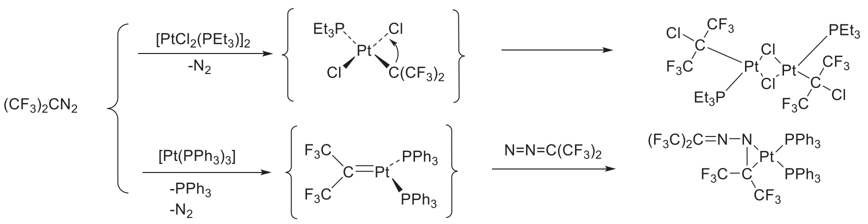
Bekir Çetinkaya



Scheme 1

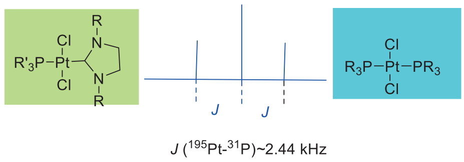
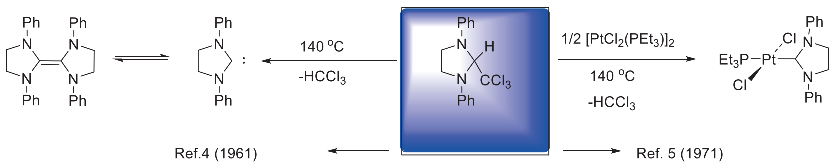
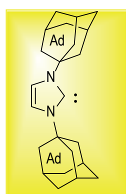


Figure 3





Ref. 7 (1991)

Scheme 2

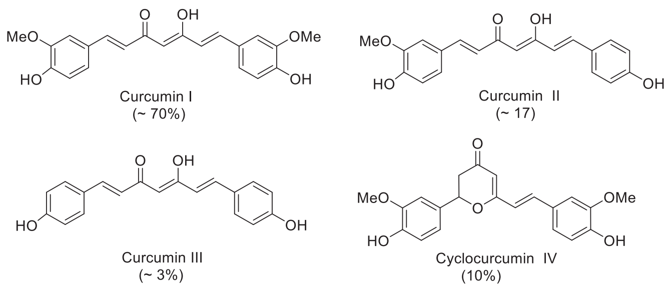
CURCUMIN AS A VERSATILE BIOACTIVE SUBSTANCE

Turmeric is a yellow-orange substance obtained from the rhizomes of *Curcuma longa* and has been widely used in Asia as a spice, pigment, and food additive since ancient times. In addition to its aromatic, stimulating, and coloring spice properties as a food, it is also used in Asian and Indian folk medicine for conditions such as respiratory problems, rheumatism, pain, and fatigue.

Curcuma longa

It has become an herbal substance attracting interest from the pharmaceutical and cosmetics industries because of its anti-inflammatory and antiviral properties. *C. longa* grows widely throughout the tropical belt in India, China, Thailand, and Indonesia and in the tropical regions of Africa. India is the leader in turmeric production and supplies 4/5 of the global production of approximately 1.1 million tons.

Curcumin, the main bioactive component of turmeric, is the source of the yellow color of the plant. Turmeric contains 60-70% carbohydrates, 8.6% protein, 5-10% fat, 2-7% fiber, 3-5% curcuminoids, and about 5% essential oils and resins [1].



The major curcuminoids in turmeric

Curcuminoids are phenolic compounds with a structure similar to that of curcumin. The amounts of curcuminoids in turmeric can vary between 2% and 9% depending on geographical conditions. The composition of curcuminoids is about 70% curcumin (curcumin I), 17% demethoxycurumin (curcumin II), 3% bisdemethoxycurcumin (curcumin III), and 10% curcumin IV. The most active of the four curcuminoid compounds is curcumin I, while curcumin IV is considered weak in terms of bioactivity [1].

Curcumin I was synthesized for the first time by Lampe and Milobedzka in 1913 using a series of reactions. [2]. C2 symmetrical curcuminoid compounds with an Ar-C7-Ar structure can be synthesized in one step by a method developed by Pabon in 1964 [3]. The synthesis uses 1 molar equivalent of 2,4-pentandion, 2 molar equivalents of aromatic aldehyde, and 1 molar equivalent of B_2O_3. Efficiency can reach up to 75% in the reaction carried out by the single vessel method.

Curcumin is known to have biological activities such as anticancer, antibacterial, antiviral, antifungal, antiinflammatory, antioxidant, antifertility, anticoagulant, antiangiogenic, antimutagenic, antiproliferative, antioxidative stress, anti-HIV and anti-AIDS, anti-Alzheimer, and antidiabetic [4-6].

Curcumin is poorly soluble in oil, but almost insoluble in water [7]. Although curcumin has shown many benefits in *in vitro* research, it has limited potential for development as a medicine as a result of its poor absorption, rapid metabolism, and limited bioavailability due to its breakdown [8]. A major portion of the research on curcumin in recent years has aimed to increase its bioavailability.

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Hülya Çelik

Curcuma longa, powder and rhizomes - complementary medicine.

HISTORY OF LIGHT

The nature of light has been a puzzle in the history of science for a long time. The early atomist Democritus proposed that all the objects were made of atoms, which make the objects visible by going into space to be received by the eyes. It was the first theory of light in the sense of particles.

Contrary to Democritus, Empedocles proposed that objects became visible through the light rays emitted by the eye touching the objects. Plato modified this theory and suggested that objects became visible when the light rays emitted by the eye intercept the rays emitted by objects.

Leonardo da Vinci was the first person to suggest that light might be a wave phenomenon, by comparing light reflection to the reflection of sound waves in echoes.

In the 17th century, Robert Hook and Robert Boyle observed the colors of oil on water and explained it as the interference of the rays reflected from the two surfaces of the thin film of oil. Newton rejected the wave theory of light. He postulated that light does not bend around sharp edges the way waves do. However, the amount of bending was too small to be observed in Newton's time. Thus, Newton thought that light consisted of particles.

A series of experiments by Thomas Young, starting in 1801, proved that light was a wave phenomenon. He showed that light rays could interfere with each other, which is only possible for waves.

In 1905, Albert Einstein explained through the photoelectric effect that light is composed of particles, where electrons are removed from a substance by light. Later, Louis de Broglie suggested that light, recognized as consisting of particles, could also be in the form of a wave. Finally, scientists agreed that the behavior of light as a wave or as a particle depended on the property being measured.

Turan Öztürk

Cultural Heritages

THE CITY WHERE HISTORY AND MYTHOLOGY MEET: TROY

It was used in the movie Troy. It is now in the city of Çanakkale in Turkey

A giant wooden horse welcomes travelers to Çanakkale when they approach Hisarlık Hill. This wooden horse shows that you have come to one of the most famous cities in history, Troy.

Like the wooden horse used at the end of the Trojan War, this horse was made of wood from the pines on Mount Ida. The wooden horse used in the movie *Troy*, which was made in 2004, was later brought to Çanakkale and exhibited there. The story of this horse is part of an epic that begins with love and then turns into an unforgettable war.

It was used in the movie Troy. It is now in the city of Çanakkale in Turkey

Ruins of the ancient legendary city of Troy in Çanakkale Province, Turkey

Roman amphitheatre, Troy, Turkey.

Regarding Troy, the first thing that comes to mind is the famous Trojan War. This war, embellished with myths, is immortalized in *The Iliad*, by the famous poet Homer. Therefore, when talking about Troy, historical facts and rumors are thought to be intertwined. The mythical story of the Trojan War begins at the wedding ceremony of Peleus and Thetis, who is one of the Nereids, the sea nymphs. Eris, the goddess of envy, is not invited to the wedding. She is very angry about this and decides to play a game, leaving an apple where everyone can see it. On the apple is written "For the most beautiful". No agreement can be reached on who to give the apple to and it is decided that the Prince of Troy, Paris, will decide. In ancient myths, it is considered the world's first beauty contest. All three goddesses say that if they are chosen by Paris, they will give him various gifts. Hera offers to make him the ruler of the Asian Continent and the richest person in the world. Athena's proposal is to make Paris the most handsome and cleverest person and the strongest warrior in the world. Aphrodite's offer is the love of the most beautiful woman in the world. That woman is Helen of Sparta. Consequently, Paris accepts Aphrodite's offer and gives her the golden apple. The Achaeans are furious when Paris goes to Sparta, kidnaps Helen, and brings her to Troy, and they gather their armies and come to Troy. Thus the famous war begins. It is said that at the end of this long war, the Achaeans were victorious and destroyed Troy.

This is, of course, mythical. In fact, the Achaeans attack on Troy was based on economic reasons. Since the beginning of recorded trade, the passage of ships loaded with gold, fabric, hemp, ship lumber, dried fish, cereals, slaves, amber, wine, jade, and olive oil on trade routes connecting the Aegean world and the Mediterranean to the Black Sea was under the control of Troy, built at the mouth of Hellespont, which we call the Dardanelles. The Trojan warships were taxing them. Mycenae, who dominated most of the trade routes in the middle of the Bronze Age, wanted to end Troy's sovereignty by adding other kingdoms on the Greek peninsula, and the main reasons for these wars were forgotten and gradually turned into a romantic heroic epic in the language of the poets like Homer.

The city of Troy emerged from mythology into reality as a result of the excavations conducted by a researcher named Schliemann in the late 1800s. Schliemann was searching for the Troy described by Homer. Most of the researchers at that time showed Troy in the location of the current small village of Pınarbaşı. The data were mostly based on the information that Homer gave in *The Iliad*. His research showed that this region was not compatible with Homer's accounts. Evaluating the information he had obtained, Schliemann decided to dig at Hisarlık Hill, which is about two hours away from Pınarbaşı. The city of Troy and the famous treasure of King Priam, for which he searched passionately, must have been under this hill.

Schliemann, however, found where he dug other things he did not expect: there were other ruins beneath the ruins that he thought were Troy, and underneath those further ruins and so on. It resembled an enormous onion that had to be peeled layer by layer. It was seen that other people had lived on each of these levels. Nations rose and fell; cities were established and demolished. While trying to find Homer's Troy, Schliemann and his assistants found seven cities in a year and later two more. So which of these nine cities was the Troy described by Homer? What was clear was that the bottom layer was prehistoric. This was the oldest layer; it was so old that the people who lived there did not yet know how to use metal. In the following years, researchers identified nine historic cities and nearly thirty different settlements in this region. This meant that many different cultures had lived there and that they had rebuilt the city as it collapsed from time to time. Homer's Troy was the sixth level.

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Notes on Troy:

■ According to legend, the Achaeans entered the city of Troy by hiding inside a wooden horse. At night when everyone in the city was asleep, the warriors exited the horse, opened the doors, and let the Achaean army in, who took over Troy. Archeologists say that this rumor may not be true after they found some cracks in the city walls, and the biggest reason for the defeat of Troy could have been a major earthquake. Damage to the walls left the city vulnerable and the Achaean army could have entered it in that way.

■ Currently, archeologists from Tübingen University in Germany are conducting excavations. Manfred Korfmann, who was in charge of the excavation until recently, became a Turkish citizen and took the name Osman. After his death, Ernst Pernicka took over.

■ Heinrich Schliemann, who found Troy and brought it to light, was not an archeologist. For this reason, he thought that the treasure he found belonged to the famous King Priam. In fact, the treasure belonged to another king, who lived about 1000 years before.

■ Another name of the city of Troy is Ilion. Homer entitled his work *The Iliad* based on this name. It is said it was one of Alexander the Great's favorite works and he read it frequently.

Bilim ve Teknik (Science and Technology magazine), August 2007

Gökhan Tok

Ruins of the ancient city of Troy, UNESCO world heritage in Turkey

Fritillaria imperialis, Van, Alacabük mountains

THE WEALTH OF PLANT TAXA IN TURKEY AND THE REASONS FOR IT

Turkey is a spectacular country on a large peninsula in the world's central belt (subtropical, latitudes 36°-40°) in a very important geographical location containing underground and surface riches.

Turkey is one of the world's richest countries in terms of biological diversity and especially in wealth of plants. The geographical location of the country, its geomorphology, past climate and geomorphological changes, glacial periods and drought periods during geological periods, and related climate shifts have important impacts on this wealth. The number of plant species on the European continent is known to be between 12,000 and 17,000 (Tutin and Heywood, 1980). Although Turkey has 1/11 the geographical area of the European continent, close to 12,000 species have been identified (Gözcelioglu, 2014). The number of plant species in Turkey is that many too. The endemism rate and the number of endemic taxa in Turkey are higher. Lately the origins of many plant taxa have been found to be in Turkey. For example, the genus *Veronica* L. is one of them. The three centers used to determine geographic origin on the world's land masses, i.e. the areal center, geometric center, and density center, for this genus are all in Turkey (Öztürk, 2010). While the number of species of *Veronica* in the world is 250, the number in Turkey, with about one hundredth of the world's land area, is 86. Thus out of the total number of species of *Veronica* in the world, one third grow in Turkey. Many of these species are endemic.

Current research has determined that the number of species of the genus *Astragalus* L. (milk vetch) in Turkey is 400. Many of these species are endemic to Turkey. The number of *Astragalus* species that are rare but not endemic is 60. Therefore, the center of density and center of origin of the genus *Astragalus* can be said to be Turkey (Öztürk, 2010).

The reason for Turkey's endemism rate and species richness being higher than Europe's was that they were less affected by the glaciation during the 4th geological period due to being at more southerly latitudes. Many species in Europe were exposed to the severe effects of glaciation and disappeared, whereas in Turkey they were protected.

Further reasons include the variety of relief in Turkey, i.e. variety of altitudes, valleys in different directions, mountains, plains, plateaus, slopes, lakes, and rivers; soil diversity; and climate and microclimate diversity (habitat diversity). The rate of endemism and species richness may also have been influenced by Turkey's being an area of human settlement for tens of thousands of years, an area crossed by many birds' migration routes, and an area of intense human activity due to for example the Silk Road, and the facilitation of the transport of plant seeds.

One of Turkey's interesting endemics is the beautiful *Fritillaria imperialis* (the crown imperial, imperial fritillary, or Kaiser's crown), which was previously known to be endemic to Van and Hakkari but according to recent findings has extended as far as Muş and Erzurum (Karayazı district).

Veronica flowers and buds

Other reasons thought to have affected Turkey's richness in terms of plant taxa and endemism are in terms of plant geography the presence of three floristic regions (Irano-Turanian, Mediterranean, and Paleoboreal Forest regions), climate changes during the geologic periods, and shifts in floristic areas.

Veronica *orientalis* subsp. *orientalis* (known locally as Doğu mine çiçeği); Erzurum, Palandöken mountains.

Androsace villosa L. FMO

Sedum sempervivum, Van, Alacabük mountains

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Avni Öztürk

Astragalus sp., Mount Erciyes, Kayseri.

TURKISH PURPLE JADE (TURKIYENITE): FROM THE BURSA REGION OF TURKEY

Turkish purple jade, also known as **TURKIYENITE**, is a unique composite material used as a modern gemstone since the 1980s. Turkiyenite is a natural untreated well-polished stone ready for jewelry. This purple stone is only found in the Harmancık District of Bursa Province in western Anatolia (Turkey). Its chemical composition is mainly 40-60% jadeite but it is also a mixture of minerals such as quartz, epidote, orthoclase, and phlogopite.

Nurullah Saraçoğlu

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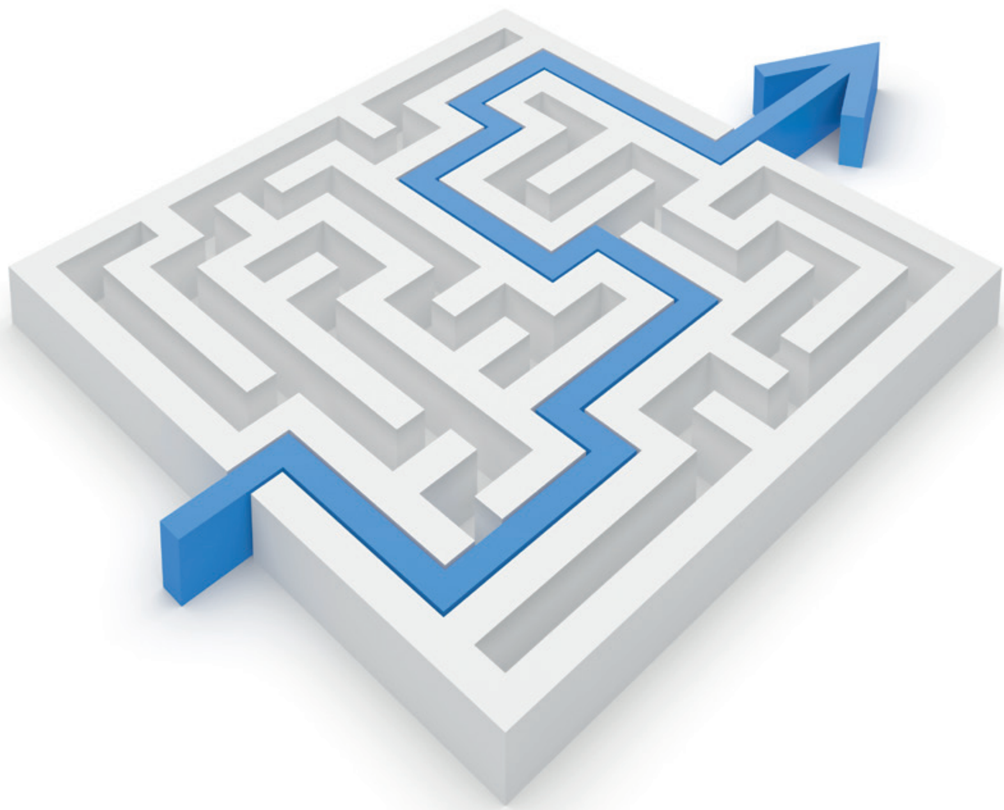
TODAY'S PROBLEM AND YESTERDAY'S ANSWER

Problem 3.

Alaaddin and the monster play the following game. The monster puts on each unit square of a 7×7 grid either a gold or a silver coin. After that Alaaddin in each move chooses two gold or two silver coins lying in the neighboring unit squares (sharing either a common edge or a common vertex) and takes them. The monster tries to minimize the total number of coins that Alaaddin will take. How many coins can take Alaaddin with certainty?

Azer Kerimov



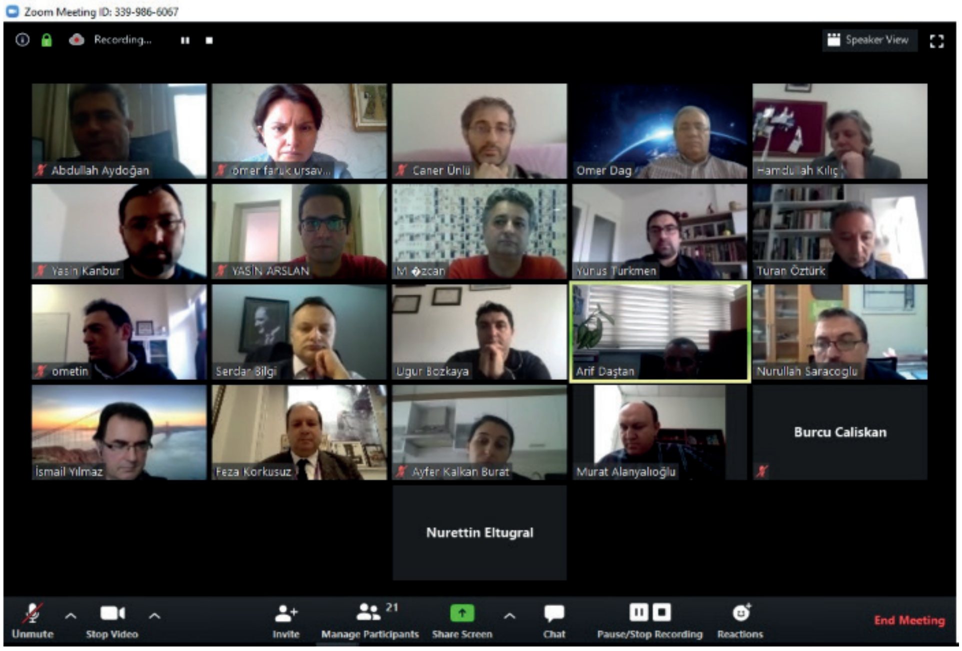
Answer of yesterday's problem :

116. The total number of assigned problems from the books is 7 × 99 = 693. Each problem is not assigned to at least one student; therefore it is assigned to at most 6 students and there are at least 693/6 > 115 problems in the book.

An example for the case when there are 116 problems: Let us divide the set of 116 problems into 7 groups of sizes 16, 16, 16, 17, 17, 17, 17 numbered 1,2,...,7 and to student number k assign 99 problems not belonging to the k-th problem group. It can be easily seen that this assignment satisfies the conditions.

REMOTE EXAM PROCESS DURING THE CORONA PERIOD

The IChO 2020 Turkish Scientific Committee held an online meeting to discuss the emergency situation.



Due to the COVID-19 pandemic, in mid-March many countries imposed international travel bans and curfews for their citizens and so it became clear that IChO, planned to be held in Turkey this year, could not go ahead in the traditional way. As the situation became understood, the IChO 2020 Turkish Scientific Committee held a video conference chaired by Prof. Dr. Feza Korkusuz, Advisor to the President of TÜBİTAK, on April 6, 2020. During the video conference, it was discussed whether the exam should be conducted remotely under secure conditions or postponed. As a result of the discussions, it was decided to suggest the possibility of a remote exam to the IChO International Scientific Committee to prevent the students who have been preparing for the Olympics for years from suffering.

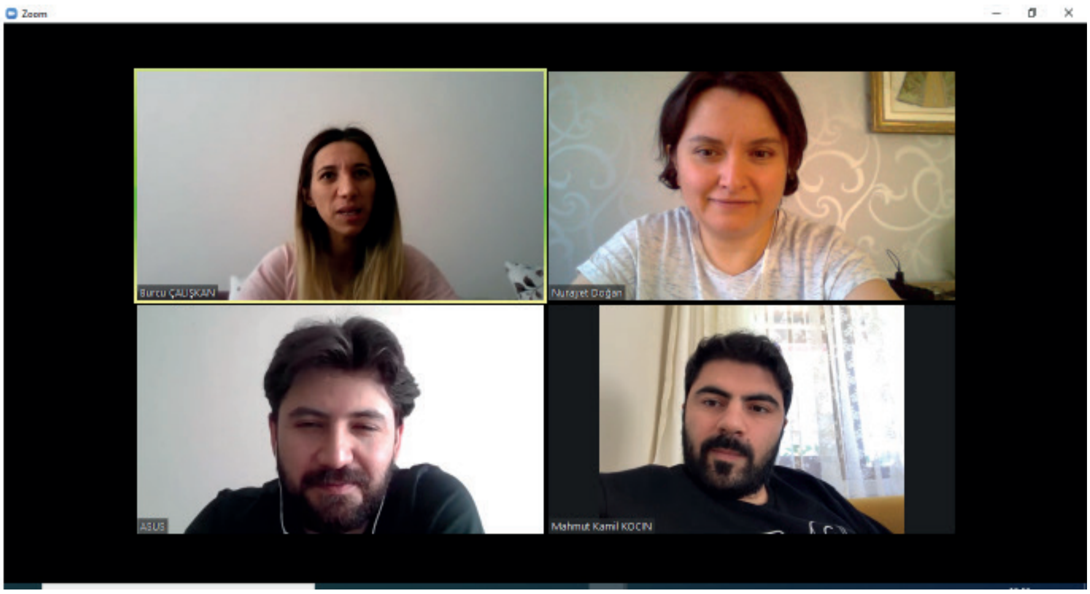
TÜBİTAK held an online meeting with the IChO 2020 International Scientific Committee.

On May 1, 2020, a video conference was held by Prof. Dr. Feza Korkusuz, Advisor to the President of **TÜBİTAK**, with the participation of IChO International Scientific Committee Members and TÜBİTAK Experts, moderated by Dr. Yunus Emre Türkmen, Vice President of the Scientific Committee. During the video conference it was decided, despite all the negative conditions, to disregard the option of cancelling the exam and to conduct IChO 2020 Remote Exam through cooperation between the International Committee and the Turkish team. During the conference, the software to be used for IChO 2020 Remote Exam and the exam's technical issues were discussed. The IChO Committee expressed their thanks for the efforts of the Turkish team towards conducting the exam.

The IChO 2020 International Scientific Committee discussed the technical issues concerning the Remote Exam.

On June 2, 2020, between 19:00 and 21:00 Istanbul time, IChO 2020 host country participants and IChO Steering Committee members discussed the content and technical features of the software to be used in the exam. Requests were sent to the representative of the company from which the software will be purchased to add necessary features to the system.

TÜBİTAK's technical team held consecutive meetings on Remote Exam registration and follow-up.



Experts from TÜBİTAK held consecutive meetings among themselves in May to discuss technical issues such as student registration, conducting of the exam, and preparation of medal certificates in the IChO Remote Exam.

The IChO 2020 Registration Page has been Updated in Line with the Remote Exam.

Important Dates are Updated in Line with the Remote Exam.
1st meeting (June 22, 2020): Problems & Solutions of the IChO 2020 Remote Exam were discussed.

2nd meeting (June 24, 2020): Problems & Solutions of the IChO 2020 Remote Exam were discussed.

Scientific board meeting (June 23, 2020)

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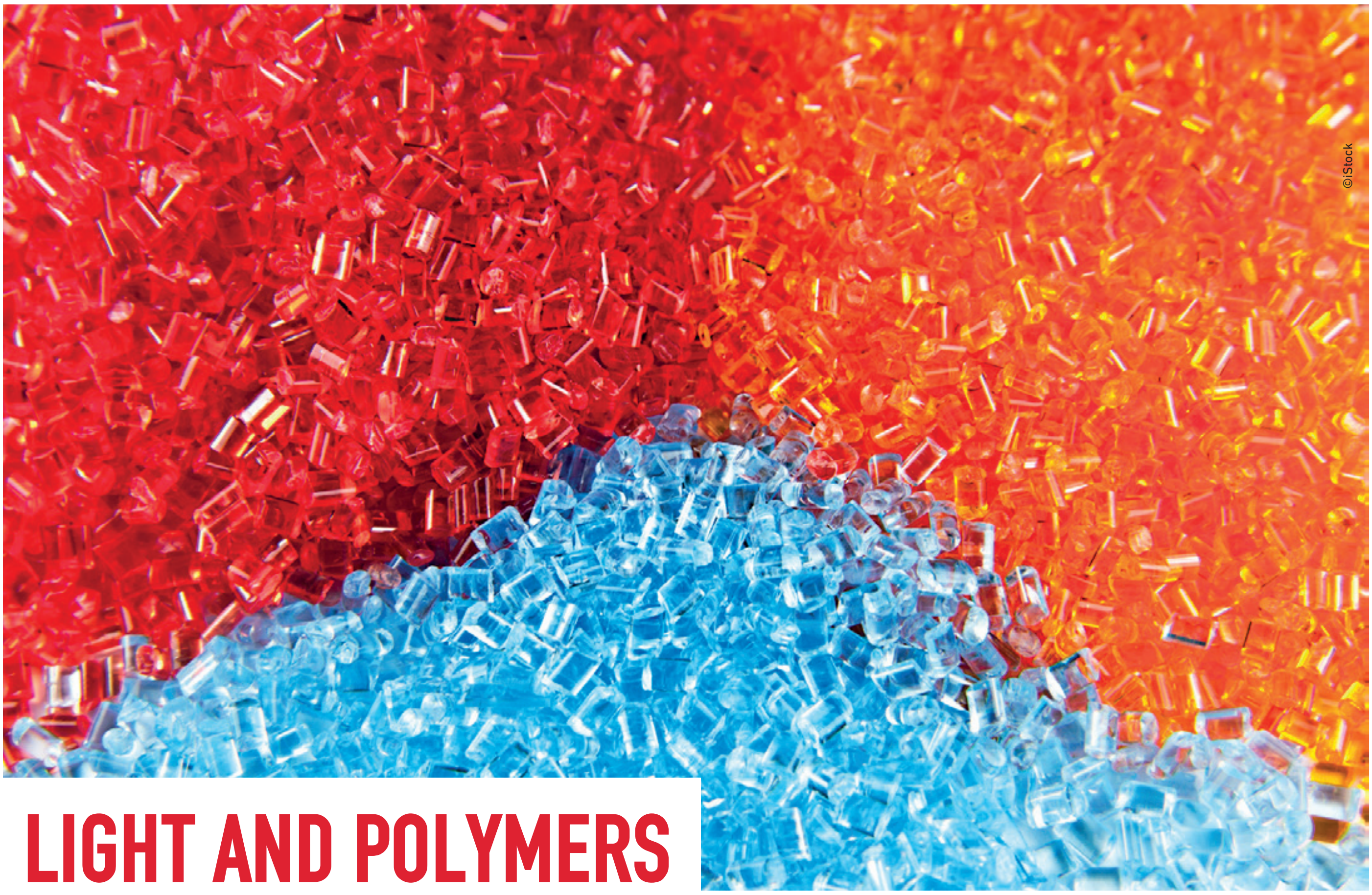
52nd IChO 2020
INTERNATIONAL CHEMISTRY OLYMPIAD

CATALYZER

THE FOURTH ISSUE OF CATALYZER MAGAZINE 18/07/2020



LIGHT AND POLYMERS

Light is the natural source of life and all living organisms on earth need light to survive. The relation between light and life is expressed in the noblest way by the famous philosopher Mevlana Celalettin Rumi [1] with the following words:

Born from the infinite darkness.

Spotted the "light", scared.
Cried...

With time, learned to live with the "light".

Spotted the darkness, scared.
Cried....

Today, light plays a crucial role in everyday life. Besides lightening, many industrially important applications such as light-emitting diodes (LEDs), organic light-emitting diodes (OLEDs), solar cells, and photovoltaics are all related to the use of light. Many chemical reactions can also be triggered by light. The use of light in polymer science dates back to as early as ancient Egyptian times. The so-called mummy is a dead human or an animal body preserved by special techniques and it has become the most famous aspect of the ancient Egyptian period (Figure 1). The dead bodies, after being washed and cleaned, were covered by materials that were immersed in special resins and kept in sunlight. Photochemical curing resulted in the preservation of the bodies in the form of mummies for centuries.

Figure 1. Antique illustration of an Egyptian mummy.

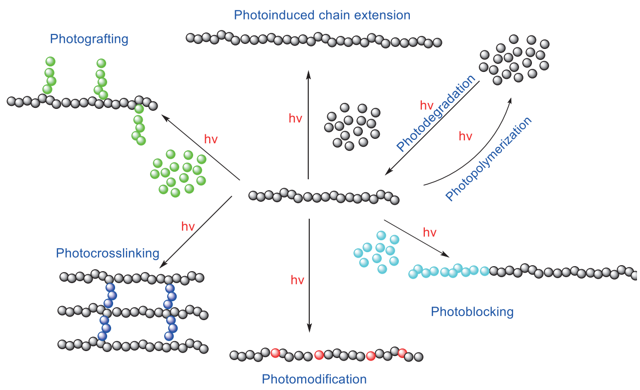


Figure 2. Light-induced synthesis of polymers with various topologies.

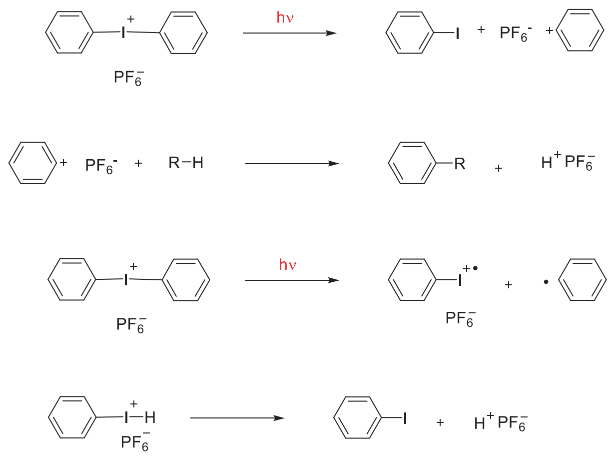


Figure 4. Photoinduced acid generation for cationic polymerization.

Light also plays a predominant role in technical polymer synthesis [2]. Polymers with a wide range of topologies can be synthesized by photochemical means (Figure 2).

Among the various modes of photopolymerization processes, free radical polymerization is in the more advanced state due to its applicability to industrially important vinyl monomers and the availability of a wide range of photoinitiators acting at the whole range of the electromagnetic spectrum. The general radical generation process is based on either α-cleavage or hydrogen abstraction mechanisms (Figure 3).

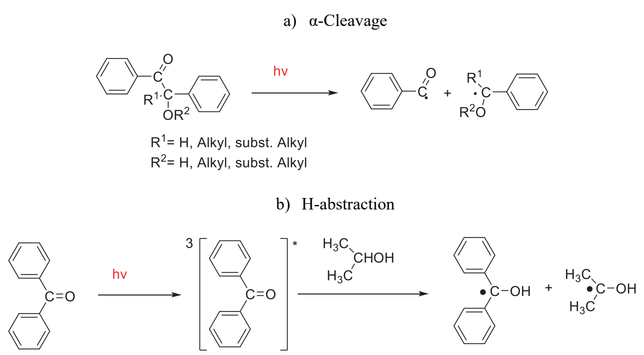


Figure 3. Photoinduced radical generation by α-cleavage (a) and H-abstraction processes.

Photoinitiated cationic polymerization [3] has also become an important process for the curing of epoxy and some vinyl monomers that can be initiated by the photoinduced generation of Brønsted acids (Figure 4). Thus formed photoacids readily react with the monomers to initiate the polymerization. The non-nucleophilic nature of the counter anions, such as PF_6^-, ensures that polymerization proceeds even after the light is turned off.

More recently, we have shown that step-growth polymerization [4] can also be accomplished by photoinduced electron transfer [5] or radical coupling [6] reactions. In all conventional polymerizations due to the various side reactions, molecular weight and functionality are not properly controlled. However, recent studies [7,8] showed that such control can be achieved by photoinitiated living/controlled polymerization methodologies.

Furthermore, photochemical routes provide the possibility to fabricate polymer/metal [9] or clay [10] nanocomposites. Nano-sized metals and their composites play a crucial role in various applications as bio- and optoelectronic materials. Usually, gold and silver nanoparticles and polymers are independently prepared and then their composites are formed. Recently, we have shown [9] that such composites can be obtained directly by simultaneous reduction and polymerization processes by the use of light. The typical photochemical dual process is presented schematically on the example of the gold-poly(ethylene glycol) diacrylate nanocomposite in Figure 5.

To improve the mechanical properties of polymers, the usual strategy is to combine them with naturally abundant materials such as clays. However, clay and polymers are immiscible and when they are mixed phase separation occurs and heterogeneous materials are formed. We have developed [10] a new strategy by inserting photoinitiators between the layers of clay by exchanging sodium ions on the surface (intercalation). Upon irradiation, polymerization starts and the layers are exfoliated, resulting in the formation of homogeneous nanocomposites.

Photoinduced electron transfer reactions can be adapted to

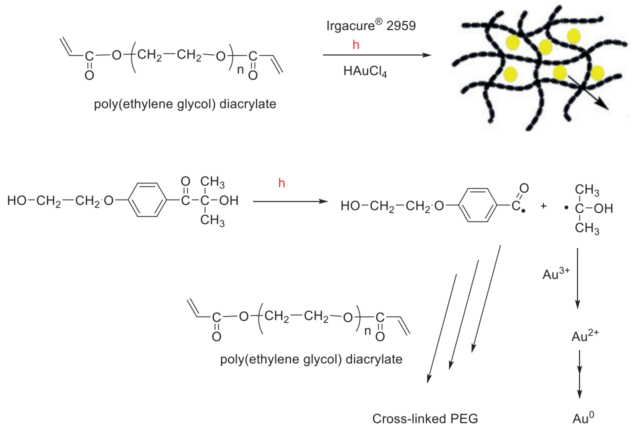


Figure 5. Photoinduced preparation of gold-poly(ethylene glycol) acrylate nanocomposites.

copper-catalyzed cycloaddition reactions known as "click chemistry", which allows simple coupling of small organic compounds and polymers [11] (Figure 6). In this case, the catalyst Cu(I) is produced by the reduction of Cu(II) salt by photochemically generated electron donor radicals.

In conclusion, light-activated processes for the preparation of polymeric materials provide a versatile methodology offering several advantages compared to the thermal analogous technique. These include low energy requirement, spatial and temporal control, and high reaction rates, and therefore light-induced approaches can be considered "green".

Moreover, the possibility of conducting reactions in the UV, visible, and even non-harmful near-infrared [12-14] region of the electromagnetic spectrum provides wavelength flexibility for specific applications.

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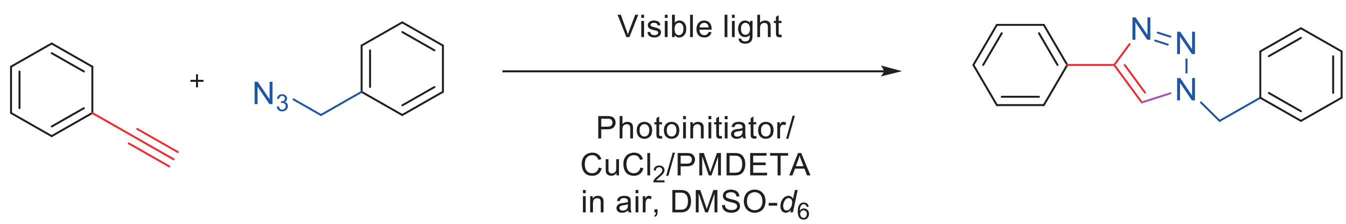
Yusuf Yagci



Bakelite bracelets

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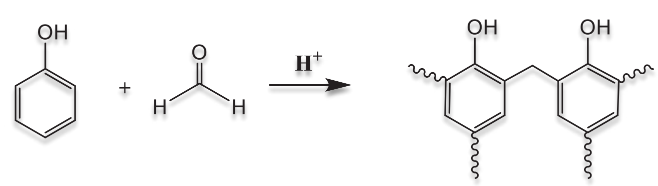
PHENOL–FORMALDEHYDE MIRACLES

In 1872 Adolph von Baeyer, a German chemist, heated aqueous formaldehyde with phenol to yield a hard, resinous, noncrystalline product. However, the chemistry to elucidate the structure of such materials was not available at that time [1]. This resin protects wooden materials in particular from external factors, such as moisture.

In 1907, Leo Baekeland, a Belgian-American chemist, developed a process via a phenol-formaldehyde reaction to produce a strong and flexible resin, which was marketed under the name "Bakelite". Bakelite, the first plastic material made from synthetic components, has attracted enormous interest since that time. Bakelite is an important synthetic material used especially in electrical devices due to its high resistance to electricity.



©photo: Hülya Çelik

An old-time radio and telephones made using Bakelite material

The story of phenol-formaldehyde in the cyclic structure begins with the work by David C. Gutsche. He isolated calixarene, which may be a third-generation compound, from the condensation of phenol and formaldehyde in basic conditions and with procedures that allow their isolation in different ring sizes. Mainly, they contain 4, 6, or 8 phenol residues. The name "calixarene" was originally conceived due to their resemblance to the vase-like shape that these phenol-derived macrocycles assume when they are in the conformation where all aryl groups are oriented in the same direction [1]. Their name derives from the Greek "calix" (meaning "vase") and "arene", which indicates the presence of aryl residues in the macrocyclic structure.

The de-alkylation reaction can be carried out quite effectively by a reverse Friedel–Crafts process, using a Lewis acid as catalyst ($AlCl_3$). Thus this reaction allows us to remove the tert-butyl groups and to make the p-position of phenolic units undergo further modifications with different groups. Some of the main characteristics that make calixarenes interesting for various types of applications are that they are not expensive materials, they are well-defined oligomers, they can be prepared with different sizes of cavities, they can be easily functionalized inserting even quite different groups, they show exceptionally high and selective complexation capacity of metal ions and molecules, and they show remarkably high chemical and thermal stability [2].

Their possible applications range from nanomedicine to biochemical and material science. For instance, patents were filed that claim the use of calixarenes in cosmetic and pharmaceutical formulation, cell transfection, and antibacterial agents. They have also been proposed as dental materials, adhesion promoters, hair dyes, photographic toners, glass photoresists, and antioxidants [3,4].

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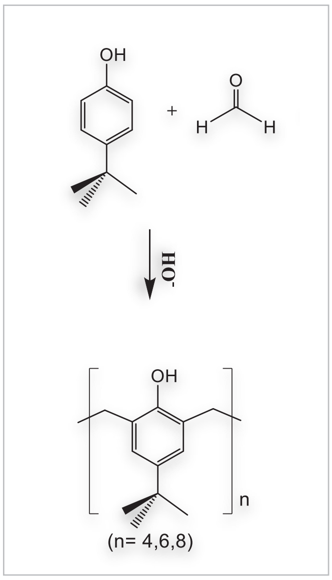
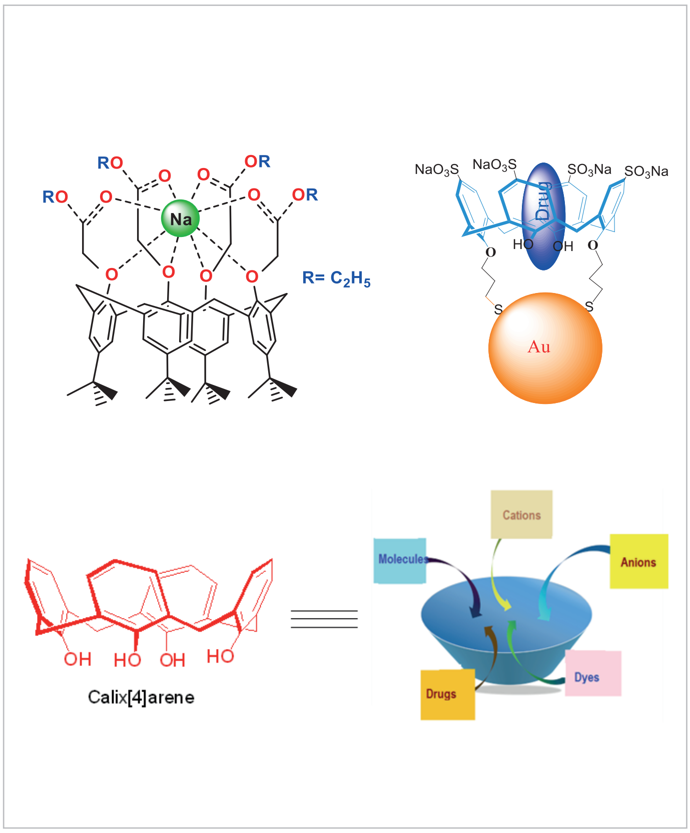
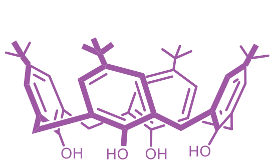
Mustafa Yılmaz

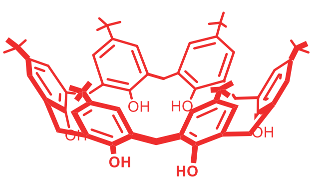


David C. Gutsche and coworkers reported an easily reproduced procedure for synthesizing p-tert-butylcalix[4]arene, p-tert-butylcalix[6]arene, and p-tert-butylcalix[8]arene in good or excellent yield on any scale from a gram or less to many kilograms.

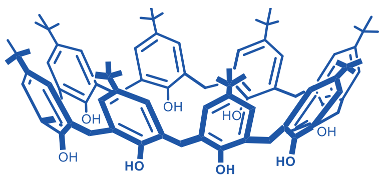




p-tert-butylcalix[4]arene



p-tert-butylcalix[6]arene



p-tert-butylcalix[8]arene

BIRTH OF ELEMENTS AND THE ATOM

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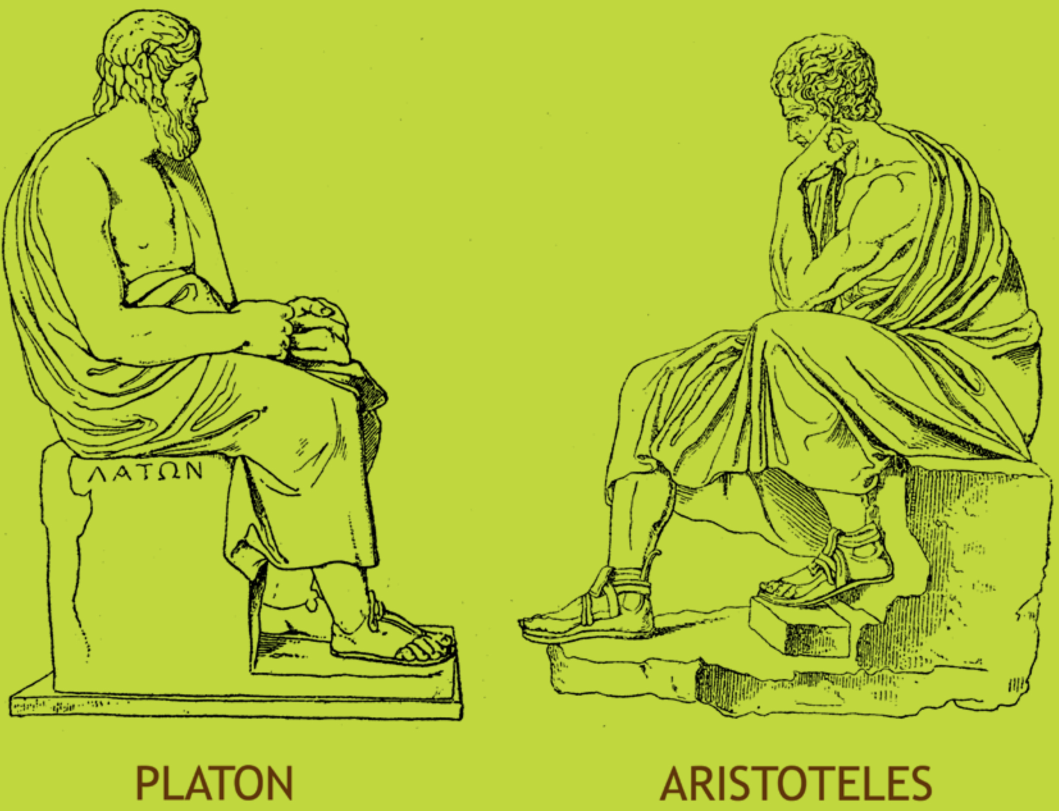


Hellenic statues of Plato and Aristotle ancient Greek philosophers and scientists

The concepts of elements and the atom are of Greek origin. Of course, the Greeks did not consider them as we do today. In Ancient Greece, although Empedocles believed that all materials were made of four primary substances: earth, air, fire, and water, the term element was introduced by Plato. It was thought that the appearance of a material could be explained by the combination or separation of these elements through the influence of love (attraction) and hate (repulsion).

Plato, adopting Empedocles' theory of elements, thought that geometry was the best way of thinking about nature and explained the smallest part of fire (not an atom as he did not believe in atoms) in the shape of a tetrahedron, air as an octahedron, water as an icosahedron, and earth as a cube.

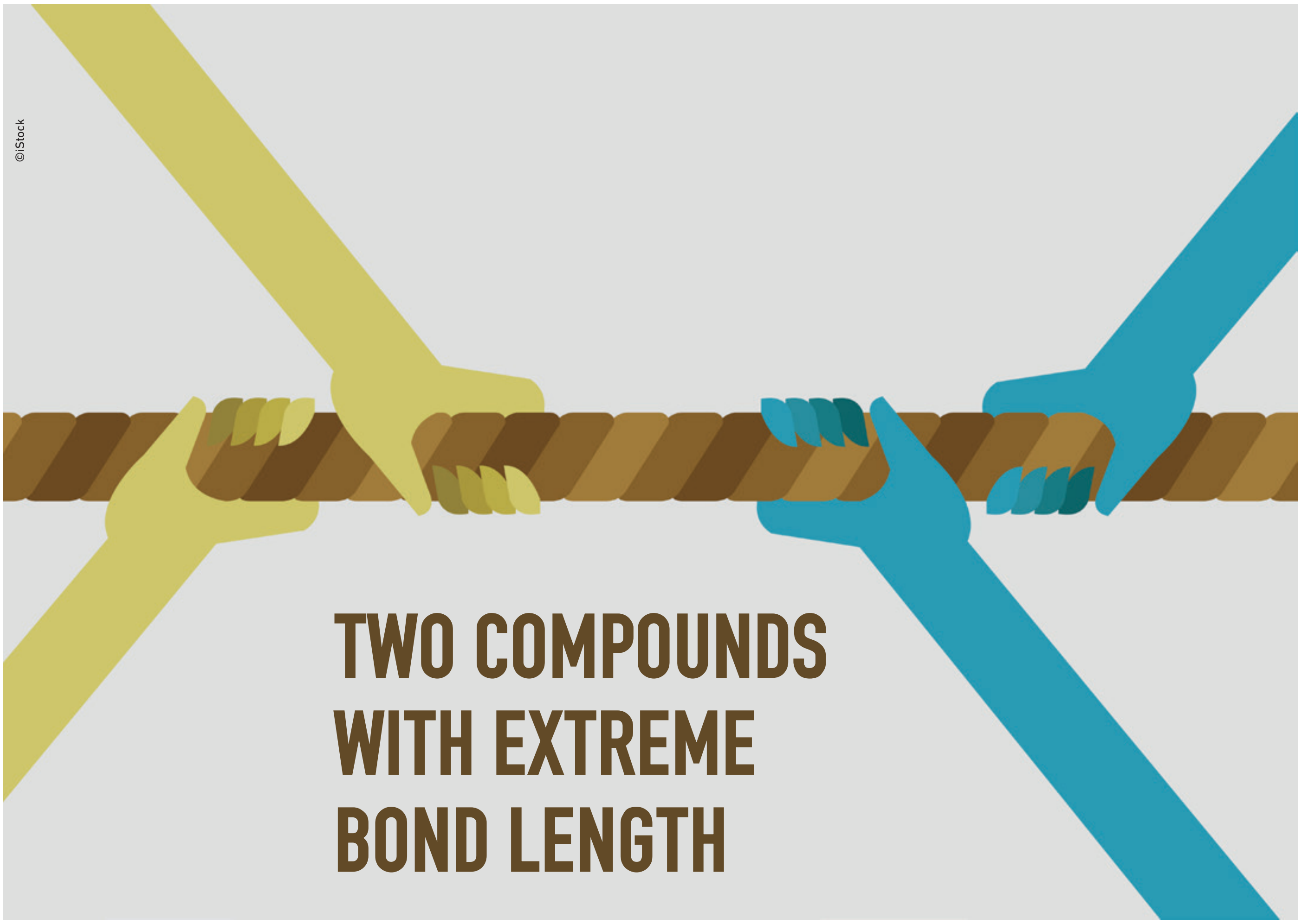
Aristotle also accepted the theory of four elements, but not in the way Empedocles claimed that the elements were immutable and the materials differ only in their compositions. On the other hand, Aristotle thought that the elements change when they combine. Moreover, Aristotle explained that elements had qualities based on how we experience them: hot, cold, dry, and moist. He said that each element was endowed with two of the qualities; thus, earth was dry and cold, water moist and cold, air moist and hot, and fire hot and dry. An element could be turned into another by changing one or two of its qualities, such as earth could turn into water by changing its dryness to moistness.

Both Plato and Aristo did not accept the theory of the atom claimed by atomists, i.e. Leucippus and Democritus.

The idea of the atom as the smallest and indivisible entity is one of the oldest concepts in science. It had its origin as a philosophical problem that Greeks discussed for a long time. Heraclitus said that *change* is the basic nature of all things. On the other hand, Parmenides did not agree with Heraclitus and said that reality is unchangeable and change is only an illusion. Democritus (probably Leuccipus was the father of atomic theory, but little known about him) explained that the change was the local motions of parts that in themselves were unchangeable and invisible. Those parts were atoms, which comprised all being; everything else was void. He claimed that materials differ from each other as a result of the shapes, positions, and grouping of the constituting atoms. He also said that while in solid bodies the atoms stick together, in liquids and gases atoms do not stick together and rebound from one another in different directions. Denser bodies are made of bigger atoms (but still indivisible). He stated that there was no limit to the size of atoms. They could be as big as a world could exist somewhere.

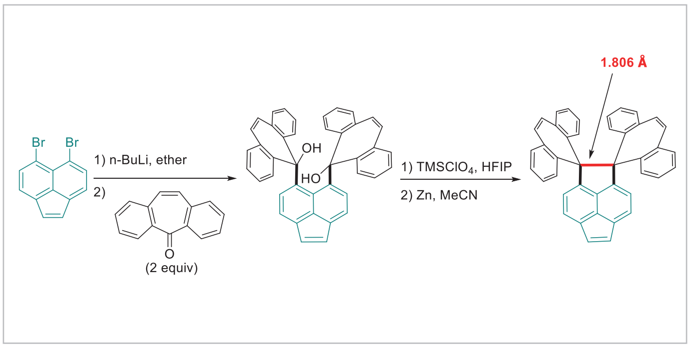
Atomists did not have many followers until the 17th century. Even Dante allocated him a very low place in hell.

Turan Öztürk

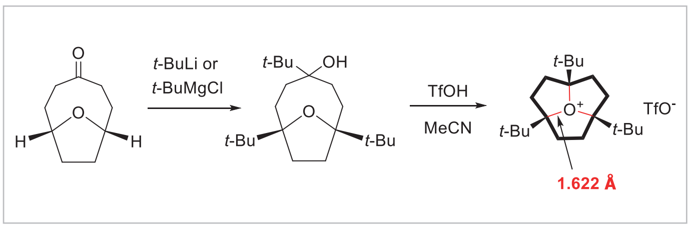


TWO COMPOUNDS WITH EXTREME BOND LENGTH

In 2018, one of the longest C_{sp3}–C_{sp3} bond lengths to date in highly strained hydrocarbons was reported by Ishigaki et al. from Hokkaido University, Japan [1]. The C–C covalent bond length (1.806 Å) of this highly strained core-shell-type hydrocarbon is 1.17 times greater than the standard length (1.54 Å). This hydrocarbon was prepared from dibromoacenaphthylene and dibenzosuberenone in two steps. Firstly, the corresponding diol was obtained by lithiation of 5,6-dibromoacenaphthylene followed by the addition of dibenzosuberenone. After the diol was exposed to acidic conditions in the presence of 1,1,1,3,3,3-hexafluoro-2-propanol (HFIP), the resulting precursor dication was reduced with Zn powder to yield this extreme compound as an orange crystal.



In 2012, stretching of a C–O bond to a record length was reported by Mascal and coworkers [2]. The team observed the formation of unusually long C–O bonds during the building of oxatriquinane structures. The substitution of the oxatriquinane ring system with *tert*-butyl alkyl groups resulted in an extraordinary C–O bond of 1.622 Å in 1,4,7 tri-*tert*-butyloxatriquinane.



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Nurullah Saraçoğlu

Olive oil on a wooden table

A DELICIOUS AND VALUABLE GIFT FROM THE UNDYING TREE: VIRGIN OLIVE OIL

The symbolic plants of the Mediterranean civilization are figs, grapes, wheat, and olive trees. The olive tree is a very long-lived plant. It is the rich tree of poor soils. The Minoan people of ancient Crete, ancient Egyptians, Phoenicians, ancient Greeks and Romans, Berbers, and later Muslims in the Middle Ages contributed greatly to olive cultivation in the Mediterranean basin [1]. Turkey is the fourth largest producer of olive oil in the world. Ninety-one domestic cultivars of olives (89 domestic cultivars + 2 hybrid olives) are officially registered in Turkey. The economically important domestic cultivars are the following: Memecik (South Aegean district, oily cultivar, approximately half of the country's olive presence, having geographical registration certificate), Ayvalık (North Aegean [Edremit Bay] district, oily, having geographical registration certificate), and Gemlik (Marmara region [Gemlik Gulf – Bursa] district, table + oily, having geographical registration document). Olive fruit cannot be consumed directly because it contains oleuropein, an especially bitter phenolic component. It is considered a processed fruit (table olives) as a result of some processes. Only the oil with natural properties is obtained from the olive fruit with the help of physical methods (pressing, centrifugation, and percolation). Virgin olive oil, called liquid gold, is a fruit oil or an oily juice [2-4].

In the evaluation of virgin olive oil, its sensory qualities come before its analytical qualities. Although the analytical quality values of many virgin olive oils on the market are appropriate, their sensory quality criteria (sensory defects) may be insufficient. The quality of natural olive oil starts with the harvest. Olive fruit is very sensitive to damage. Harvesting must be done manually or by machine to obtain a ground fruit. It should be transported in plastic containers having ventilation holes. To protect the sensory quality of the oil, the ground/good olives (collected from the branch) and the damaged/bad olives (that have fallen onto the soil) must be processed separately for oil extraction. The oils of good and damaged olives should be stored separately and should not be mixed [2]. From the ancient period up to the 1960s, virgin olive oil was obtained entirely by pressing (classical) methods and today the oils are mostly produced based on centrifugation methods, which are continuous (modern) systems known as 3 (oil + olive pomace + wastewater) phase and 2 (oil + high humidity pomace) phase [3].

Virgin olive oil contains chemically saponified (triglycerides or triacylglycerols and fatty acids known as neutral oil, 98-99%) and non-saponifying components (the most important are sterols, phenolic compounds, volatile aromatic components, and squalene, 1-2%). Fatty acids (as a source of essential fatty acids) are an important food ingredient for human nutrition. The fatty acid profile in virgin olive oil follows as the main major component according to official norms: palmitic (7.5-20 %) and stearic (0.5-5.0%) (saturated fatty acids, [SFA]), oleic acid (55.0-83.0 omega 9, monounsaturated fatty acid, [MUFA], the dominant and characteristic most important fatty acid in olive oil) and linoleic (3.5-21% omega 6), linolenic (<0.9 omega 3). These fatty acids are known as polyunsaturated fatty acids (PUFAs). According to the fatty acid profile, olive oils are classified into two types: 1st type oils, including low linoleic and palmitic and high oleic acid levels (Northern Mediterranean countries [Spain, Italy, Greece, Turkey], and 2nd type oils, containing high linoleic and palmitic acid and low oleic acid contents (North Africa [Morocco, Algeria, Tunisia, and Libya]. The fatty acid profile is a useful marker in determining possible frauds and adulterations in virgin olive oils, and this parameter was successfully used in the characterization and classification of oils based on their cultivar and regional basis [4].

Squalene (200-12,000 mg/kg for virgin olive oil), a component found in a non-saponifying fraction of oils, is an important hydrocarbon specific to this oil. The highest value of squalene in nature is found in the shark liver. Squalene helps regenerate tissue cells (anti-inflammatory) and is a protective (anti-carcinogenic) substance against skin cancer. Other important non-saponifying components in virgin olive oil are biophenolic substances. These components contribute to the formation of permanent sensory taste and unique flavor (fruity, bitter, and pungent) in virgin olive oil and the shelf life (oxidative stability) as a technological property. In addition, phenolic components are a remarkable source of antioxidants (anticarcinogens, inhibitors of free radicals) in human nutrition [4].

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Harun DIRAMAN

Olives on the tree.

Olive tree is the rich tree of poor soils.

Ephesus - Selçuk, Turkey

THE ANCIENT CITY OF EPHESUS

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

The first establishment of Ephesus, which is a port city in the Selçuk district of İzmir Province, goes back to as far as 6000 BC. The city named Apasas in the second half of the 2nd millennium BC in Hittite documents is located in today's Ephesus region. Especially the finds at Ayasuluk showed that Apasas, the capital of the Arzawa-Mira Kingdom of Hittites in Western Anatolia, is Ayasuluk Hill. The population of Ephesus, where immigrants from Greece lived in 1050 BC, constituted Anatolian peoples such as Carians, Lelegians, and Lydians before the Ionians. The city was moved by the King of Lydia Croesus in 560 BC to around the Temple of Artemis, and then to its present place by Lysimachus, one of the generals of Alexander the Great, in the 300s BC. The city, which was established in the valley between mounts Panayır and Bülbül, is surrounded by a 9-km-long wall. Experiencing the richest period in the Hellenistic and Roman periods, Ephesus was the capital of the Asian Province with a population of 200,000. Due to the filling of the harbor during the Byzantine period, the city was again moved to Ayasuluk Hill, where the first finds were made. The new name of the city, which had started to take shape since the 7th century AD, was Hagios Theologos (holy theologian). With the Turks arrival in the 14th century, the region became known as Ayasuluğ/Ayasuluk. The name of the city, which the Aydinids used as a center for a while, was documented by the Genoese as Alto Luogo. During the Ottoman period, the name Ayasuluk continued to be used and in 1914 it was changed to Selçuk.Ephesus is an important settlement in terms of historical and cultural ruins. The Temple of Artemis

Great theater of Ephesus ancient city in Turkey in the city was built entirely of marble in 550 BC and is one of the Seven Wonders of the Ancient World. Another important building in the region is the Ephesus Theater, which was started to be built in the 1st-2nd century AD with a capacity of 25,000 people. Other important cultural ruins include the Library of Celsus, the upper agora and its basilica, the Odeon (the place seating 1400 people where city council meetings were held), the Prytaneion, the Gate of Hercules, the terrace houses, the Fountain of Trajan, the public baths and latrines, the Octagon burial chamber, the Temple of Hadrian, the Church of Mary, the palace structure, and the Gymnasium.

Amphitheater in Ephesus, Turkey

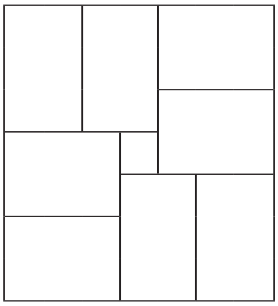
The Library of Celsus, built in AD 135, in the ancient city of Ephesus.

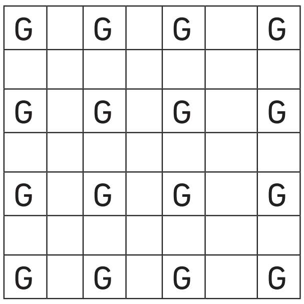
TODAY'S PROBLEM AND YESTERDAY'S ANSWER

Problem 4.

A modern artist uses only 8 colors. It turns out that each of his paintings presented at the exhibition is painted using only 3 colors and any 2 of his paintings have at most 1 common color. What is the maximal possible number of paintings by the modern artist in the exhibition?

Azer Kerimov





Answer of yesterday's problem :

Alaaddin can take with certainty only 32 coins.

Note that Alaaddin can take 2 coins from each group of 3 unit squares of form L. Therefore, from each rectangle of size 2×3 he can get at least 4 coins. Since the 7×7 grid

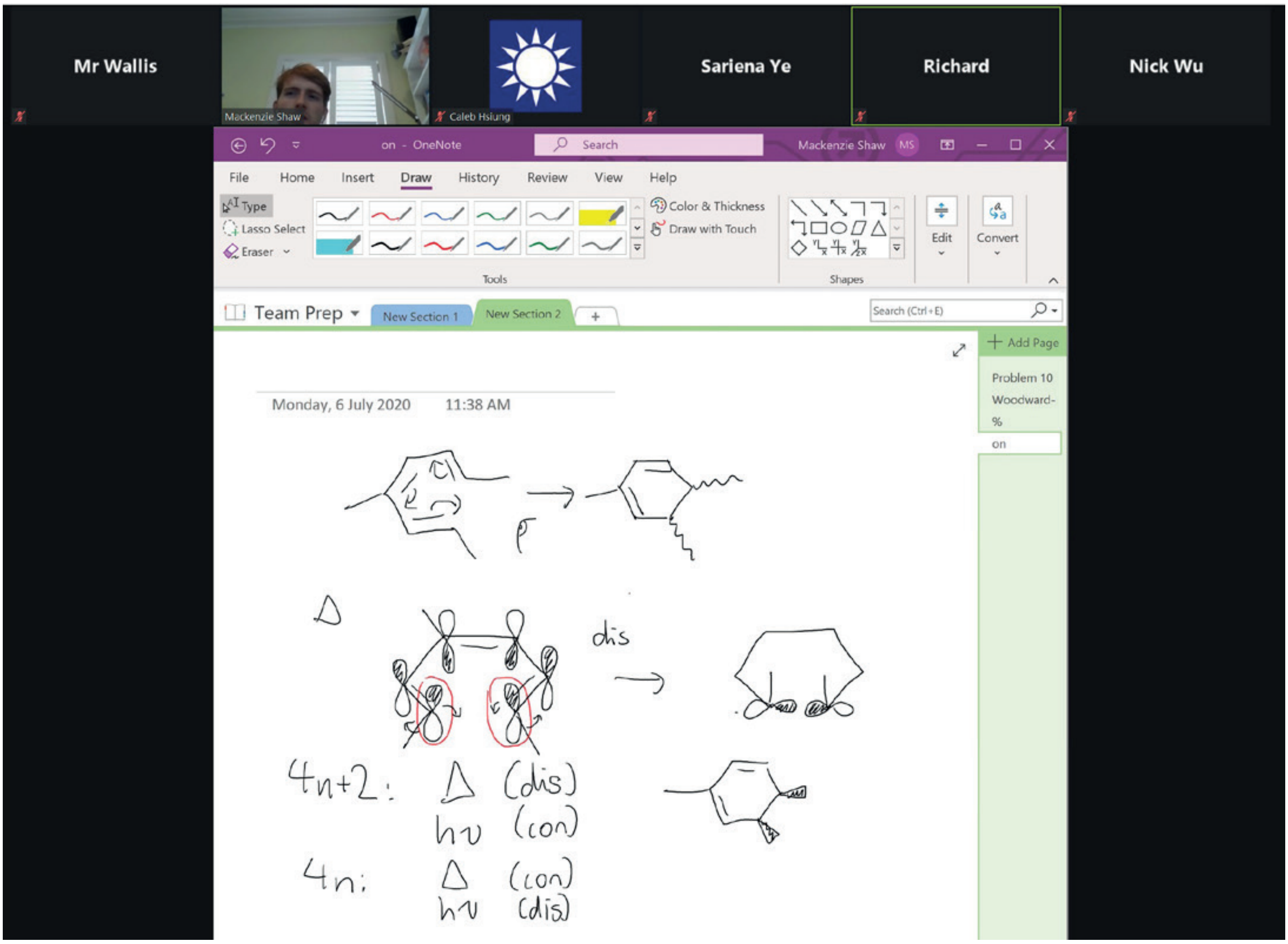
contains 8 such rectangles Alaaddin can take $8 \cdot 4 = 32$ with certainty (see the picture).

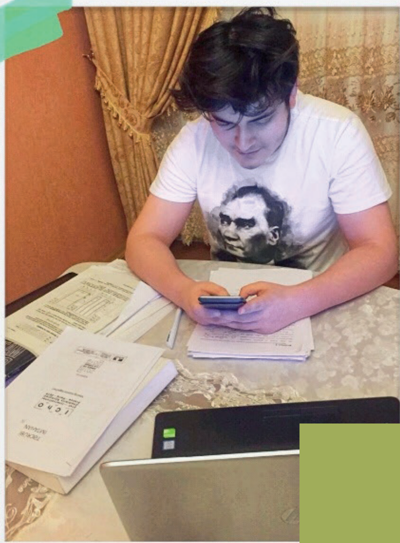
On the other hand, if the monster puts 16 gold coins into unit squares marked with a G and 33 silver coins into remaining unit squares then Alaaddin cannot take any gold coins. Therefore, he can take at most $49 - 16 = 33$ silver coins. Since Alaaddin takes an even number of coins the answer is at most 32.

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

AUSTRALIA

Final team training





AZERBAIJAN

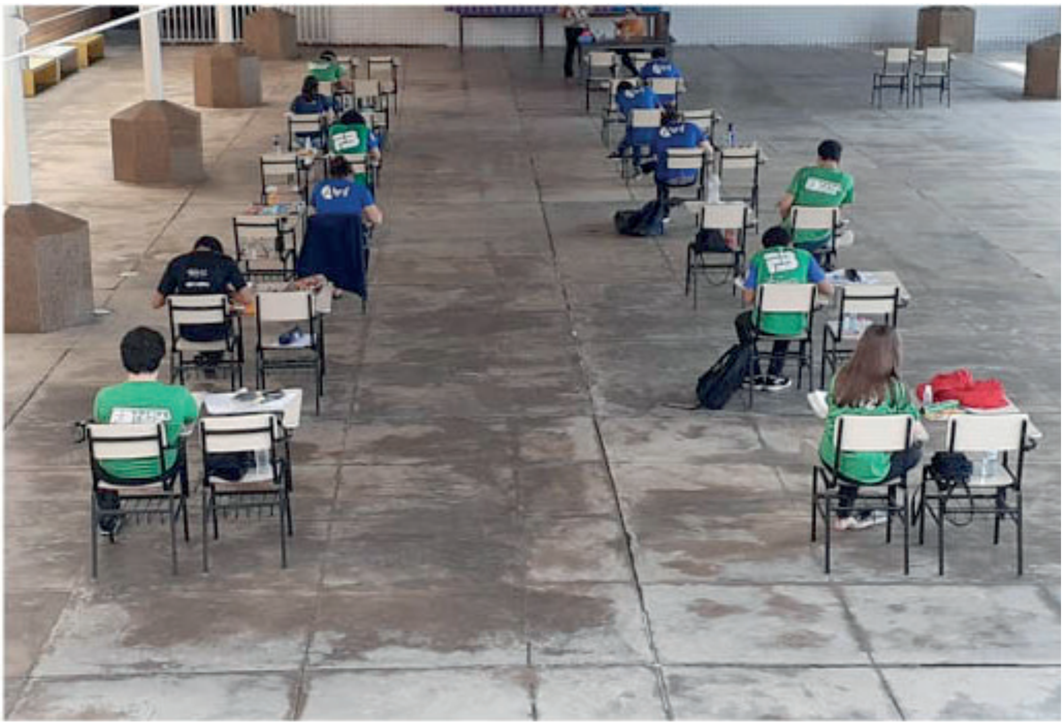
#StayHome #StaySafe and stay positive with high morale :)

BELGIUM

Regional selection round held in early March
before lockdown

BRAZIL

Brazilian Chemistry Olympiad, final exam.



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52nd IChO 2020
INTERNATIONAL CHEMISTRY OLYMPIAD

CATALYZER

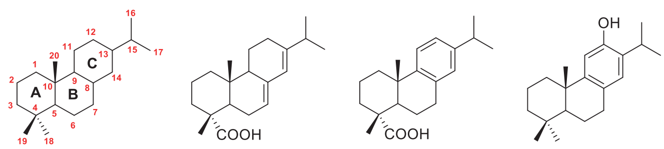
THE FIFTH ISSUE OF CATALYZER MAGAZINE 19/07/2020

ABIETANE DITERPENOIDS AS POTENTIAL DRUGS

Abietanes are naturally occurring diterpenoids that have been isolated from several terrestrial plant families including Lamiaceae (Labiatae), Asteraceae, Celastraceae, and Boraginaceae, and resins from conifers belonging to the families Cupressaceae, Pinaceae, Podocarpaceae, Phyllocladaceae, and Araucariaceae.

Secondary metabolites of plants can be classified, namely as terpenoids and steroids, flavonoids and other phenolics, and alkaloids, which all play an important role in their defense mechanisms, such as fighting with herbivores, pests, and pathogens as well as other types of external damage. As one of the secondary metabolites of plants, terpenoids are composed of isoprene (*2-methyl-1,3-butadiene*) units. The name "terpene" is derived from the word "turpentine". Each isoprene unit also called a "C5 building block" or hemi-terpene; they are linked to form terpenes in "head-to-tail" fashion, in general. Therefore, monoterpenes are formed from 2 isoprene units (10 C's), sesquiterpenes from 3 units (15 C's), diterpenes from 4 units (20 C's), and sesterterpenes from 5 units (25 C's), while triterpenes are from 6 units (30 C's) and tetraterpenes from 8 units (40 C's).

Mono- and sesquiterpenoids are the main constituents of the essential oils of all plants and flowers and they give them their special smell and taste. Diterpenoids are composed of four isoprene units with a core molecular formula $C_{20}H_{32}$ to form different skeletons, such as abietane, kaurane, atisane, labdane, jatrophane, tigliane, lathyrane, or taxane.



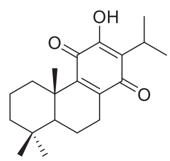
Abietane skeleton Abietic acid Dehydroabietic acid Ferruginol

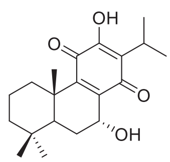
Abietane diterpenoids have three six-membered cyclic rings (*trans*-fused A-B, and *trans*-fused B-C rings) with an isopropyl side chain attached to C-13 on ring C. A simple example of them is abietic acid (7,13-abietadien-18-oic acid), and dehydroabietic acid, which has an aromatic ring C, previously obtained during chemical studies starting from abietic acid. Another simple abietane diterpene with the aromatic ring C is ferruginol, first isolated in 1939 from the resin of the miro tree (*Podocarpus ferrugineus*) endemic to New Zealand [1].

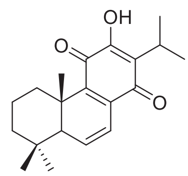
Aromatic abietanes comprise the largest group of naturally occurring abietanes [1] and are the main secondary metabolites of the *Salvia* L. (sage) plants belonging to the family Lamiaceae. The genus *Salvia* is represented by over 900 species throughout the world, and the best known *Salvia* species are *S. miltiorrhiza* (Danshen or Tanshen) in China and other Asian countries, *S. officinalis* L. in Europe (sage), and *S. fruticosa* Mill. (syn: *S. triloba* L.) in Mediterranean countries, and *S. divinorum* L., a hallucinogenic species, whose origin dates back to the Mazatec hallucinogenic sage. Most *Salvia* species are rich in abietane diterpenoids, while *S. divinorum* is rich in neo-clerodane diterpenoids. In Turkey, *Salvia* species are represented by over 100 species (114 taxa), and half of them are endemic to Anatolia (Asian part of Turkey).

During our group studies on *Salvia* species by Prof. Ulubelen and by Prof. Topcu, over 140 abietane diterpenoids were isolated [2,7], at least half of them being new, and most of them have an aromatic ring C. Their structures were elucidated based on 1D- and 2D-NMR and mass spectroscopic analyses as well as UV and IR spectrophotometric measurements.

Some abietane-type diterpenoids have a *para*-quinone C ring, such as royleanone and horminone, or an *ortho*-quinone C ring, such as miltirone [8], but the last of these was a norditerpene with 19 C atoms.

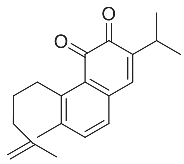

Royleanone

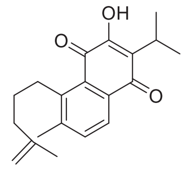

Horminone


6,7-Dehydroroyleanone

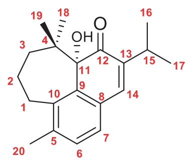
Furthermore, some abietanes contain an enone group in ring B conjugated to the aromatic ring C such as taxodione, salvinolone, and 6-hydroxysalvinolone.

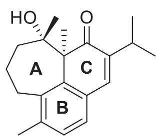
Some *Salvia* species afforded abietane diterpenoids that have opened ring A, which are called seco-abietanes, such as aethiopinone and salvipisone [2,8].

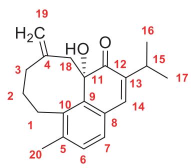

Aethiopinone


Salvipisone

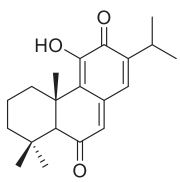
The most interesting re-arranged abietanes were obtained from endemic Anatolian *Salvia* species, such as *S. microstegia* Boiss. et Bal. growing in the Binboğa Mountains (Turkey), which afforded a rearranged tricyclic abietane diterpene. Its structure was elucidated by a series of NMR techniques, such as ^{1}H and ^{13}C NMR, COSY and 1D-NOE and SINEPT experiments as well as HRMS analysis. Examination of its unusual carbon skeleton suggested that this compound might be derived biogenetically from regular abietane diterpene having a three six-membered C skeleton by ring A cleavage between C-4 and C-5, followed by recyclization of C-4 to C-11. Therefore, the final product, named microstegiol, with a seven-membered ring A, is optically active, suggesting that the rearrangement is under enzymatic control, and it was found to be active against P-388 lymphocytic leukemia cells (ED_{50} = 3.0 μg/mL) [3]. Total synthesis of microstegiol was carried out by Taj and Green and published in 2010 [9].

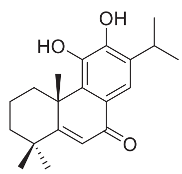

Microstegiol

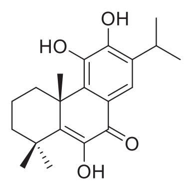

Salvibretol

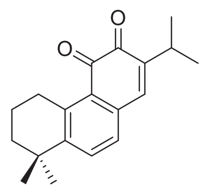

Candidissiol

Another endemic *Salvia* species, *S. candidissima*, also afforded a re-arranged abietane with an eight-membered ring A, which is very unusual for natural compounds, and its structure was identified by extensive NMR techniques running 1D and 2D NMR experiments and named candidissiol [4].


Taxodione

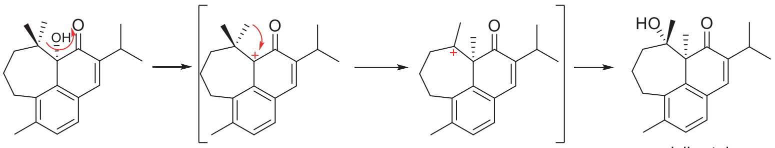

Salvinolone


6-Hydroxysalvinolone

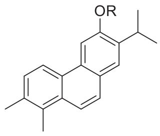

Miltirone

Salvibretol and its natural derivatives 1-oxosalvibretol and 3-oxosalvibretol were isolated first from *S. montbretii* [5], and later from a few other *Salvia* species [2,5], and their structure analyses were elucidated by sophisticated NMR and mass techniques. The formation of salvibretol [5] from microstegiol through Wagner–Meerwein rearrangement is seen below, which is a very common carbocation reaction in natural products.

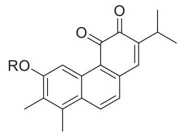
Multicaulins were isolated as a series of fully aromatic abietane diterpenoids; their skeleton has 19 C atoms since they were converted into norabietanes from abietanes and they showed very strong antituberculous activity against *Mycobacterium tuberculosis* [2,10].



microstegiol
Wagner Meerwein Rearrangement
salvibretol



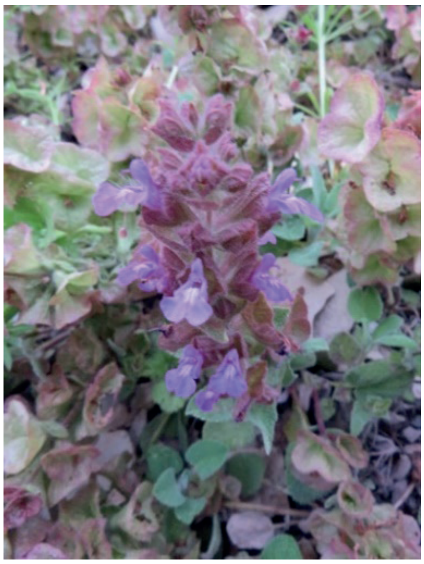
R= CH_3: Multicaulin
R= H: Demethylmulticaulin



R= CH_3: Multiorthoquinone
R= H: Demethyl-multiorthoquinone

Salvia microstegia Boiss et bal.

Salvia montbretii Benth.



Salvia multicaulis Vahl

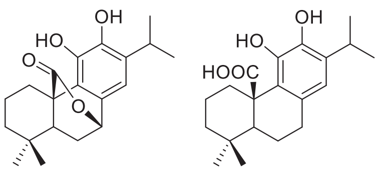
Salvia triloba L. f.

Salvia triloba L. with 3 lobe leaf

Salvia officinalis L.

It is notable that the extracts of *Salvia* roots were found to be rich in diterpenoids, particularly abietane diterpenoids, while their triterpenoids were isolated from the aerial parts rather than other parts.

S. fruticosa Mill., also named *S. triloba* due to its leaves with 3 lobes, Mediterranean sage, although Greek people call it Greek sage, Dalmatian people Dalmatian Sage Lebanon people Lebanese sage, and Turkish people Turkish sage. Its phytochemical structure [2] is fairly similar to that of European sage, *S. officinalis*; the main difference is observed in their essential oil. *S. triloba* contains almost no thujone, while *S. officinalis* is rich in thujone. Due to the presence of thujone, the European Medicines Agency (EMA) allows max. 5 mg/day thujone in medicinal plant products, such as *S. officinalis* essential oil. Therefore, *S. triloba* is much more preferable and valuable in terms of its essential oil. Both species contain strong antioxidant abietane diterpenoids, and the strongest ones are carnosol and carnosic acid. Carnosol protets us against narrowing of the cerebral arteries carrying blood to the brain. Carnosic acid increases the body's production of glutathione, which is one of the most important antioxidants, helping to protect the brain from free radical damage.



Carnosol Carnosic acid

Therefore, aromatic abietanes are strong antioxidant, and some of them might be used in neuroprotective and cardioprotective agents, such as carnosol and carnosic acid. Abietanes having ring C conjugated with enone or enol moiety on ring B, particularly such as taxodione and 6-hydroxysalvinolone, exhibited very strong cytotoxic activity against a series of cancer cell lines [2]. Thus, the potential impact of abietanes in the discovery of therapeutic drugs should be considered.

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Gülaçtı Topçu

MALATYA APRICOT

Flowering period of apricot

Apricot on the branch.

Dried apricot.

Historical Perspective

Apricot (*Prunus armeniaca* L.) is a plant whose homeland is Central Asia and Western China. It is cultivated in regions with a temperate climate zone from the Mediterranean to Australia. According to historical sources, it can be produced in many countries including Turkistan, Central Asia, and Western China. Apricots were known and cultivated in this region 5000 years ago. It was brought to Anatolia in the 1st century during the expeditions of Alexander the Great. It has become the second homeland of the apricot, as the climate and soil are suitable for its cultivation [1].

History of the Apricot in Malatya

The first written records on apricot in Malatya are from 1655. The famous traveler Evliya Çelebi[1], who came to Malatya, mentioned about 7800 orchards and 7 apricot varieties in Malatya where 53 thousand people lived. Çelebi also wrote that Malatya had apricots that were "red, yellow, white, juicy, and succulent" and that when someone brought them home from the garden, they had no choice but to run to keep them fresh. More importantly, he stated that unimaginable amounts of dried sheets of pulp were made from the heaps of apricots, loaded onto wagons, and transported to other countries [2].

Apricot Varieties Grown in Malatya

Approximately 90-95% of the apricot orchards in the region have been established with dried apricot varieties. While 73% of the cultivated apricot varieties are Hacıhaliloğlu, 17% are Kabaaşı, and the rest are Soğancı, Hasanbey, Çataloğlu, and zerdali (less than 1%) trees [2].

Agriculture and Production

In 2017, 536 thousand hectares of land worldwide was used for apricot production and 23.3% of this was in Turkey. Global fresh apricot production was 4.3 million tons in 2017. Most of the fresh apricot production in the world was in Turkey, with 985 thousand tons. According to 2018 data, Turkey exports annually 71 thousand tons of apricots and ranks third in exports worldwide. A total of 120 thousand tons of dried apricot exports were reported worldwide, with 94 thousand tons (78.2%) from Turkey. An important part of the produced apricot is considered dried apricot. Turkey is a leader in dried apricot production, followed by Spain with 4.2% and Kirghizstan with 3.4%. With the many advantages of its special ecological conditions, Malatya Province ranks first in production. Although the production of dried varieties is at

1 For further information about the most famous Ottoman traveler of the 17th century, see: https://en.wikipedia.org/wiki/Evliya_%C3%87elebi

the forefront in this country, most of the apricots produced in the world are for daily consumption [3,4].

Apricot Production

Approximately 770 thousand tons of apricot including zerdali species were produced last year in Turkey. Malatya has a special position in Turkey with 401 thousand tons of apricot, which is 52.1% of the total production [5]. Apricot fruit has become indispensable for Malatya due to its production amount and its contribution to the economy [6].

Medicine

Various mechanisms in the human body keep the oxidant and antioxidant defense mechanisms in balance. Some of these are healthy nutrition and dietary antioxidants.

The most prominent representatives of dietary antioxidants are carotenoids, ascorbate, tocopherols, and flavonoids [8]. According to the recent literature, apricot has significant antioxidant potential due to its content such as vitamins A and C and some polyphenols like beta carotene [9].

Nutritional Potential

Apricot is a fruit rich in carbohydrates, fiber, minerals, and vitamins among the hard fruits (Table 1) (10). It contains many bioactive phytochemicals, that is, polyphenols and carotenoids that have certain roles in the biological system and are effective in preventing oxidative stress damage [11]. These compounds also give the plant tissue colors (red, blue, and purple) and thus greatly contribute to the visual quality of the fruit [12]. Apricot also contains a reasonable amount of dietary fiber ranging from 1.5 to 2.4 g/100 g on a fresh weight basis [13]. It also contains various amounts of essential minerals. The main elements are potassium, phosphate, calcium, magnesium, iron, and selenium [14]. Sodium, manganese, zinc, and copper are also found in small quantities [15]. Similarly, the vitamins found in apricot include provitamin A, C, K, E, thiamine (B1), riboflavin (B2), niacin (B3), pyridoxine (B6), folic acid (B9), and pantothenic acid [16]. In general, apricot is especially rich in vitamins A and C [17]. Apricot contains organic acids, namely malic acid (500-900 mg/100 g] and citric acid (30-50 mg/100 g) as the main acids; it has also been reported to contain tartaric, succinic, oxalic, galacturonic, kinic, malonic, acetic, and fumaric acid [18]. These acids, which are natural components of many fruits and vegetables, reduce bacterial spoilage and provide flavor, taste, and shelf stability. They also play an important role in maintaining quality and determining nutritional value. Apricot kernels contain a considerable amount of protein and fat in 20-30% and 40-52%, respectively [19]. The average protein and fat ranges in apricot fruit are 1.4-2.0% and 0.4-0.6%, respectively. Despite the low amounts, apricot fruit also contains many essential amino acids [14].

Table 1: Proximate composition of apricot fruit [15].

Ingredients	**Concentration (g/100 g fresh weight)**
Water	83.00
Carbohydrates	11.00-13.00
Protein	1.40
Fat	0.40
Crude fiber	1.50-2.40
Ash	0.74

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Hakan Parlakpınar

A FORENSIC DETECTOR: NINHYDRIN

Hamdullah Kılıç

Ninhydrin (Fig. 1; also known as 2,2-dihydroxyindane-1,3-dione) reacts with primary and secondary amines to give a compound with a deep blue or purple color known as Ruhemann's purple. Thus, ninhydrin is a chemical indicator to test whether or not a compound has the terminal amine group. Ninhydrin is a white solid with a melting point of 250 °C and is soluble in polar solvents such as water, ethanol, and acetone at ambient temperature.

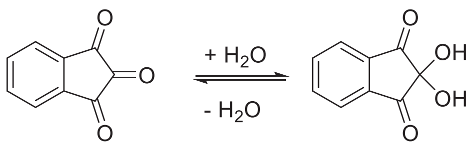


Figure 1. The structure of ninhydrin and its hydrates form.

How does ninhydrin help forensic science in obtaining evidence for theft detection? Fingerprints are composed of water, salts, lipids, vitamins, and amino acids. Commercially available visible stain theft detection kits contain ninhydrin, which is used to identify thieves by applying it to any object that may get stolen. When skin comes into contact with an object marked with ninhydrin, the body's amino acids (Fig. 2) react with ninhydrin to create a very visible purple stain on the body lasting a few days.

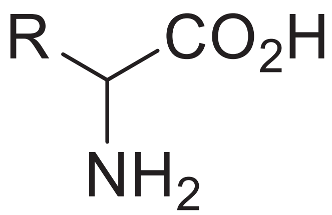
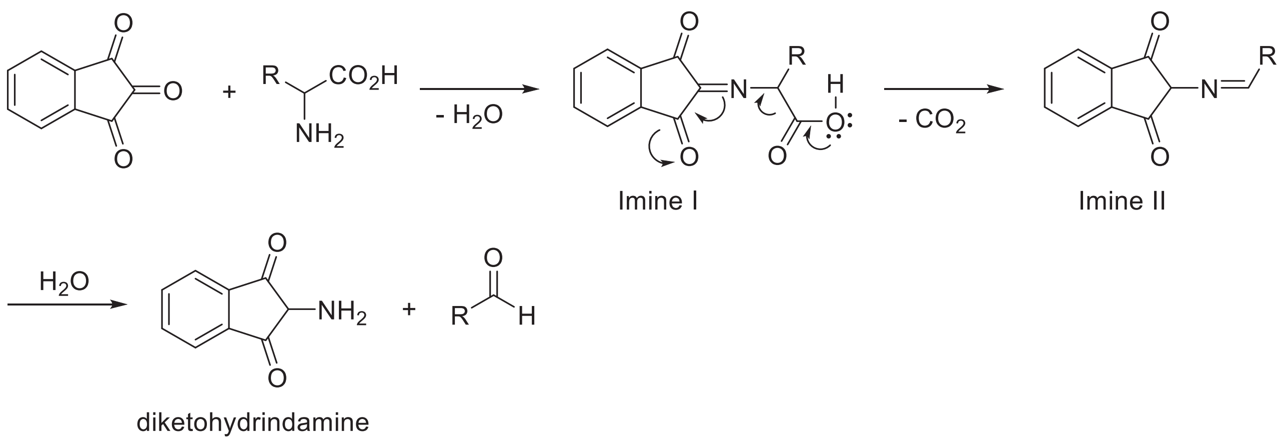
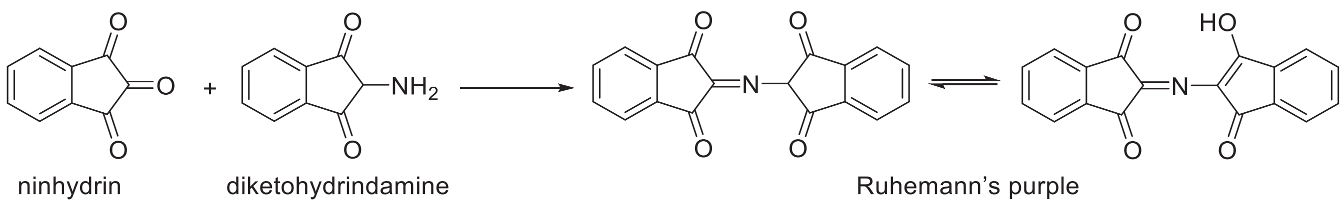


Figure 2. General structure of amino acids.

Now let us look at the chemistry behind ninhydrin. In the first step, ninhydrin is dehydrated and reacts with an amino group of the amino acid (except proline) to give an imine I. In the next step, decarboxylation from the imine I take place to give imine II. Then the imine II undergoes hydrolysis with water, forming an aldehyde and diketohydrindamine.



Finally, diketohydrindamine with primary amine moiety undergoes a condensation reaction with ninhydrin to give a colored product, which is called Ruhemann's purple.



WHAT ARE BEHIND CUBES?

Have you ever tried solving a Rubik's cube? I am sure you have and gave up working on it after completing only one face. Although you see Rubik's cube solution exhibitions on talent shows just as if the performers are magicians, there is, of course, an algorithmic way of explaining how they do it.

As a Rubik's cube solver from Turkey, I have been doing this as a hobby for 7 years. First of all, I saw one of my friends in middle school solving a Rubik's cube within 5 minutes after scrambling it. At that moment, my interest in Rubik's cubes was born, and so I did some quick research on the Internet and found out that there were a few methods to solve the cube. Because there are 43 quintillion combinations for a 3 × 3 × 3 Rubik's cube, I patiently watched videos to learn the "Beginner's Method" on YouTube. My first personal record without looking at the video was 5 minutes. I memorized only a few algorithms and did a lot of practice. Any progress? I improved my record to 1 minute. However, after that point, I realized that my record would not get better than that. Consequently, I decided to improve my technique of the most famous speedcubing method, known as the Friedrich Method. This method has plenty of algorithms to be memorized, yet instead of memorizing every single notation, coding those algorithms into your fingers rather than your mind consumes less time. Therefore, I developed a way of enhancing my memory, which assisted me in my academic and social life

since I was able to memorize everything much faster. Finally, my record was below 1 minute as I had expected.

I started following popular Rubik's cubers on social media, and so I found another division of speedcubing. Did you know that a Rubik's cuber takes care of his/her puzzles like a baby? I watched lots of unboxing and reviewing videos of different brands of Rubik's cubes to decide on my first professional cube and ordered one. 50 seconds! After that, I met the Turkish delegate of the World Cube Association (WCA), İskender Aznavur, and learned that many competitions were being held in one day all around the globe. Since I was fond of this hobby, I increased the number of puzzles in my collection by learning how to solve 2 × 2 × 2 and Pyraminx puzzles. Can you believe that there is a puzzle in the shape of a pyramid? Just wait for the next ones! I attended the national competition in Istanbul and met a lot of speedcubers. It was a stunning day for me since everybody around me was speaking the language of Rubik's cubes. Everyone was teaching and challenging each other. Although I competed in three categories, I witnessed all the categories. Blindfolded, one-handed, and Skewb categories were the most fascinating ones. In total, I took part in three different national competitions and in each of them I was so excited just like everyone else since sharing a common secret talent in an organization is superb.

Throughout all my experiences, I saw the impact of practicing a lot. My fingers got much stronger. Thus, I am now able to perform more than three moves per second, and I can use all of my fingers perfectly. In addition to that, when I tried learning blindfolded cube solving this process taught me a new aspect: 3-D thinking! Because I have to imagine all those next steps in my mind, I rotate the image of the Rubik's cube in my mind. Furthermore, this skill helped me even in science classes. It is very useful for me to imagine a 3-D model of a molecule in chemistry classes. As it was a hobby for me and had a lot of benefits, I was willing to widen my collection. Subsequently, I found the most extreme puzzles on the market such as the 7 × 7 × 7, gear cube, void cube, and 360 puzzles. By the way, some of these puzzles don't have a method. Therefore, I developed my own strategies and challenged myself. Also, one of the most important things that improve your solutions is foreseeing the next move. I wholeheartedly believe that when figuring out your next move becomes your way of thinking, it makes everything easier in your real life as well.

I was aware of the fact that there were not many Turkish online resources and so I created a YouTube channel called "*MyCubes AndI*", in which I shared tutorials about how to solve Rubik's cubes and get prepared for competitions. Then I decided to share videos of me solving puzzles in the other countries I visit. Those moments are so special to me because many people gather around me while I am solving the puzzle in front of a tourist attraction, scramble the puzzles, and applaud me as I complete them. I even met an old Rubik's cuber in Barcelona and shot a video with him. Seeing how people get interested in such an extreme hobby satisfies me a lot.

To conclude, Rubik's cubes entered my life 7 years ago. However, my interest has never waned since then. It taught me a lot of things and enhanced my performance in real life in many aspects. This entertainment may be the most beneficial and interesting one in the world since you catch everybody's eyes once you start doing it. So, if I were you I would take the closest Rubik's cube, it is the best-selling toy of all time and so I am sure there is one close to you, and learn how to solve it!

Burak Alanyalioglu

Cultural Heritages

DIVRIGI GREAT MOSQUE AND HOSPITAL

Hüseyin YURTTAŞ

Esra HALICI

Burak Muhammet GÖKLER

Muhammed Emin DOĞAN

Located in the Divriği district of Sivas Province, the mosque was founded by the Mengüjek bey Ahmed Shah between 1228 and 1243; the hospital, on the other hand, was founded by Ahmed Shah's wife Turan Melek between the same dates and designed by architect Hürrem Shah, son of Ahlatlı Muğis.

The design of the mosque involves a sanctuary section consisting of five naves and it is covered with 23 different vaults and two domes. The front of the mihrab is covered with a star-shaped cone on the outside and dominates the mosque from the outside. The mosque has three entrances with the qibla portal (north crown portal), the bazaar portal in the west, and the shah portal in the east.

The stone decoration created by the craftsmen from Ahlat was reflected differently on all three portals. These ornamentations

Divriği, Mosque - Decoration

Divriği, Turkey - located in Central Anatolia, Divriği is a popular tourist destination. Here in particular the Great Mosque, a UNESCO World Heritage site

are regarded as unprecedented and unique examples in Anatolia, both in size and magnificence. The distinctive feature of Divriği Great Mosque and Hospital is that many motifs seem symmetrical but are actually asymmetrical and do not repeat each other. In addition, the double-headed eagle, which is considered to be the coat of arms of Alaaddin Keykubad, and the figures of Ahmed Shah's coat of arms, were carved into the western crown portal.

Built on the south wall of the mosque, the hospital consists of three iwans, the central part of which is covered with a skylight dome. A tomb is located in the northeast corner of the hospital. The crown portal of the building is monumental like the northern crown gate of the mosque but has a different design. Both male and female heads are embossed on both sides of the entrance door.

Divriği Great Mosque and Hospital was added to the UNESCO World Heritage List in 1985.

Divriği Mosque- Decoration

TODAY'S PROBLEM AND YESTERDAY'S ANSWER

Problem 5.

Alaaddin is trapped in a dark cave. In order to escape he should activate his enchanted lamp. He knows that if one simultaneously puts two magic sticks into the enchanted lamp then it will be activated and the gates of the cave will immediately open. There are 200 indistinguishable sticks and exactly 100 of them are magic. In each trial Alaaddin puts two sticks into the enchanted lamp. Determine the smallest possible value of n if Alaaddin can guarantee to activate the enchanted lamp in at most n trials.

Azer Kerimov

Answer of yesterday's problem :

There are at most 8 paintings in the exhibition.

Let us denote the colors by 1, 2,...,8. The collection of paintings colored by colors (1,2,3), (1,4,5), (1,6,7), (2,6,8), (3,4,8), (5,7,8), (3,5,6), (2,4,7) is an example for 8 paintings.

Now let us show that the number of paintings is at most 8. Let us fix a color c. Each of the remaining 7 colors can be used with c only in one painting. Therefore, the color c is used in at most 3 paintings and the total number of used colors is at most 8 · 3 = 24. Therefore, there are at most 8 paintings in the exhibition.

CHINA

Theoretical knowledge exam of the Chinese Chemistry Olympiad

NEWS FROM
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ECUADOR

National Ecuadorian Competitions

COMPETENCIAS EN CIENCIAS

FCNM

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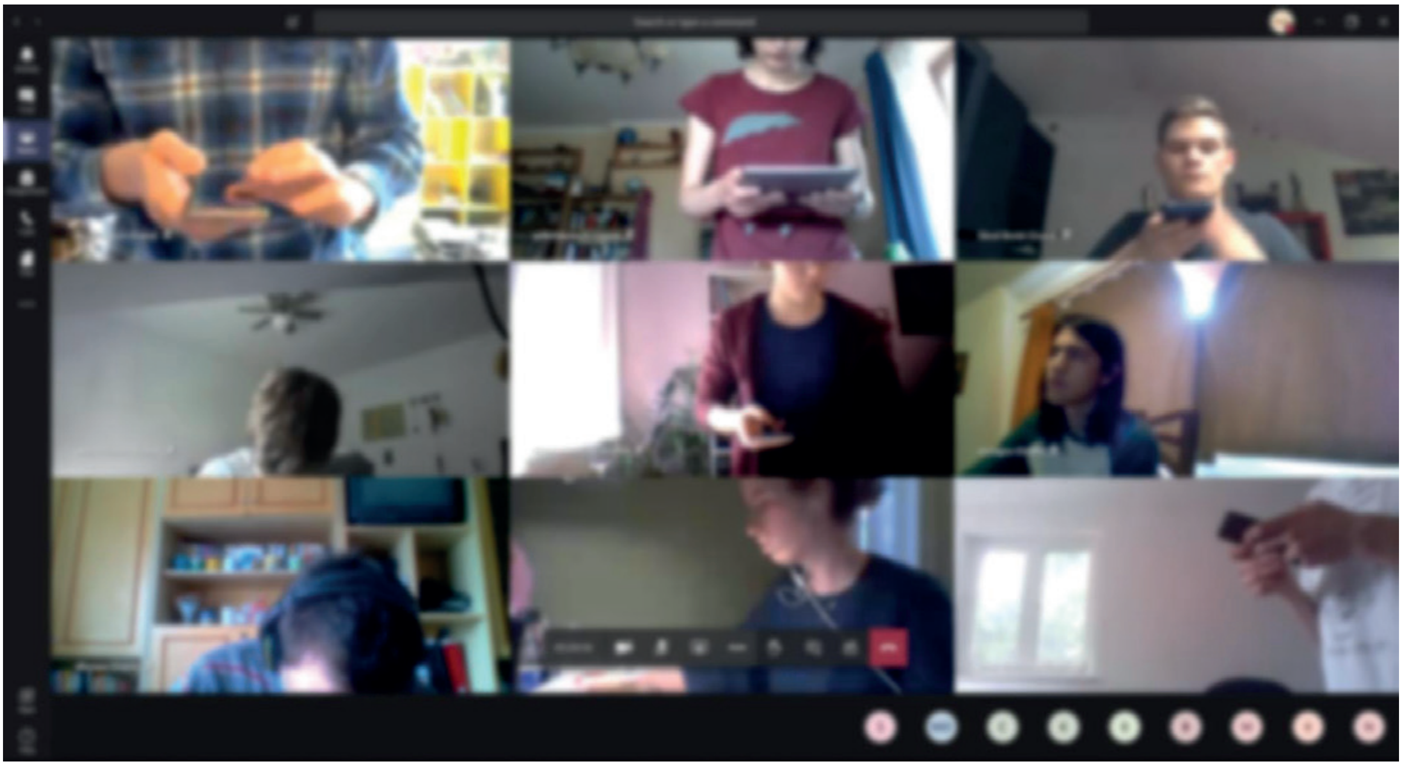
Participants of El Salvador



HUNGARY

MS Teams exam all over Hungary

Publisher : Scientific and Technological Research Council of Turkey
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52nd IChO 2020
INTERNATIONAL CHEMISTRY OLYMPIAD

CATALYZER

THE SIXTH ISSUE OF CATALYZER MAGAZINE 20/07/2020

Interview

THE AVOGADRO CONSTANT WAS RECALCULATED AND CONNECTED TO THE DEFINITION OF THE MOLE

THE IMPORTANCE OF THE AVOGADRO PROJECT FOR THE NEW DEFINITION OF THE MOLE AND THE KILOGRAM

***Bernd Güttler** studied mineralogy at Leibniz University Hannover, Germany, and received his Ph.D. in crystal physics in 1988 also at Hannover with a dissertation on the electronic transport properties of transition metal oxides. During this time he moved to Cambridge University in England and worked as a research scientist mainly on phase transition phenomena in the Department of Earth Sciences and the Cavendish Laboratories between 1987 and 1989. He joined PTB* (Physikalisch-Technische Bundesanstalt, the National Metrology Institute of Germany) *in 1990, initially focusing on metrology in solid state chemistry. He was responsible for the Department for Metrology in Chemistry at PTB between 2002 and 2016. Since 2015 he has been Head of Division for Chemical Physics and Explosion Protection at PTB. Bernd Güttler represents PTB at the Consultative Committee for Amount of Substance: Metrology in Chemistry and Biology of the Meter Convention and is Chairman of the Working Group on the Mole. He is also the German contact person at the Technical Committee for Metrology in Chemistry (TC-MC) of the European Association of National Metrology Institutes (EURAMET) and chaired this committee between 2007 and 2011. He also holds a teaching position in Metrology in Chemistry at the University of Braunschweig.*

Dear Dr. Güttler, could you please inform us on PTB and your division, briefly?

The Physikalisch-Technische Bundesanstalt, the National Metrology Institute of Germany, is a scientific and technical higher federal authority falling within the competence of the Federal Ministry for Economic Affairs and Energy (BMWi).

PTB is Germany's highest authority when it comes to correct and reliable measurements. It is the supreme technical authority of the BMWi and employs a total of approx. 1900 staff members.

The tasks of division 3 "Chemical Physics and Explosion Protection" include metrology in chemistry, i.e. the development of primary methods in analytical chemistry and the dissemination of the related unit mole, the measurement of thermodynamic quantities, as well as physical and electrical explosion protection.

You are head of the redefinition of mole project. I have read the "mise en pratique" of the definition of the mole. It is a very nice information sheet also about the result of the Avogadro project. What was the aim of the project? Why did you need to do this project?

The redefinition of the mole was part of a general endeavor to redefine the SI base units in terms of natural constants. This included the removal of practical realizations of the units from their definition.

For example, the kilogram was realized by a prototype made from a platinum-iridium alloy. It acted as the international kilogram prototype since 1889 and is located at the International Bureau for Weights and Measures (BIPM) in Paris. It is compared with its copies that are used as national measurement standards for mass in most countries in regular intervals.

Such a prototype - no matter how stable it is and how well it is kept- is exposed to changes over time. This might be surface reactions, damages and, in the worst case, a destruction of the body. What we see in practice is a relative increase in the mass of many national copies of the prototype when compared to the prototype itself. This situation required a new primary realization of the kilogram that is independent of a prototype and can be fully described and reproduced at any time – at least in principle - and it should be accurate enough to replace the prototype kilogram. This requires a relative standard uncertainty of $2x10^{-8}$. This goal was set by the consultative committee for mass and related quantities (CCM) as a minimum requirement for a redefinition of the units in order to safeguard continuity with the current system for the dissemination of the unit kilogram.

One of the experiments conducted to achieve this ambitious goal was the so-called "Avogadro-Project".

In simple terms, it aimed at counting the atoms of silicium in a single crystalline Si-Sphere of extremely high quality by measuring the volume of the sphere and the crystal lattice constant of the silicium used.

This experiment was used to redefine the (interrelated) defining constants for the kilogram (Planck constant h) and the mole (Avogadro-constant N_A) within the old system with sufficient accuracy and such that the consistency of the units between the old and the new definition is maintained.

After the redefinition, these spheres are also primary (most accurate) realizations of the unit kilogram and mole. A "mise en pratique" [1] is a description of such a primary realization of a unit and accompanies the new definition. Consequently, the "mise en pratique" of the definition of the mole and also that of the kilogram contain a principle description of the work on the silicium spheres produced and measured in the Avogadro-Project.

Could you please mention the partners of the project?

The Avogadro Project would have not been possible without an international collaboration that aimed at the redetermination of the Avogadro constant with sufficient accuracy to permit the redefinition of the SI system based on this constant. The International Avogadro Coordination (IAC) started in 2004 among the BIPM, INRIM (Italy), the IRMM (Belgium), NIST (United States), the NMIA (Australia), the NMIJ/AIST (Japan), the NPL (United Kingdom), and the PTB (Germany). The collaboration was renewed in 2012 among the BIPM, INRIM, the NMIA, the NMIJ, and the PTB.

Dr. Ahmet C Goren and Dr. Bernd Güttler in Braunschweig

Could you please inform me about the work package of the project? Which parts were done by which partners?

The accurate determination of the Avogadro constant was made using a ^{28}Si enriched spherical shaped single crystal of silicium. A range of measurements was required for that purpose. This included the interferometric determination of the volume of the sphere (NMIJ, PTB, NMIA), the mass of the sphere (BIPM, PTB, NMIJ), its lattice constant based on x-ray interferometry (INRIM, NIST), the crystal density (PTB, NMIJ), the surface layer that covers the sphere (PTB, NMIJ), the impurities in the single crystal (PTB, INRIM) as well as its isotopic composition (to calculate its molar mass) using mass spectrometry (PTB, NIST, NMIJ).

Silicium 28 sphere (photo from PTB)

The ^{28}Si enrichment of the silicium used for the crystal sphere was made in Russia. Single crystals were grown at Leibniz-Institute for Crystal Growth (IKZ) in Berlin. The crystals were cut and polished into spheres at NMIA in Australia and at PTB in Germany.

Some work is still ongoing even after the redefinition of the mole and the kilogram in the new SI and the fixing of the Avogadro constant. It aims at reducing the measurement uncertainty of the primary realisation of the mole and the kilogram.

In your opinion what was the most problematic part of the project in the past? How did you solve it?

All those measurements had to be carried out with utmost precision to achieve the aspired relative accuracy of 2 x 10^{-8}. It was a challenge for all measurements involved and often required dedicated instrumentation for this specific purpose. Many years of work went into any of these experiments.

A breaking point was certainly a new method for the determination of the molar mass of silicium with sufficient accuracy. This was considered as the key problem for many years and almost stopped the entire project. It is related to silicium isotope ratio measurements as elemental impurities are small. This problem was overcome by an entirely new measurement concept that considered the Si isotopes ^{29}Si and ^{30}Si as an independent element in a matrix of ^{28}Si. This so-called virtual element approach led to an improvement of the measurement uncertainty of the molar mass by more than two orders of magnitude. This was decisive for the success of the project.

What is the benefit of the redefinition of a mole in our scientific life?

As mentioned before, the idea behind the redefinition is a general concept for the SI units that aims for definitions that are based solely on natural constants. Any artifacts should be removed from the definitions – the most obvious one being the kilogram prototype.

The new definition will be more robust and stable as the defining constants are independent of time.

The benefit for chemistry is a solution for an uncomfortable situation: The value of a natural constant, the Avogadro constant, depended previously on the stability of an embodiment of a unit – the kilogram prototype. Any damage to this prototype changes the Avogadro constant – this is very unsatisfying!

Now, as a result of this project, the Avogadro constant and the Planck constant are fixed. Mole and kilogram were realized using those numbers and will be stable over time. Finally, the following new definition is now valid since 20 May 2019 and available on the website of BIPM:

“The mole, symbol mol, is the SI unit of amount of substance. One mole contains exactly 6.022 140 76 x 10^{23} elementary entities. This number is the fixed numerical value of the Avogadro constant, N_A, when expressed in the unit mol^{-1} and is called the Avogadro number” [2].

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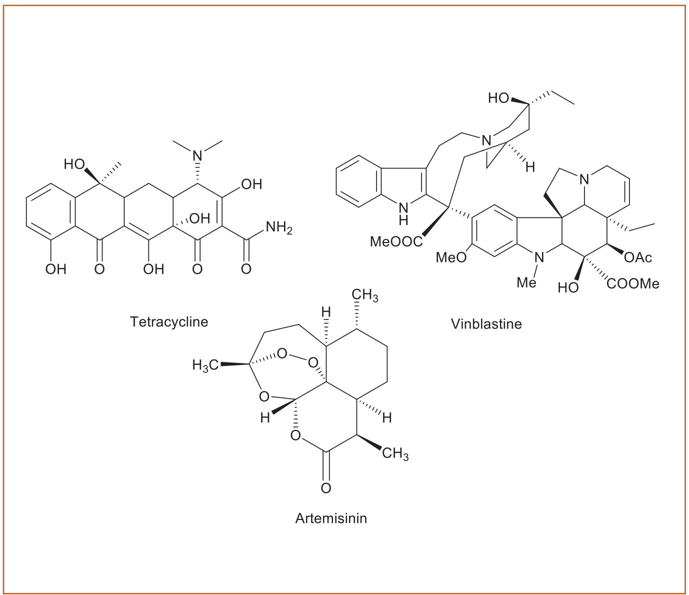
2. Chemistry and Biology: SI base unit (mole). https://www.bipm.org/metrology/chemistry-biology/units.html

Ahmet C Goren

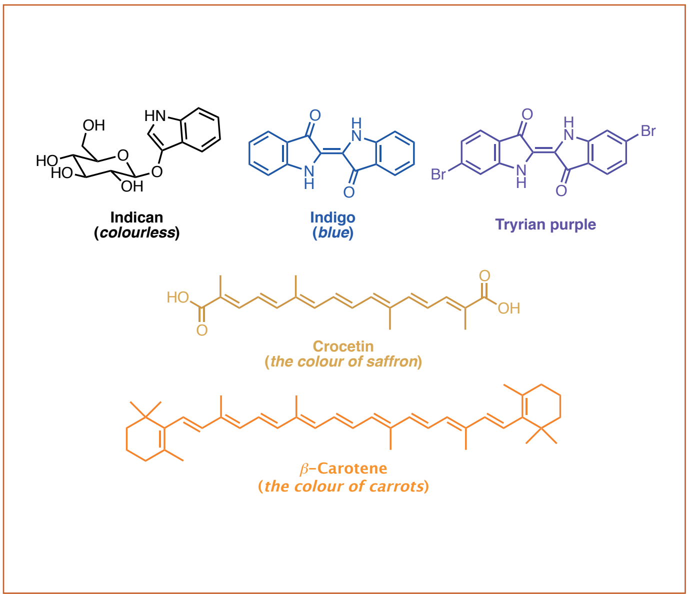
Variety of orange color fruits and vegetables, which are a good source of beta-carotene.

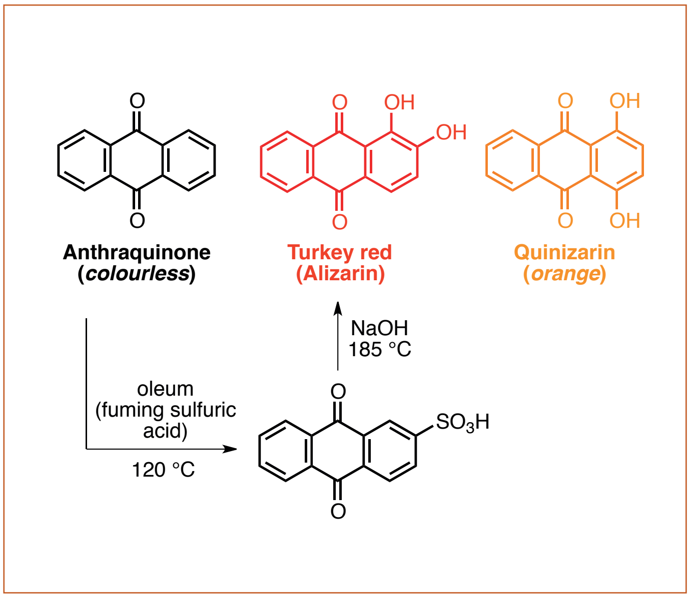
TURKEY RED AND ALIZARIN

As chemists, we all have a certain level of knowledge on natural products (secondary metabolites) mostly due to their fascinating biological activity profiles. While some natural products such as vinblastine and taxol are used as highly potent anti-cancer drugs, many other natural products including penicillins, cephalosporins, tetracyclines, and vancomycin were discovered to be extremely useful antibiotics. Another famous example is artemisinin, which was isolated and studied by the Nobel laureate Tu Youyou [1]. Artemisinin is currently one of the most effective drugs against malaria.



In addition to their biological activities, natural products have found widespread use in other areas as well throughout history. Before the advent of synthetic dyes, plants and, to a lesser extent, animals were used as main sources of dyes. For instance, indigo, which is famous for its blue color, was prepared from naturally occurring indican via alkaline treatment followed by oxidation. Interestingly, the dibromo analogue of indigo, isolated via a similar procedure from snails, exhibits a purple color, and is named Tyrian purple [2]. Moreover, a variety of organic molecules are responsible for the characteristic colors of certain fruits and vegetables. Crocetin forms the core polyene skeleton of crocin, which is responsible for the color of saffron, whereas the characteristic orange color of carrots is due to a similar polyene molecule, beta-carotene.





Historically, one of the most important dyes obtained from plants was Turkey red, which was produced from madder, the root of *Rubia tinctorum* (kökboya in Turkish). The procedure for the production of Turkey red was a lengthy process and involved the use of alum as a dye mordant [3]. The structure of alizarin, which is responsible for the bright color of Turkey red, was elucidated by the German chemists Carl Graebe and Carl Liebermann from BASF in 1868 [4]. After this discovery, synthetic routes to alizarin starting from anthracene and anthraquinone were developed. An efficient synthesis of alizarin involves the conversion of anthraquinone to anthraquinone-2-sulfonic acid by a sulfonation reaction and its subsequent treatment with NaOH at high temperature under oxidative conditions [5]. Interestingly, the infantrymen of the French army wore trousers dyed with Turkey red until World War I [2,6]. The production of Turkey red from madder declined after the commercial production of synthetic alizarin. Finally, it should be noted that 1,4-dihydroxyanthraquinone, which is a constitutional isomer of alizarin, is named quinizarin and has an orange color.

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Yunus Emre Türkmen

TURKEY'S HIGHEST MOUNTAIN, MOUNT AGRI

Ayfer Kalkan Burat

Mount Ağrı, Turkey's highest mountain, is located in the country's Eastern Anatolia Region. The mountain has won the admiration of those who have seen both its geological location and spectacular view. For Mount Ağrı, Marco Polo mentioned in his writings that "it is a mountain that will never be able to be climbed", but according to records, the first ascent of the mountain was carried out in 1829 by Prof. Friedrich Parrot, and the second one in 1970, many years after the first. Nowadays, it is a place frequented by many climbers.

It consists of two major volcanic cones: Greater Ağrı, the highest peak in Turkey, with an elevation of 5137 m, and Lesser Ağrı, with an elevation of 3896 m. The Ağrı massif is about 40 km (25 mi) in diameter. The summit of the mountain is covered with a snow and ice cap glacier (10 km^2) that remains throughout the year. This glacier is Turkey's largest. A total of 11 glacial tongues hanging from the ice caps and varying in length from 1 to 2.5 km have reached 4200 m on the southern skirts and 3900 m on the northern skirts.

Digital depiction of Noah's ark in a stormy ocean.

Many people who believed that Noah's ark was located on Mount Ağrı attempted to climb this mountain [1-3]. Moreover, the fact that the view of some dents in the mountain resembled a ship further reinforces this idea. Therefore, many adventurers visit the mountain every year. In 2007, Turkish and Chinese explorers claimed to have found seven large wooden compartments buried at 13,000 feet (4000 m) above sea level, near the peak of Mount Ağrı. After this announcement many explorations have been mounted for the ark. However, no confirmable physical proof of the ark has been found yet.

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What many people believe are the remains of Noah's Ark (centre right) near the town of Doğubayazıt in the far east of Turkey near the border with Iran.

DIYARBAKIR GREAT MOSQUE

Cultural Heritages

The Great Mosque of Diyarbakır is the oldest and one of the most significant mosques in Mesopotamia, Turkey.

Located in the city center of Diyarbakır, the building was designed as a mosque in 639. It is understood from the inscription on the northern façade that it underwent a major repair upon the command of Malik Shah, the Great Seljuk ruler, in 1091.

The mosque was badly damaged in an earthquake and fire in 1115-16 and was entirely rebuilt. During this construction process, the decorated columns were taken outside and used in two-storey porticos in the east and west. Diyarbakır Great Mosque, which provides the architectural features of Umayyad Mosque in Damascus in Anatolia, is the most magnificent and decorated structure of the early Islamic period and is regarded as one of the holy places of the Islamic world after Mecca, Medina, and Jerusalem.

Evliya Çelebi said, "*It is such a perfect structure that it is impossible to make it smoother and stronger than it already is*." The mosque has three naves parallel to the mihrab and has a plan created by cutting these naves with a vertical one in front of the mihrab.

The Zinciriye and Mesudiye Madrasas are located to the northeast and west of the mosque courtyard. The minaret in the southwest is representative of the square-bodied minarets in North Africa and Syria.

The mosque has entrances on three sides. A fighting lion and bull, shown on the portal on the eastern side and considered a reflection of the Central Asian ornamentation style, adds importance to this façade.

The decorations and inscriptions of the Great Mosque from different periods are presented in harmony on the inner walls of the courtyard.

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

View of the Grand Mosque (Ulu Cami), the center of Diyarbakır

©iStock

The Great Mosque (dates back to 7th century) of Diyarbakır is considered by some to be the fifth holiest site in Islam.

TODAY'S PROBLEM AND YESTERDAY'S ANSWER

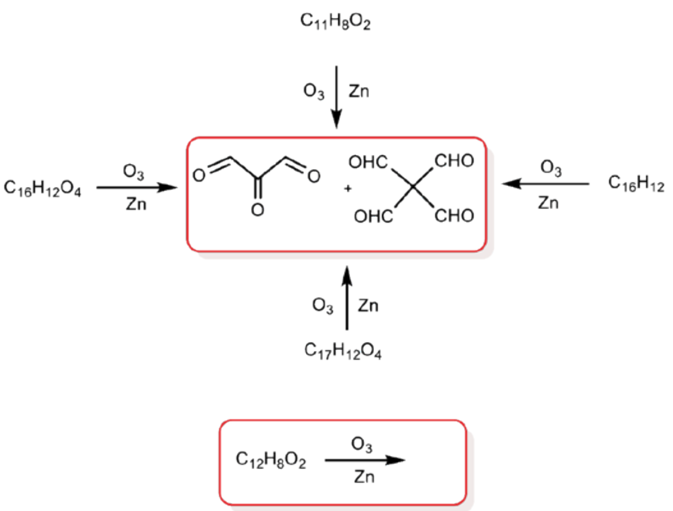
Problem 6.

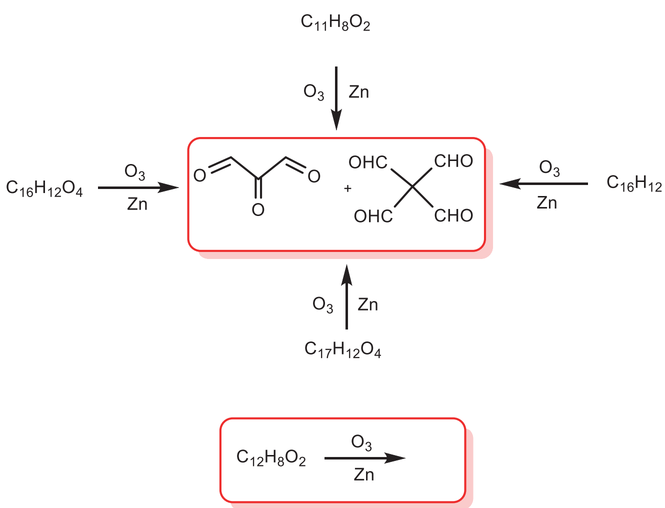
Structural Analyses by Ozonolysis Reaction: An Old Method

Before the development of modern spectroscopy methods, ozonolysis was used as a method for the structure determination of unknown molecules for many years. By analyzing the fragments of the ozonolysis reaction, it is then possible to deduce what the original structure was, through "binding" together with the fragments.

Let's go back to the past and guess molecular structures with this old method. The reductive ozonolysis reaction of A, B, C, and D resulted in the formation of products 1 and 2. On the other hand, the reaction of E gave only compound 1. Suggest a possible structure for compounds A-E.

Arif Daştan





The smallest possible value of n is 103.

Alaaddin can divide the sticks into 97 groups containing 2 sticks and 2 groups containing 3 sticks each. Since there are 100 magic sticks, at least one of these groups contains a pair of magic sticks. Therefore, by trying all stick pairs in at most 103 trials Alaaddin will activate the enchanted lamp. If the total number of trials is 102 then some stick, assumed not magic, is used at least twice. Then the number of trials without this stick is at most 100 and it can be easily shown that these 100 trials are not sufficient to activate the enchanted lamp.

INDONESIA

The Journey of Indonesia Team to IChO 2020: From Offline to Online

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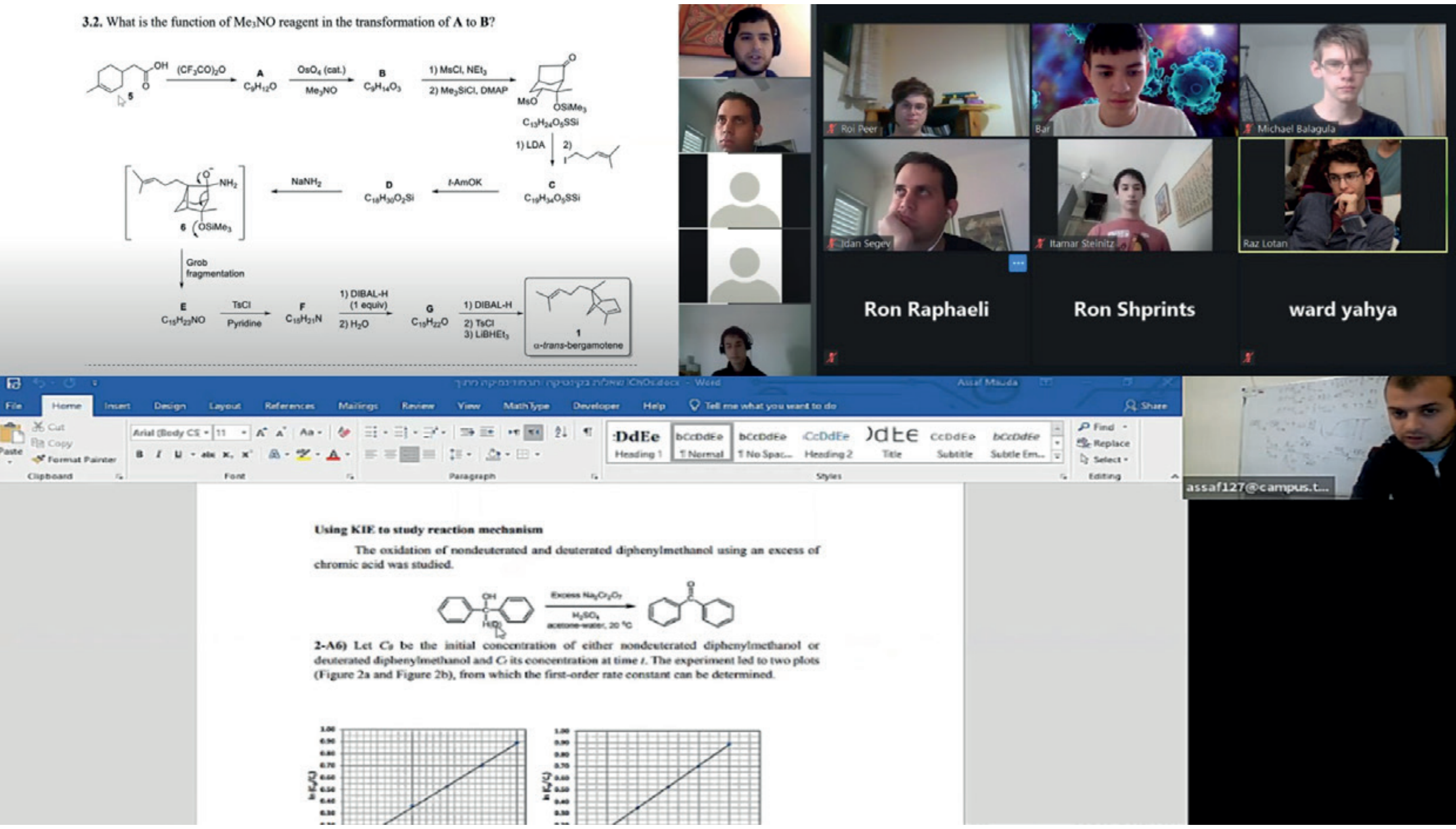
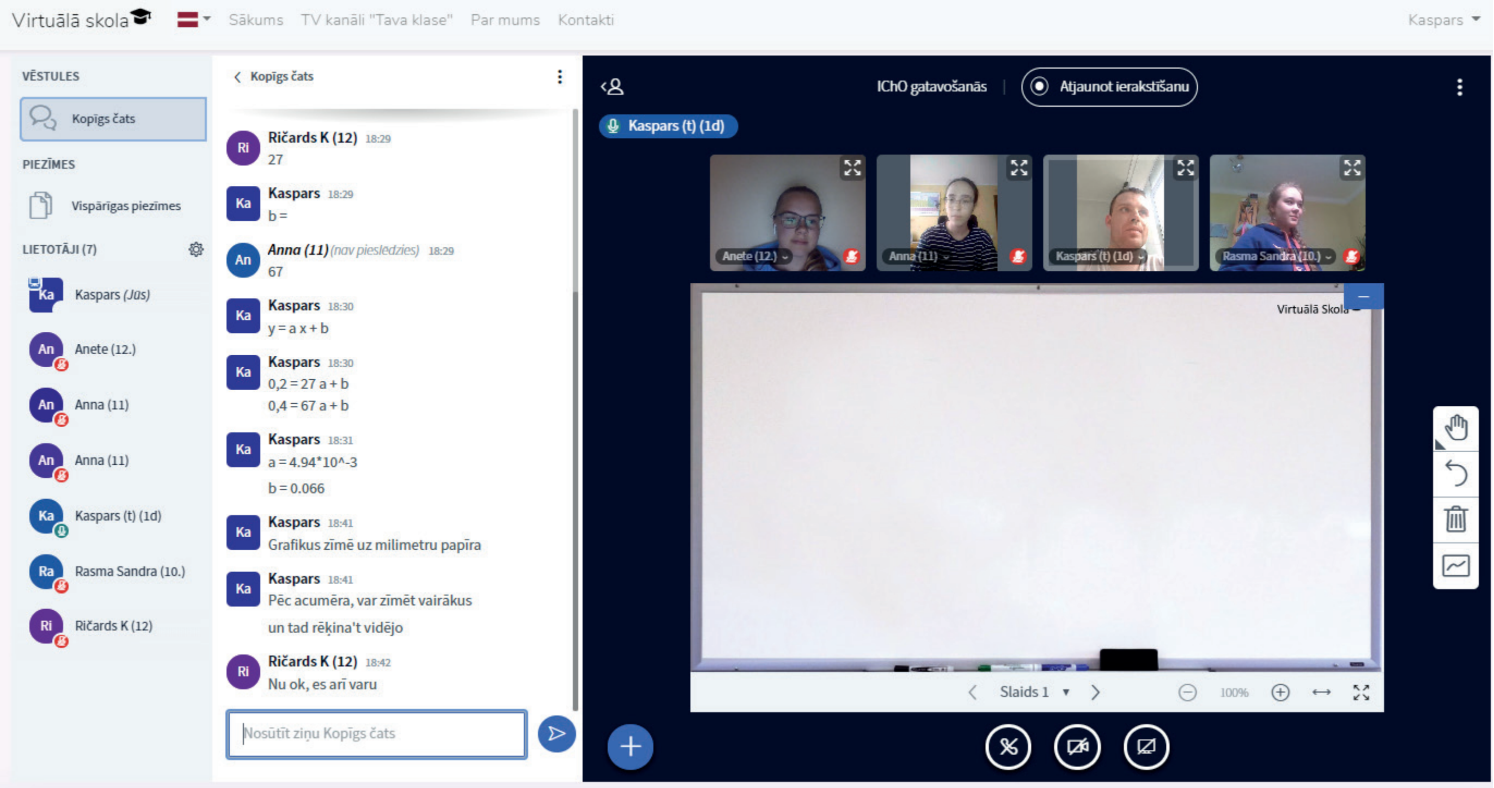
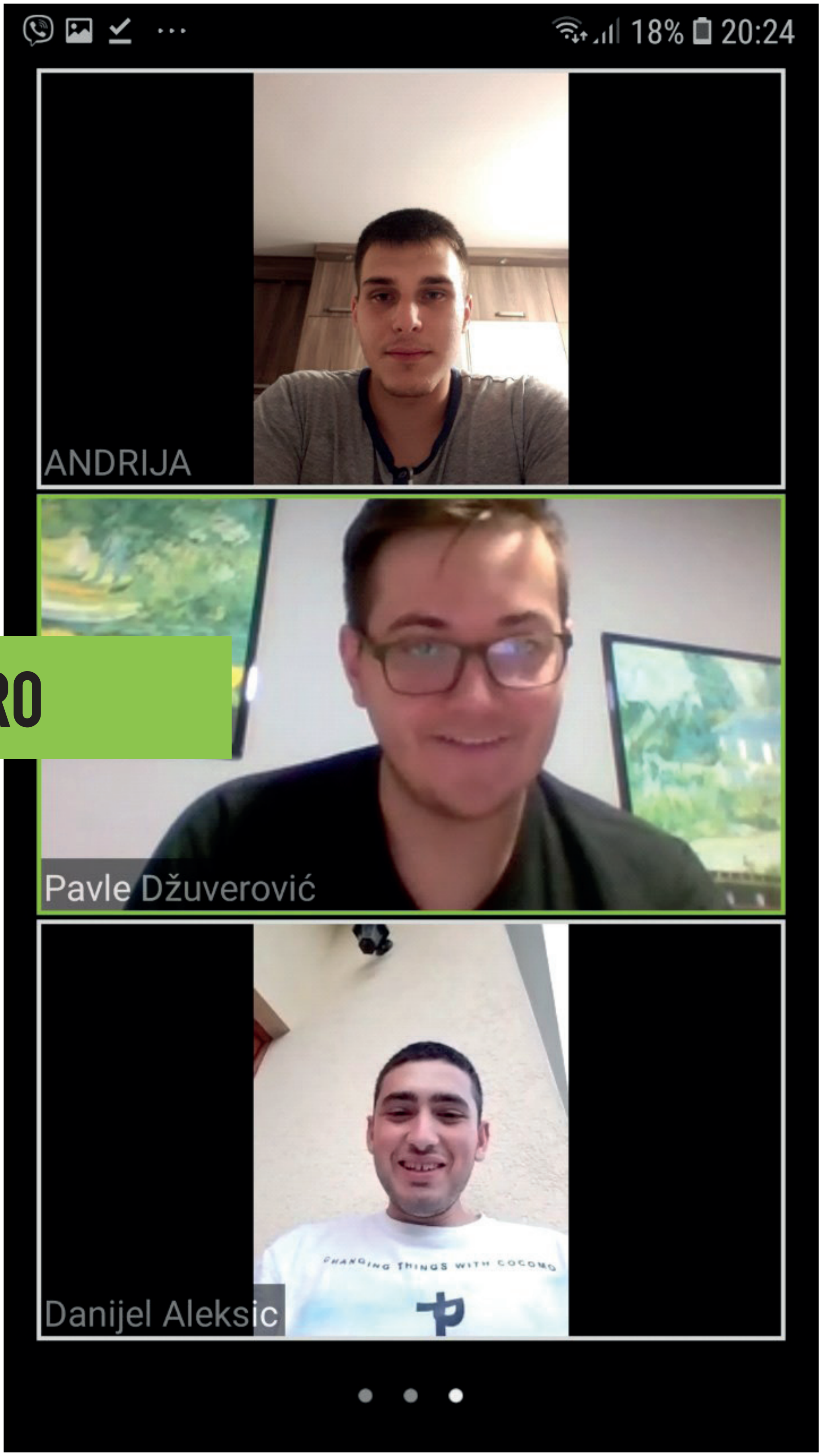
IChO and Covid-19 Preparations





LATVIA

Preparations online @virtualaskola.lv



MONTENEGRO

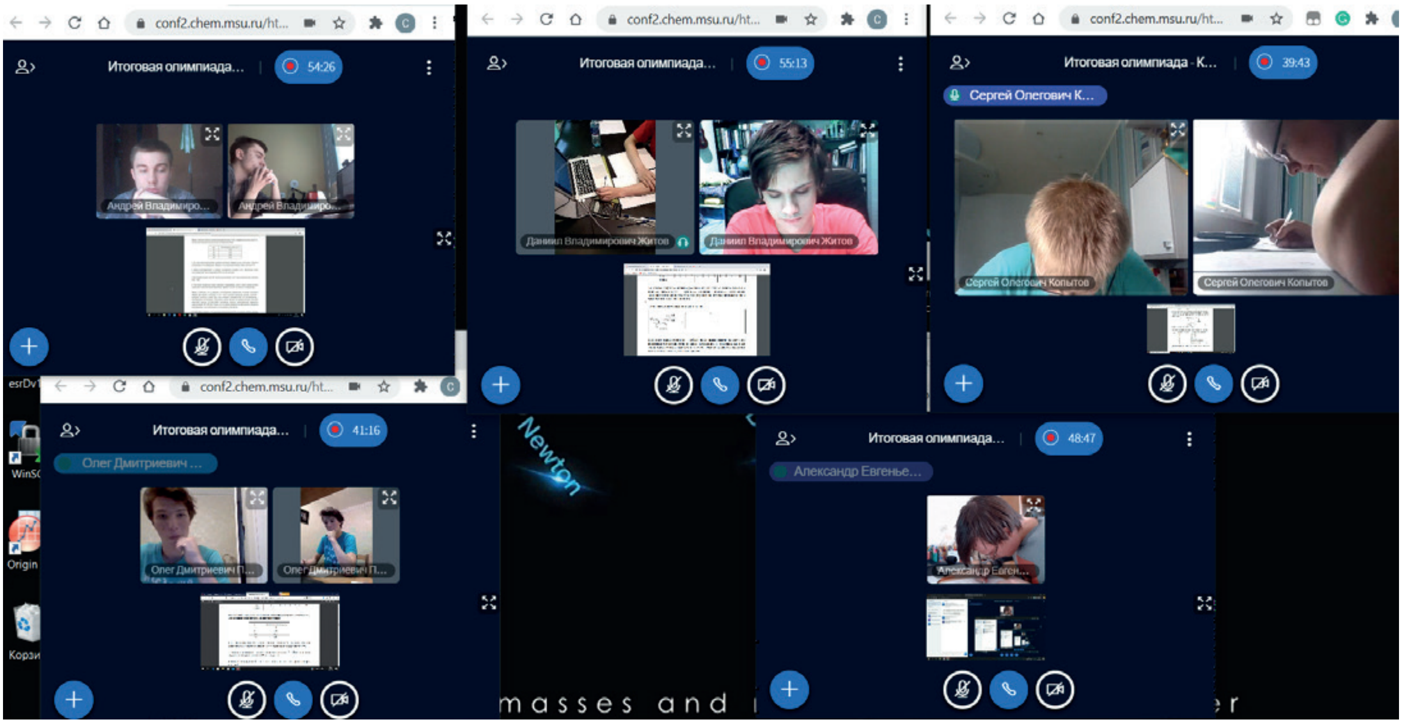
Due to the COVID-19, Montenegrin national preparataions were organized online.

NEPAL

National Olympiad picture

NETHERLANDS

Theoretical exam of the Dutch team



RUSSIAN FEDERATION

Final selection on-line

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52nd IChO 2020
INTERNATIONAL CHEMISTRY OLYMPIAD

CATALYZER

THE SEVENTH ISSUE OF CATALYZER MAGAZINE 21/07/2020

FROM CHAOS TO COSMOS, FROM COSMOS TO CHAOS

Look at the floods of sand,

They never stop and rest.

Look how the world suddenly ends,

How it founds a new world at the best.

Rumi (1207-1273)

As Rumi[1] said, every disorder/chaos underlies a new order/cosmos. Scientists have discovered in the last century that each sand grain, billions of which spread chaotically over the Earth, had indeed a very ordered structure.

Depending on the local rock sources and conditions, sand is composed of tens of different minerals. As is known, the most common constituent of sand in inland continental settings and nontropical coastal settings is silicon dioxide (SiO_2), usually in the form of quartz (Fig. 1). There is a projection of quartz's structure in Fig. 2. We can imagine a reiteration from the perspective of the figure. The red balls represent oxygen atoms and the gray balls silicon atoms. The structure's part that is shown in a frame is its periodic repetitive part. This frame (two-dimensional cell) can be moved to every part of the figure in parallel with itself, and hereby the top of the frame will be suitable for non-diversifying points. Crystal compounds can be determined with this type of three-dimensional frame. It can be called a unit cell too. The size of the unit cell's edges or angles between the edges can be changed. Resolving the structure of compounds determines the size of unit cells, edges, angles between the edges, and how atoms settle into the cell.

Linus Pauling (1901-1994), who was one of the most famous chemists of the last century, suggested showing the structure of crystals by a different method. According to this method, it is needed to tie atomic points with straight lines in inorganic components. Let us compare the description of silicon dioxide's structure, which was drawn according to this method (Fig. 3), with the other description. As we can see, all gray balls (silicon atoms) form a tetrahedron with the nearest red balls (oxygen atoms). Projections of polyhedrons on a plane become polygons. As a result, projections of crystal structures on a plane generally look like patterns made of these types of polygons. In this type of figure, the position of atoms is indicated on the polygons' center or where lines merge.

1 Mevlana Celaleddin-i Rumi was a very famous philosopher and sufi-mystic who lived in the 13th century and whose tomb is in Konya, Turkey. For further information about him see: "Rumi" at https://en.wikipedia.org/wiki/Rumi and "Mevlânâ Celâleddîn-i Rûmî" https://islamansiklopedisi.org.tr/mevlana-celaleddin-i-rumi.

Amazing views of the Gobi desert under the night starry sky.

In the description of the crystal structure of quartz mineral (silicon dioxide – SiO_2), the points where tetrahedrons (squares) cross are the position of oxygen atoms and the centers of tetrahedrons (squares) are the position of silicon atoms.

Khudu Mamedov (1927-1988) determined that this description of the crystal structure of silicon dioxide was similar to a pattern in a mausoleum that was built in Barda, Azerbaijan, in 1322. In addition, he wrote that the same pattern was seen in an older monument from the 13th century in Mardin [1]. The carved pattern on the stone is in Shehidiye Madrasa, which features architectural work from the Artuqid period [2].

Since the Middle Ages, this pattern has been encountered in Anatolia. For example, the Green Tomb in Bursa is one of them (Fig. 4). The same pattern is frequently observed in architectural monuments in Central Asia [3].

The mineral berlinite, with the formula $AlPO_4$, has a crystal structure that is depicted similar to that of quartz. The difference between quartz (whose constituent is SiO_4 tetrahedrons) and berlinite is that the latter has Al and P atoms instead of Si in tetrahedrons. They are shown in different colors in Fig. 5.

The mineral cristobalite is a high-temperature polymorph of silicon dioxide, meaning that it has the same chemical formula, SiO_2, but a distinct crystal structure. Both quartz and cristobalite are polymorphs with all the members of the quartz group (coesite, tridymite, stishovite, etc.). The pattern in Fig. 6 is a structural depiction of -cristobalite. At the same time, it is one of the descriptions of laminal silicon-oxygen radicals, which are found easily in nature.

We can see a similar pattern on 7000-year-old ceramics in Tabriz Museum (Fig. 7). The same pattern garnishes the 12th century Seljuk Palace in Ani (Kars, Turkey, see Fig 8). Tile versions of this pattern can be seen in Konya (Mevlana Museum, see Fig. 9; Sahib Ata Mosque) and in Bursa (Grand Mosque and Green Mosque) [4]. I had a chance to see these patterns on architectural monuments in Tehran and Shiraz during my trip to Iran in 2013 (Fig. 10 and 11).

Furthermore, the same pattern garnishes a miniatures from the15th [5] and 16th century [6]. I want to draw your attention to the formation of a similar pattern in a basket woven by American Indians [3].

Arkose, which is formed by weathering and erosion of granitic rock, consists of quartz particles and feldspars. Feldspar is a mineral group, constituting 60 percent of the Earth's crust. We can see that one mineral of this group, orthoclase ($KAlSi_3O_8$), has a crystal structure [7] that resembles the Selsebil mosaics of Mardin Marufiye Madrasa [4].

This pattern, which is also seen in Konya Mevlana Museum (Fig. 12) and in Bakhchisaray Palace, Crimea (Fig. 13), is just the same as the crystal structure of the mineral erionite [$(Na_2,K_2,Ca)_2Al_4Si_{14}O_{36}\cdot 15H_2O$] [8], which exists in Turkey too. Moreover, the mineral chabazite [$(Ca,Na_2,K_2,Mg)Al_2Si_4O_{12}\cdot 6H_2O$], which is found in India, Iceland, Ireland, Bohemia, Italy, Germany, Arizona, and New Jersey, has the same structure.

Masjid-e Jameh (Isfahan), an 11th-century monument of the Seljuk Empire, and the mirror work (Fig. 14) of the Shah Abdol Azim Shrine (Tehran), a 19th-century monument of the Qajar Empire, have a pattern similar to ferrierite [$(Na,K)_2Mg(Si,Al)_{18}O_{36}(OH)\cdot 9H_2O$], found in Canada [9].

Black sands found in different regions of the world essentially consist of dark-colored heavy minerals, like hematite (Fe_2O_3), ilmenite ($FeTiO_3$), and magnetite (Fe_3O_4). Scientists determined that there are more than 50 minerals in these sands. By presenting patterns of the crystal structures of spinel and chromite minerals, which are isostructural with magnetite minerals, in two different projections, I want to show that there are tens of patterns in a handful of sand. (Fig. 15 and 16)

Khudu Mamedov has named such patterns "crystallographic patterns" due to their resemblance to the structures of crystals [10]. As we know, analyzing the crystal structure of materials by X-rays started almost a century ago. Therefore, how did these people, who had no idea about crystal structures, create the same patterns as the crystal structures of materials centuries ago? What is the reason for the similarity between crystal structures and crystallographic patterns? We can answer these questions that we always face as follows. The reason for the similarity may be accounted for by some formation styles. Humans, as a part of the cosmos, can create the same patterns intuitively by using the creativity principles of Mother Nature. The similarity of patterns to some crystal structures enables us to reach the following conclusions: mankind may use the principles from which nature was created, and he may achieve a resemblance to the creation of nature in ideal form; mankind cannot create anything that does not have a prototype in nature.

I want to finish the journal version of my article published in Elvira Wersche's book [11] with verse by William Blake (1757-1827):

To see a World in a Grain of Sand

And a Heaven in a Wild Flower,

Hold Infinity in the palm of your hand

And Eternity in an hour.

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Hacali Necefoğlu

Fig. 1 Quartz (SiO_2)

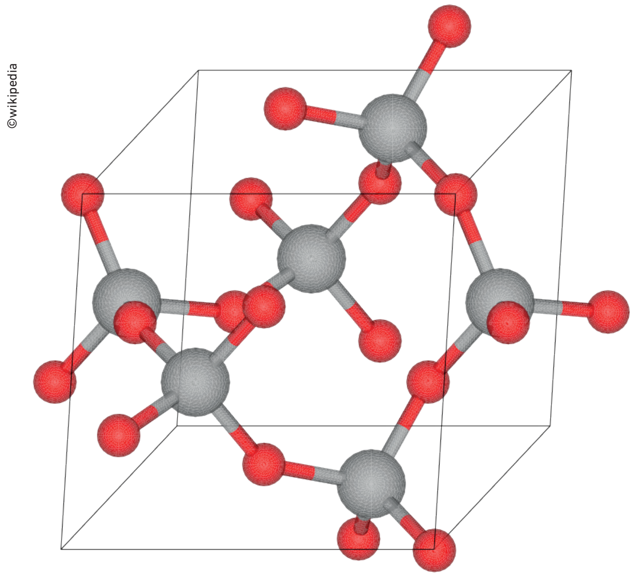


Fig. 2. Structure of quartz.

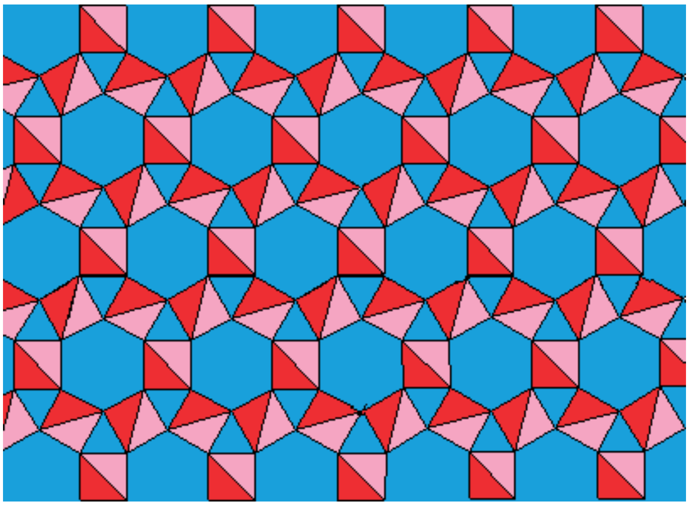


Fig. 3. Structure of quartz (by Pauling method).

Fig. 4. Green Tomb, Bursa, Turkey.

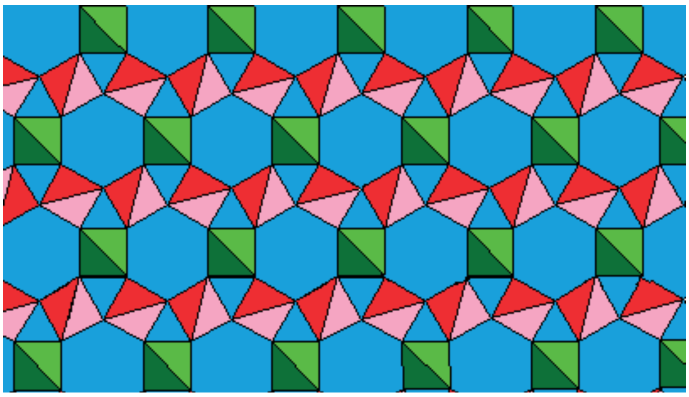


Fig. 5. Structure of Berlinite.

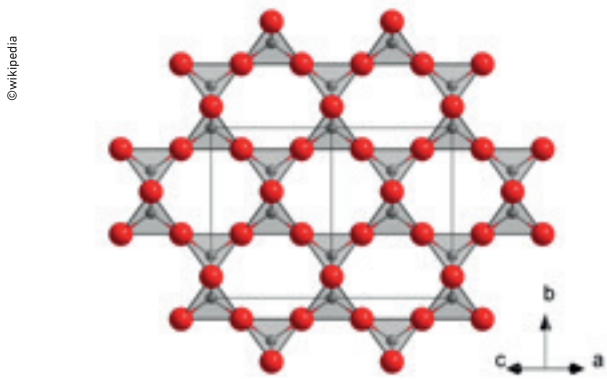


Fig. 6. Structure of Cristobalite.

Fig. 7. Ceramic from Azerbaijan Museum (Tabriz, Iran).

Fig. 8. Decoration from Ani (Kars, Turkey).

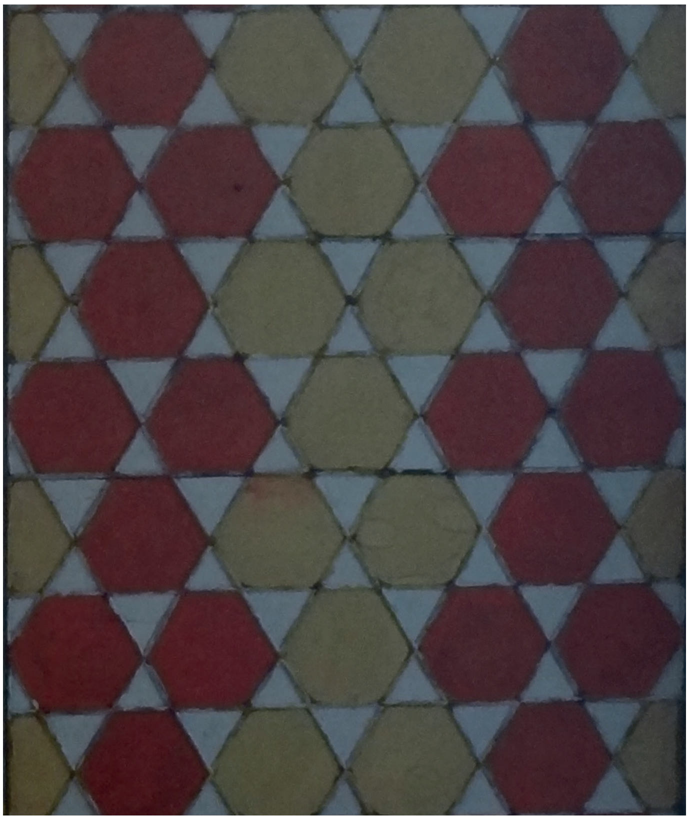


Fig. 9. Decoration from Mevlana Museum (Konya).

Fig. 10. Shah Abdol Azim Shrine (Tehran).

Fig 11. Shah Cheragh Mosque (Shiraz).

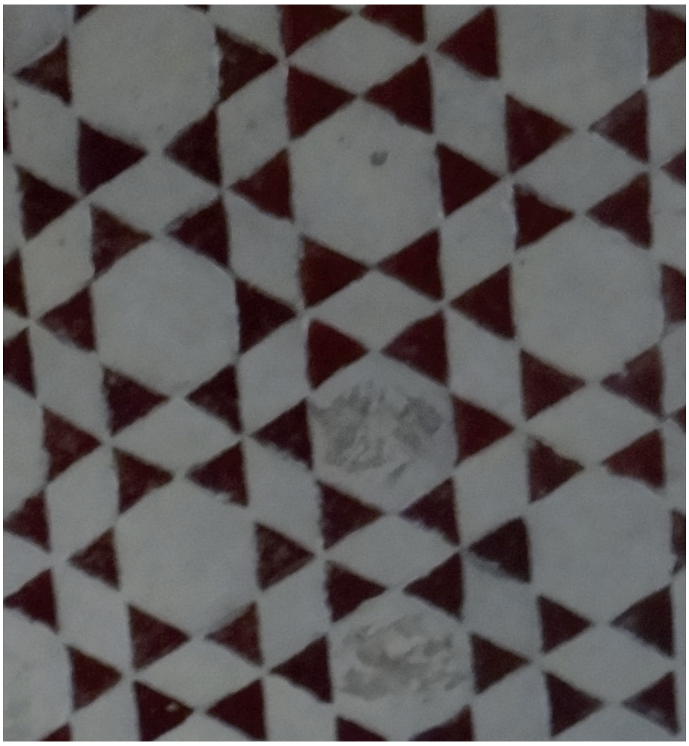


Fig. 12. Decoration from Mevlana Museum.

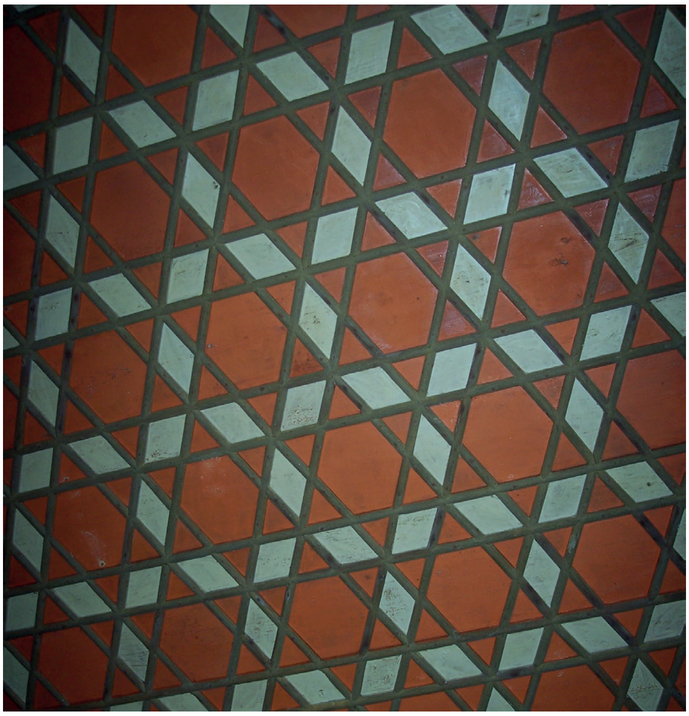


Fig. 13. Decoration from Bakhchisaray Palace, Crimea.

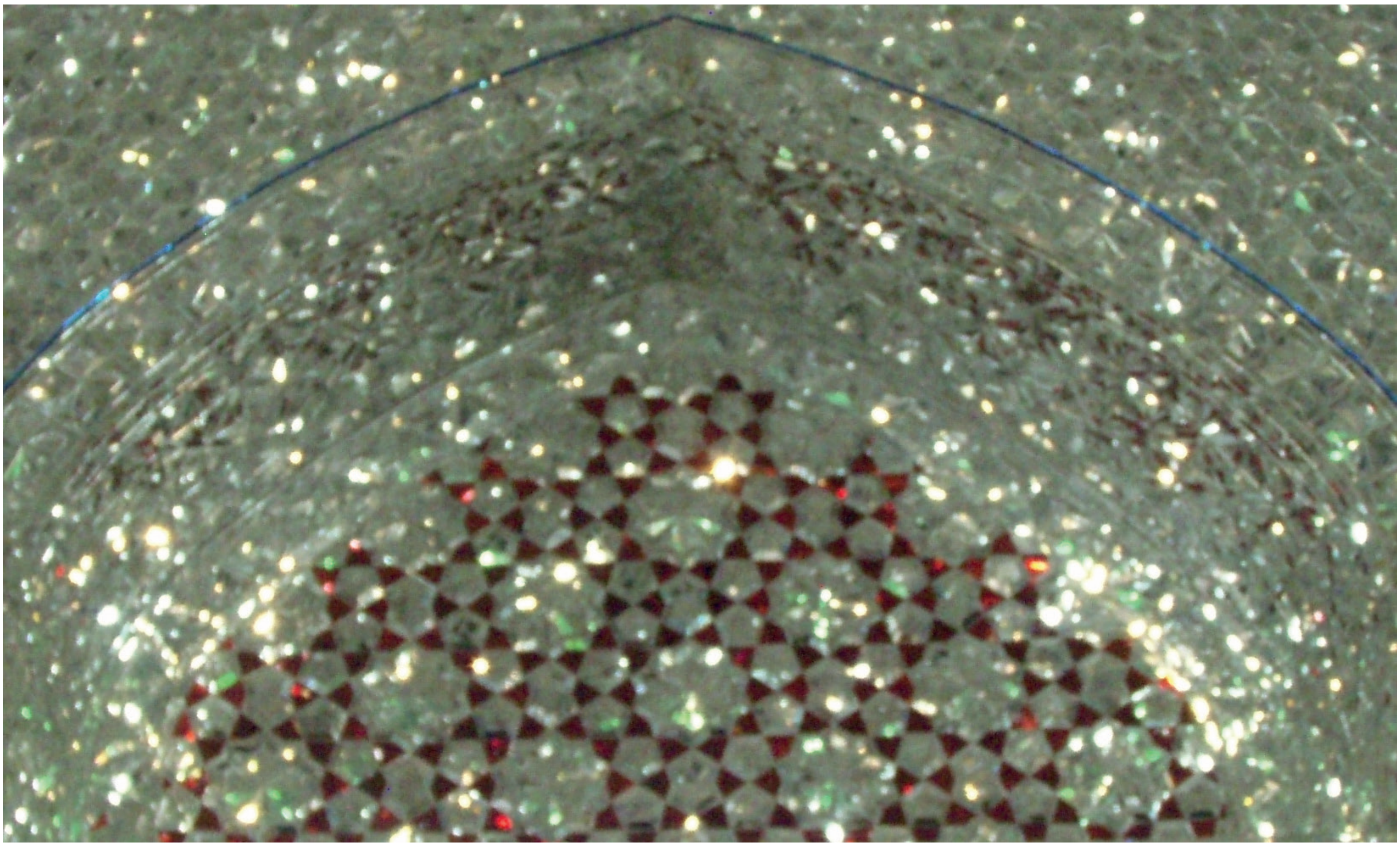


Fig. 14. Shah Abdol Azim Shrine (Tehran).

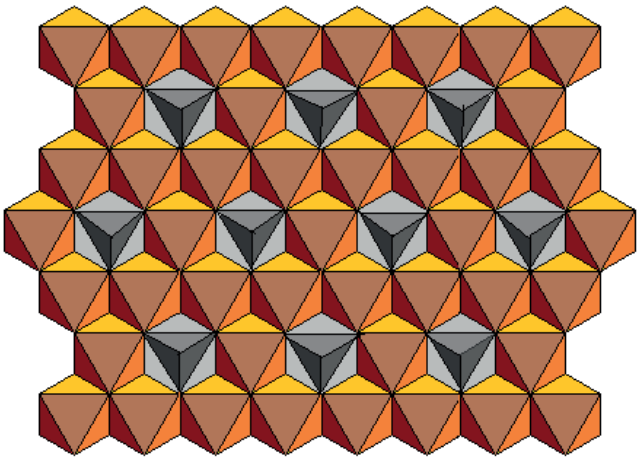


Fig. 15. Spinel structure.

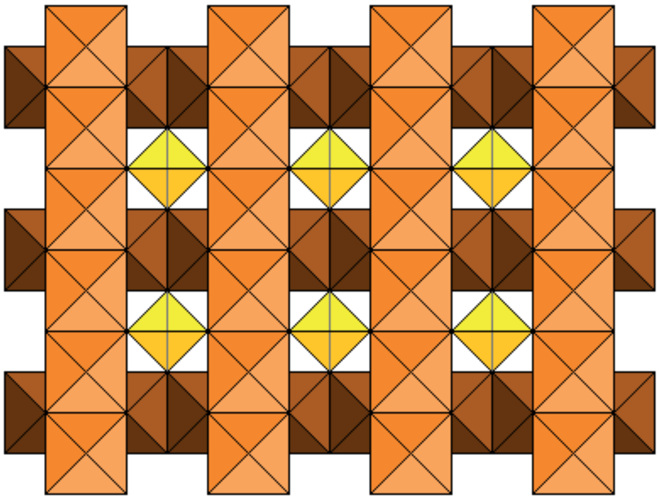
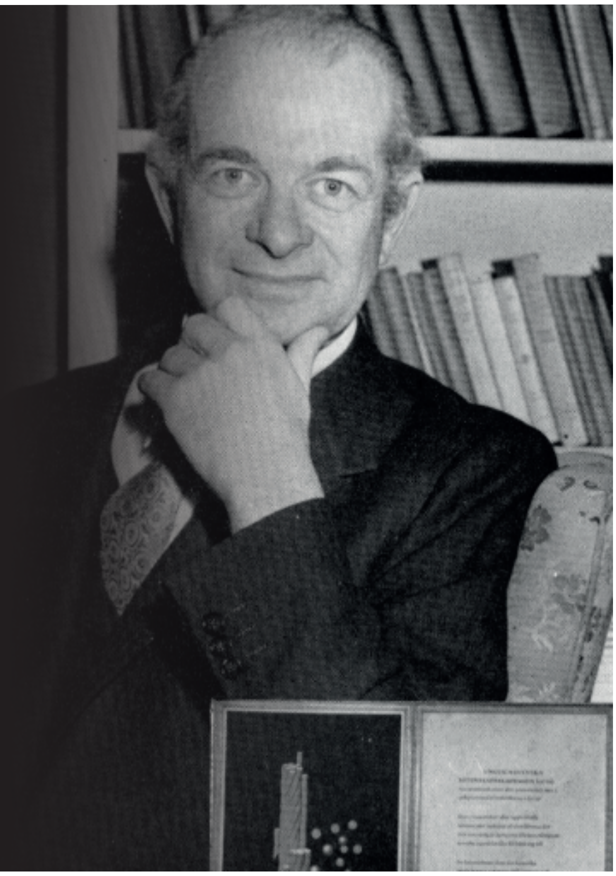


Fig. 16. Spinel structure.

LINUS PAULING (1901–1994), QUANTUM CHEMISTRY AND MOLECULAR BIOLOGY



Linus Pauling, considered one of the 20 greatest chemists of all time, is regarded as the father of quantum chemistry and molecular biology. Pauling received the Nobel Prize in Chemistry in 1954 and then the Nobel Peace Prize in 1962 for his anti-war efforts. Pauling was born in Portland, Oregon, USA in 1901, and when he was in high school he created a chemistry laboratory in the basement of his home. He took the necessary courses to graduate from high school, but the high school administration did not give him his diploma because he had not taken citizenship courses. Oregon State University enrolled him without the need for a diploma. When Pauling received the Nobel Prize, the high school administration gave him his high school diploma 47 years later. Pauling, who lost his father at the age of 10, worked as a laborer at the port so that he could study at university. The university administration recruited him as a chemistry assistant because of his chemistry knowledge and superior intelligence when he was in his third year. After graduating from university, he completed his PhD on examination of the structures of crystalline materials at the California Institute of Technology as a high honor student in 1925. As a postdoctoral researcher in Europe, he worked with Niels Bohr, Erwin Schrödinger, and Arnold Sommerfeld, the world's leading names in quantum mechanics.

Linus Pauling (1950s): Father of Molecular Biology

Linus Pauling said "When I was a student, I was very curious about the state of electrons in atoms and the distances between atoms when they form molecules and new states of electrons." In Europe, Pauling, who studied quantum physics closely, later determined the principles of quantum chemistry, becoming the founder of this scientific field. He explained in 1932 that atoms had different forces to attract electrons in covalent bonds that they created by using each other's electrons while forming molecules. He called this force of attraction electronegativity and prepared an electronegativity table of the elements by performing the necessary calculations. It was understood thanks to Pauling why the carbon atom sometimes forms coal and sometimes forms diamonds, and carbon sometimes bonds to four atoms, sometimes to three, and sometimes to two. This feature of carbon became clear as a result of the hybridization concept Pauling explained in 1931. Pauling explained that the orbitals in carbon atoms hybridize as sp^3 and make 4 carbon–hydrogen bonds in the methane molecule of the same length and equidistant from each other. In this way, the reason why carbon orbitals can hybridize as sp^3, sp^2, or sp form creating single, double, or triple bonds in organic compounds was easily understood. Pauling made a revolutionary discovery in medicine in 1949. As is known, in the disease called sickle-cell anemia, circular red blood cells take the shape of a sickle due to an abnormality in the hemoglobin molecule. This prevents blood flow in the vessels, causing problems in the organs. Pauling discovered that this disease was caused by a genetic defect in the structure of the hemoglobin molecule and became the father of molecular biology and molecular genetics. Pauling, who discovered that the structure of proteins is spiral-shaped in 1951, explained the structure of DNA as a triple spiral, but it was soon proved to be a double spiral. Pauling did not participate in the construction of the atomic bomb. He was unable to attend a scientific meeting in England in 1952 when his application for a passport was denied for a period by the US administration because he took part in anti-nuclear protests.

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Ural Akbulut

FAMOUS TURKISH SCIENTIST IN THEORETICAL CHEMISTRY: OKTAY SINANOGLU (1935–2015)

Sinanoğlu was born on February 25, 1935, in Bari, Italy. After he graduated from high school, he won a scholarship for education in chemistry in the USA. In 1956, he got his bachelor's degree from the University of California at Berkeley in chemical engineering with highest honors. The following year, in only eight months, he completed a master's degree on "Viscosity of Polar Vapor Mixtures" [1] at the Massachusetts Institute of Technology (MIT) with the highest degree. He returned to Berkeley, where he received his Ph.D. degree in "Intermolecular Forces and Statistical Mechanics" [2] in theoretical chemistry under the guidance of Kenneth Pitzer in 1959. Sinanoğlu was appointed to Yale University in 1960 and promoted to associate professor for his work on the "Many-electron Theory of Atom and Molecules" providing a powerful approach to the electron correlation problem [3-5]. In 1963, at the age of only 28, Sinanoğlu was appointed full professor of chemistry, and he thus became the youngest full professor in Yale's 20th-century history.

Sinanoğlu, known as the Turkish Einstein, provided the greatest scientific contributions to world science literature in both theoretical chemistry and molecular biology with theories he developed such as the many-electron theory of atoms and molecules (which is the best known of his works), solvophobic theory [6,7], network theory of coupled chemical reactions [8], micro-thermodynamic surface tension [9], and valency interaction formula theory [10].

Sinanoğlu made significant contributions to quantum mechanics throughout his life. The most important of them is his development of a theory about the electronic structure of molecules. While the behavior of electrons is governed by the Schrödinger equation, this equation is essentially impossible to solve except for in systems with very few electrons. In contrast to what is taught, electrons do not move independently in their own orbitals. Rather, they interact with each other such that their motions are correlated. Methods to address this 'electron correlation' problem are still being developed today. Sinanoğlu's early works represent an important step toward the goal of developing accurate approximations to the electronic Schrödinger equation. In addition, he introduced a successful solution to a problem of the topology of a Hilbert space and high symmetries it contains in quantum mechanics. Further, P. A. M. Dirac was also dealing with this problem but could not solve it. Sinanoğlu had thus built chemistry science on solid ground with this topologic solution. Another of his contributions is that he explained how the DNA helix retains its helix structure in solution (solvophobic theory).

Sinanoğlu was awarded many science awards for his outstanding works throughout his academic career. He received the TÜBİTAK Science Award, Alexander von Humboldt's Science Prize, and International Outstanding Scientist Award of Japan. In addition, he was nominated for a Nobel Prize in chemistry twice.

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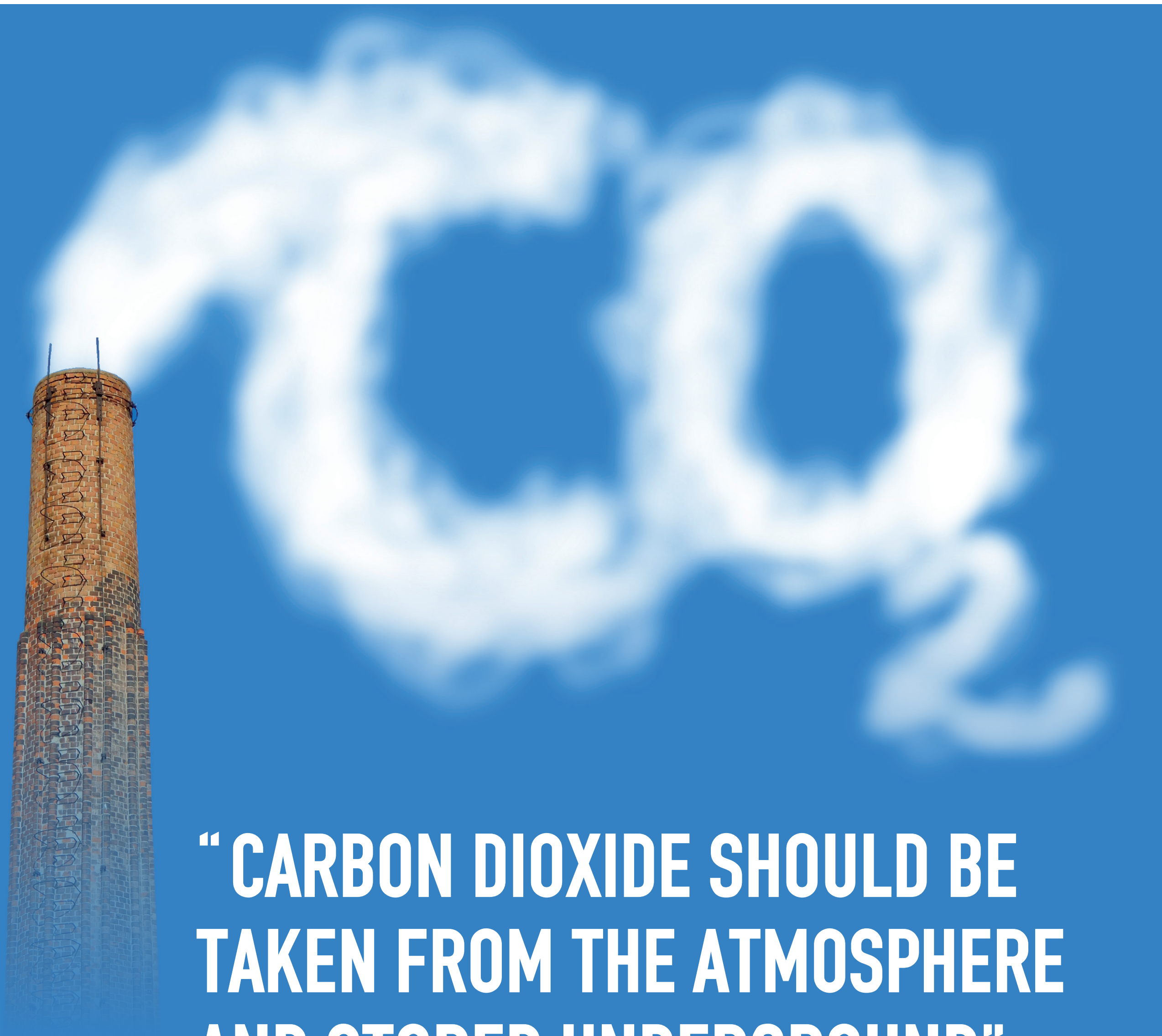
Uğur Bozkaya

Abdurrahman Atalay



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"CARBON DIOXIDE SHOULD BE TAKEN FROM THE ATMOSPHERE AND STORED UNDERGROUND"

Prof Wally Broecker, the first person to warn the world about global warming, says CO_2 in the atmosphere must be captured and stored underground. This is the best way to keep global warming under control over the next 50 years, according to Broecker.

A lecturer at Columbia University, Broecker made this claim during his presentation at the International Carbon Conference in Iceland. The 150 scientists attending the conference discussed the removal of carbon from the atmosphere and its storage. In his presentation, Broecker said that the Earth had cooled very slowly over the past 51 million years, but that the rise in temperature caused by human activity would cause problems over the next 100,000 years. Broecker said, "We can't reduce our reliance of fossil fuels quickly enough, so we need to look at alternatives. One of the best ways to deal with this is likely to be carbon capture – in other words, putting the carbon back where it came from, underground. There has been great progress in capturing carbon from industrial processes, but to really make a difference we need to begin to capture atmospheric CO_2. Professor Eric Oelkers, one of the organizers of the conference, said, "We have proven methods to store carbon in the Earth but are limited in our ability to capture this carbon directly from the atmosphere. We are very good at capturing carbon from factories and power stations, but because roughly two-thirds of our carbon originates from disperse sources, implementing direct air capture is key to solving this global challenge.

Bilim ve Teknik (Science and Technology magazine), December 2019

İbrahim Özay Semerci

HOW DO TREES AFFECT THE TEMPERATURE OF CITIES?

The average temperature of areas with a high urbanization rate is 1-3 °C higher than that of rural areas around them. This difference can reach 12 °C at night. This phenomenon, which was first recorded by the British scientist Luke Howard in 1818, is called a heat island.

Some of the radiation that reaches the Earth from the sun is absorbed by the atmosphere, some of it is reflected back into space directly by the atmosphere, and the rest is absorbed by the surface of the Earth. The Earth's surface loses heat by radiation, convection, and evaporation. The balance between the energy the Earth receives and gives constitutes its energy "budget".

The main reason why the average temperature of the cities is higher than that of the rural areas is thought to be the decrease in evaporation and cooling in the cities. In addition to cooling by evaporation, trees and other plants contribute to the cooling process by the shade they create.

For example, the temperature of an object in the shade may be 11 °C to 25 °C lower than when exposed directly to the sun under the same conditions. The leaves and branches of trees and other plants allow only 10-30% of the energy from the sun to pass to the lower parts in the summer. This effect causes objects under trees to absorb the sun's rays less and their temperature rises less.

Trees and other plants also contribute to cooling by evaporation. Plants that convert water and carbon dioxide into food through photosynthesis take the water in the soil through their roots. They release some of the water they take from the soil through their leaves and stems through transpiration and dripping. In order for it to evaporate from liquid state to gas, water must take heat from outside. Therefore, evaporation helps to reduce the air temperature. Moisture in the soil also contributes to cooling by evaporation.


©Ayşe Özdemir

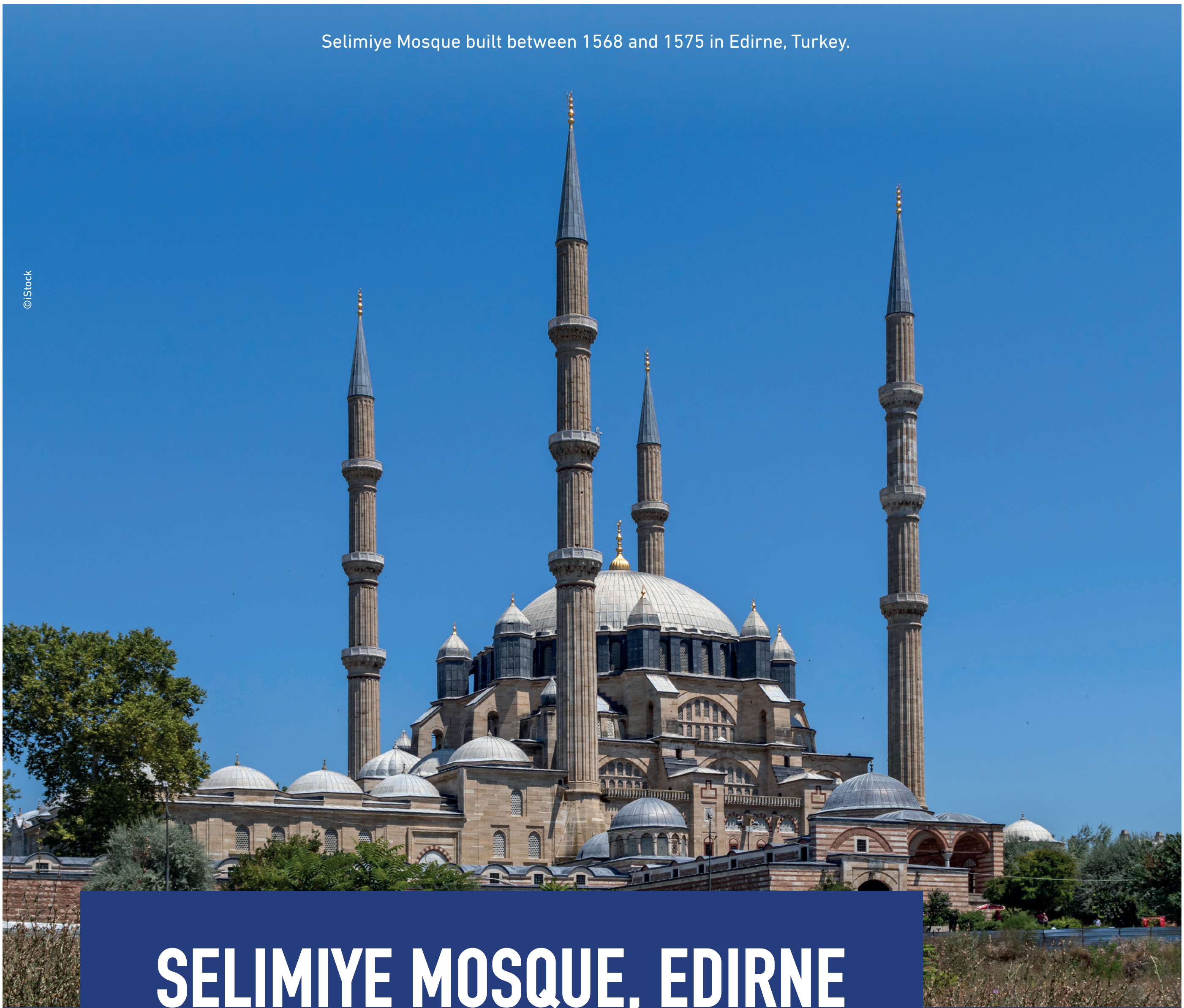
Research has shown that evaporation and shade can cause a drop in air temperature between 1 °C and 5 °C in summer.

Buildings and other unnatural structures and materials in cities absorb sunlight more than vegetation and soil do. Energy stored in these materials is released at night. This is one of the reasons why the temperature difference between urban and rural areas is higher at night. In addition, the high amount of heat released as a result of human activities in cities causes the energy exchange balance in cities to differ from that in rural areas. The type of materials used in the construction of buildings, the shape of buildings and streets, and human activities affect energy exchange in cities.

Bilim ve Teknik (Science and Technology magazine), April 2018

Tuba Sarıgül

Selimiye Mosque built between 1568 and 1575 in Edirne, Turkey.



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SELIMIYE MOSQUE, EDIRNE

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

Selimiye Mosque is the building that Sinan described as his masterpiece. It was built between 1568 and 1575 and is one of the best examples of Ottoman architecture. Selimiye Mosque, built as a complex on a hill, represents the highest level achieved by Ottoman architecture. The mosque was built using yellowish cut stone on a floor raised in the middle of a rectangular courtyard. It is covered with a single dome with a height of 42.25 m and a diameter of about 31.50 m that sits on eight supports. Thanks to this layout implemented by Mimar Sinan in the building, the congregation was gathered under a single dome.The balconies of the fluted minarets rising on polygonal bases

Cultural Heritages

Selimiye Mosque

at the four corners completing the mosque integrity are accessed by three separate stairways.

In addition to its architectural features, it is a very important example of Turkish-Islamic art with its stone, marble, tile, hand-drawn, and wooden decorations.

The platform for the muezzin, located in the middle of the sanctuary section, is supported by 12 marble columns.

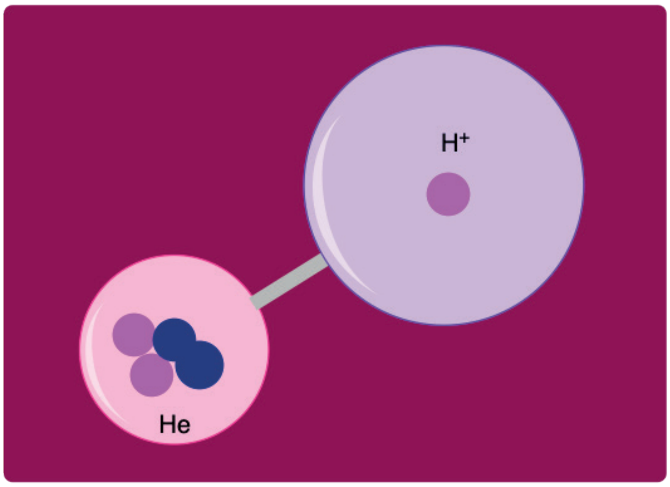
The Iznik tiles decorating the building are one of the most beautiful examples of 16th century tile making and made by the glaze technique.

Selimiye Mosque and Complex in Edirne, which was the capital of the Ottoman Empire before Istanbul, was added to the UNESCO World Heritage List in 2011.

Selimiye Mosque

©Photo: Hüseyin YURTTAŞ, Esra HALICI, Burak Muhammet GÖKLER, Muhammed Emin DOĞAN

THE UNIVERSE'S FIRST MOLECULAR BOND: THE HELIUM HYDRIDE ION (HeH^+)



The helium hydride ion or hydrohelium (1+) cation, HeH^+, is a positively charged ion formed when a proton reacts with a gaseous helium atom. It was first discovered in 1925 and is isoelectronic with molecular hydrogen. It is the strongest acid known for its proton affinity (177.8 kJ/mol). This ion is also referred to as the helium hydride molecular ion. It has been suggested that it is found naturally in interstellar matter. It is the simplest heteronuclear ion and the hydrogen molecular ion is comparable to H_2^+. However, unlike H_2^+, there is permanent molecular polarization that facilitates spectroscopic characterization. Hydrogen and helium were the two first elements, and in the extreme conditions of the universe's birth astrochemists presumed they formed the first-ever molecular bond in HeH^+. Its first detection, in the nebula NGC 7027, was reported in an article published in the journal Nature in April 2019. Rolf Güsten, from the Max Planck Institute for Radioastronomy in Germany, and colleagues knew HeH^+ could exist; it was spotted in the lab in 1925. Güsten and colleagues observed the HeH^+ rotational ground state in a planetary nebula using a terahertz (THz) spectrometer flying on the airborne Stratospheric Observatory for Infrared Astronomy. Helium hydride may have no practical use here on Earth, but this most ancient of molecules is providing a fascinating insight into the way that the universe first evolved, and as such it is a compound with a compelling history.

$$He^+ + H \longrightarrow HeH^+ + h\nu$$

$$HeH^+ + e^- \longrightarrow He + H$$

$$HeH^+ + H \longrightarrow H_2^+ + He$$

Haydar Kılıç

TODAY'S PROBLEM AND YESTERDAY'S ANSWER

Problem 7.

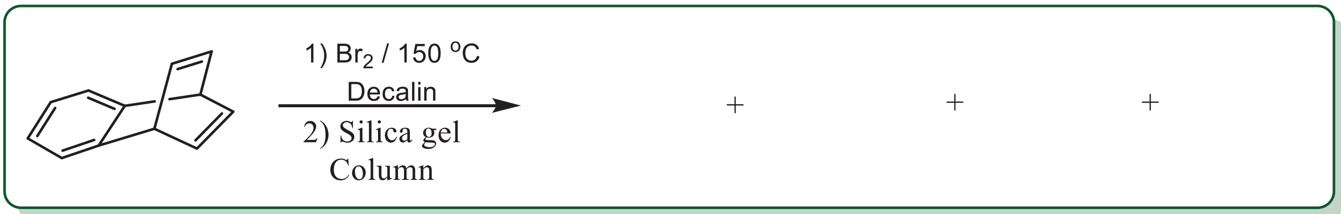
One reaction and many products

Both in the synthetic organic laboratory and in the chemical industry, one of the primary goals of modern chemistry is to control the identity and quantity of the products of chemical reactions. After the reaction, if the target compound is formed as a single product in quantitative yields, you are very lucky. However, this kind of reaction is very rare in organic synthesis. Sometimes the reactions surprisingly result in the formation of an abnormal number of products. In the literature, it has been reported that 18 products are formed under the reaction conditions given below. Estimate the structure of these products using the hints given.

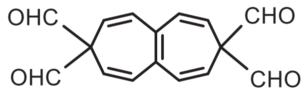
Arif Daştan

Hints:

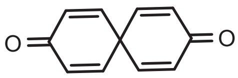
1) In addition to the ionic reaction, high-temperature bromination is known to be more predominantly radicalic.
2) Note that allylic and benzylic bromides can easily be hydrolyzed to related alcohols in the silica gel column.
3) Only one of the products is formed from the bromination of the solvent. This product has 3 signals in ^{13}C-NMR.



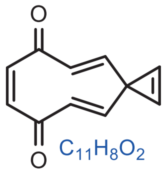
Solution: Problem 6



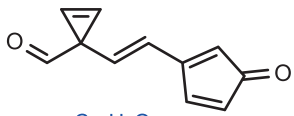
$C_{16}H_{12}O_4$



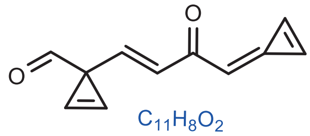
$C_{11}H_8O_2$



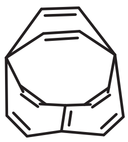
$C_{11}H_8O_2$



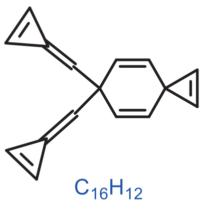
$C_{11}H_8O_2$



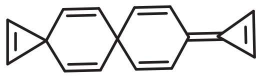
$C_{11}H_8O_2$



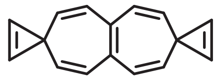
$C_{16}H_{12}$



$C_{16}H_{12}$



$C_{16}H_{12}$



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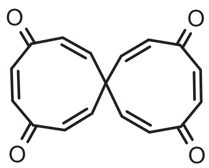
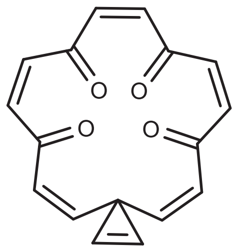


$C_{17}H_{12}O_4$



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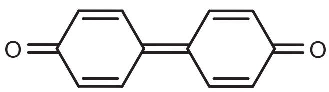
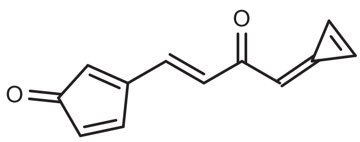
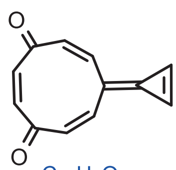


$C_{12}H_8O_2$



$C_{12}H_8O_2$



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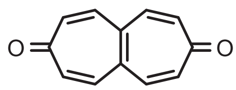

$C_{12}H_8O_2$

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

SYRIA

National Team Preparation - Syria

TURKEY

The selection exam of the Turkish IChO 2020 National Team was completed in TUSSIDE, a Scientific Institute of TUBITAK, on July 01, 2020. In the end theoretical exam, four students are selected to represent the country.

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52nd IChO 2020
INTERNATIONAL CHEMISTRY OLYMPIAD

CATALYZER

THE EIGHTH ISSUE OF CATALYZER MAGAZINE 22/07/2020

THE CHEMISTRY OF PAMUKKALE (COTTON CASTLE)

Pamukkale, meaning cotton castle in Turkish, is a natural site in Denizli in southwestern Turkey. The area has been declared a World Heritage Site by UNESCO, and the ancient Greco-Roman city of Hierapolis was built on top of the white "castle". It is known as Pamukkale or ancient Hierapolis (Holy City). This area has been built gradually by the thermal springs since the time of classical antiquity.

The Turkish name refers to the surface of the shimmering, snow-white limestone, shaped over millennia by calcium-rich springs. Dropping slowly down the vast mountainside, mineral-rich waters foam and collect in terraces, spilling over cascades of stalactites into milky pools below. There is a legend that says the formation is solidified cotton (the area's principal crop) that was left out to dry.

The water dissolves pure calcium carbonate ($CaCO_3$), becomes saturated with it, and carries it to the earth's surface, where it bursts forth and runs down the steep hillside. Cooling in the open air, the $CaCO_3$ precipitates from water, adheres to the soil, and forms white calcium carbonate "cascades" frozen in stone called travertines.

Pamukkale travertine terraces at sunset. Denizli, Turkey

Natural travertine pools and terraces at Pamukkale. Cotton castle in southwestern Turkey

A travertine is a slip formed by a multifaceted chemical reaction and subsequent precipitation of various causes and environments. The geological events that led to the thermal source of Pamukkale affected a large area. In this region, there are 17 hot water areas with temperatures ranging from 35 to 100 °C. Pamukkale's thermal source has been used since antiquity. Some travertines are yellow as they contain iron oxide, for example, Karahayıt travertines in other areas.

The thermal water comes from the source in a covered channel of 320 m length per travertine, and from there it pours into the travertine floors where 60-70 m of partial sedimentation takes place, and it travels 240-300 m on average.

The mineral-rich Pamukkale hot spring waters are high in calcium, magnesium sulfate, and bicarbonate. They also contain carbon dioxide (CO_2) and radioactive content of 56 becquerels/L. The water temperature is 36-38 °C with a pH of 6. The total mineral contents are 2430 mg/L. The waters are used for drinking and bathing.

Travertines of Pamukkale spa resort. Turkey

When the water starts to lose its warmth, CO_2 is released into the air. As a result, $CaCO_3$ is precipitated. Thus, the water forms the magnificent travertines. The chemical precipitation reaction from the beginning to the end is:

$$Ca(HCO_3)_2 \text{ (aqueous)} \longrightarrow CaCO_3 \text{ (solid)} \downarrow + H_2O \text{ (liquid)} + CO_2 \text{ (gas)} \uparrow$$

The precipitate is in gel state in the first step. The reaction is occurs chemically. It hardens and becomes travertine over time. However, the walking and playing of visitors on the floors cause the soft $CaCO_3$ to be crushed and to disintegrate.

The waters are recommended for the treatment of rheumatic, dermatological, and gynecological diseases; neurological and physical exhaustion; digestive maladies; and nutritional disorders.

Since the amount of thermal water is not sufficient, the water should be supplied to the terraces alternately. The site is a truly remarkable natural phenomenon and it would be a pity if human interference damaged it permanently for future generations.

Emin Erdem

©iStock

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

SUMELA MONASTERY

Sümela Monastery, located at a height of 300 meters in the Maçka district of Trabzon Province, is also known as the Virgin Mary Monastery. The name Sümela comes from the word "melas", meaning black. The monastery was first established by two monks named Sophranios and Barnabas, who came from Athens to Maçka during the reign of Byzantine Emperor Theodosius I (375-395). It took its current form in the 13th century.

In 1461, the region came under Ottoman rule. The Ottomans protected the rights of the monastery and granted it privileges.

Cultural Heritages

In the 18th century, some walls were decorated with frescoes and many parts were renovated. Some buildings were added in the 19th century. That was followed by one of its brightest and richest periods and it gained the magnificent appearance that exists today. During the Russian occupation between 1916 and 1918, the monastery was seized. In 1923, it was completely abandoned.

Sümela Monastery includes a library, a sacred spring, student rooms, a guesthouse, a kitchen, a chapel, and a rock church. There are guardrooms next to the entrance. From there, you can go down to the inner courtyard.

The outer and inner walls of the rock church and the adjacent chapel in the monastery are decorated with scenes from the Bible.

Sümela Monastery stands at the foot of a steep cliff facing Altındere valley in the district of Maçka in Trabzon Province. The Orthodox monastery, which was named Panaghia tou Melas in Byzantine Greek, was founded in the 4th century by two monks called Barnabas and Sophronius.

Painting on Sümela Monastery in Trabzon, Turkey. The Black Sea region has become a popular tourist destination in recent years. There are many small and large plateaus in the region. In recent years, plateau tourism began in this region. The district attracts attention due to its different architecture as well as its incredible nature. The architectural details of the wooden houses are also interesting.

Close-up view of Sümela Monastery


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2019 THE YEAR OF PROF. DR. FUAT SEZGIN

Prof. Dr. Fuat Sezgin (24 October 1924-30 June 2018) was one of the world's leading names in the field of Islamic science and technology research. In Turkey, 2019 was dedicated to this distinguished scientist and his works were introduced through various activities.

By permission of Corporate Communications Directorate, Ataturk University, Turkey

Prof. Dr. Fuat Sezgin, who had wanted to study mathematics at university and become an engineer, changed his mind and decided instead to study the history of science after attending a seminar by Prof. Dr. Helmut Ritter, working at the Institute of Oriental Studies at Istanbul University. Prof. Dr. Sezgin completed his doctoral thesis, entitled "The Sources of Al-Bukhari", in 1956 under the supervision of Prof. Dr. Ritter and went to Germany in 1960. In 1965, he wrote his second doctoral thesis, on "Jabir ibn Hayyan", at the University of Frankfurt and received the title of professor a year later. Prof. Dr. Sezgin, in his work "History of Arabic-Islamic Science", which is a comprehensive study of Arabic written works, covered subjects including Quranic sciences, hadith sciences, history, fiqh, theology, sufism, poetry, medicine, pharmacology, zoology, veterinary medicine, alchemy, chemistry, botany, agriculture, mathematics, astronomy, astrology, meteorology and related fields, grammar, mathematical geography, cartography in Islam (cartography), and history of Islamic philosophy.

Prof. Dr. Sezgin, who founded the Arab-Islamic History Institute at Goethe University in Frankfurt in 1982, opened the Museum of Islamic Science History a year later. In the museum, more than 800 examples of models of the inventions of scientists raised among Islamic culture based on written sources are exhibited. There are 45,000 volumes of books and 10,000 microfilms in the History of Sciences Library established within the museum. Prof. Dr. Sezgin founded the Istanbul Museum of the History of Science and Technology in Islam in 2008.

The museum has 570 tools, copies of devices, model collections, and maps related to the fields of astronomy, timepiece technology, maritime navigation, war technology, medicine, minerals, physics and technology, optics, chemistry, mathematics and geometry, architecture and city planning, and geography. With this feature, the museum is the first example in Turkey in this field and the second in the world after Frankfurt. The inventions and discoveries by Muslim scientists in the museum comprehensively reveal the changes in different fields of the history of science. The museum also has a catalogue entitled "Science and Technology in Islam", written by Prof. Dr. Sezgin. To date, this work, which has been written as a museum catalogue, has been published in four languages: Turkish, English, German, and French.

Prof. Dr. Sezgin was deemed worthy of many awards internationally for his work in the field of the history of Islamic science. Among the awards he received were many important ones such as the Frankfurt am Main Goethe Plaque, German First Class Federal Service Medal, German Distinguished Service Medal, Iran Islamic Science Book Award, Hessen Culture Award, and Turkish Presidential Culture and Arts Award.

Bilim ve Teknik (Science and Technology magazine), January 2019

Şahin İdin

THE SCIENCE HISTORIOGRAPHY OF FUAT SEZGIN

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Ritter was undoubtedly influential in the formation of the scientific thinking of Fuat Sezgin and shaping his identity as a historian of science as a discipline, since they met very early and worked together for a long time. However, it is noteworthy that in almost all of his writings he spoke of another thinker he carefully mentioned. This person whom he calls a close friend and qualifies as a genius is Matthias Schramm. Sezgin states that Schramm developed an understanding of science history based on the principle of "Science history is the common heritage of humanity" and that he has the same view. Without discussing whether this point of view is appropriate for justifying the intellectual heritage of humanity, we must state that the famous science historian George Sarton (1884-1956) laid the foundations for the birth of this proposed idea.

According to Sarton, the progress of humanity is based on the development of positive knowledge and the development of one branch of science is directly related to the development of another. This means unity of knowledge; on the other hand, the development of science depends not on one person but on the common effort of people, which means the unity of humanity; these two units form two aspects of a great truth. In order to fully grasp these qualities of science, a true science historian needs to know at least one Western language, have knowledge of paleography and political history, and have a basic education in natural science. In this respect, Sarton calls the history of science "new humanism" in order to draw attention to how important the studies of science history are. Therefore, Schramm's claim is a generalized version of Sarton's idea.

However, Sezgin mentions that a thinker other than Schramm was more influential in forming his own understanding of science history. That thinker was Joseph-Toussaint Reinaud (1795-1867). According to Reinaud, people do not invent and discover; they just develop. In this context, sciences do not undergo leaps either; they progress gradually and continuously. Thus the task of science historians is to find continuity by finding the missing piece.

This perspective constitutes Sezgin's way of evaluating the history of science. Accordingly, the progress observed in sciences takes place in a linear way. Thus, it is seen that Sezgin did not compliment the well-accepted philosopher of science, Kuhn, who advocates that progress in science is through leaps or revolutions.

When evaluated in the light of these explanations, it is understood that Sezgin adopted an understanding that sees civilization as a whole and sees the young Western civilization as the continuation of Islamic civilization under different geographical and economic conditions. Another point to be mentioned in this context regarding Sezgin's understanding of science history is his adherence to the principle of continuity of scientific studies. In this context, Sezgin stated that Muslims were constantly engaged in obtaining Greek, Indian, Byzantine, and Iranian knowledge until the 9th century, and the phases of assimilating this acquisition phase and producing new information followed. While making these determinations, it was carefully emphasized that every society receiving past information could not contribute to the information or even failed to understand it, but Muslims carried out successful studies until the 16th century.

Stating that there are a few basic rules of scientific development in a society, Sezgin summarized the topic under three headings:

- Determined and intense acquisition and learning of the legacy of past civilizations;
- Support of this process systematically by the state
- The process is not disturbed by religion.

According to him, in order to achieve success after acquisition in this way, it is imperative that the knowledge, experience, and tools received are not only used but also developed in a way that aims to contribute as a part of the new cultural environment.

Sezgin listed the main factors that enabled scientific development in the Islamic world between the 8th and 16th centuries:

- Readiness to take from the past;
- Encouragement of this initiative by religion;
- Support from the state;
- Respect for the other;
- An effective learning system;
- Conducting science and philosophy with a worldly understanding, not a theological one;
- Effective socialization of information;
- Advanced language;
- Advanced philology knowledge to connect with other languages;
- A serious terminology study;
- Development of tools (such as paper and ink) that will ensure the circulation and permanence of information.

Stating that all of these factors dominated the Islamic world between the 8th and 16th centuries and that the decline occurred since the moment they were moved away from, Sezgin's thoughts support the views of scientists and intellectuals such as Al-Kindi, Al-Farabi, İbn Rushd, and Al-Biruni, who lived between the 8th and 14th centuries.

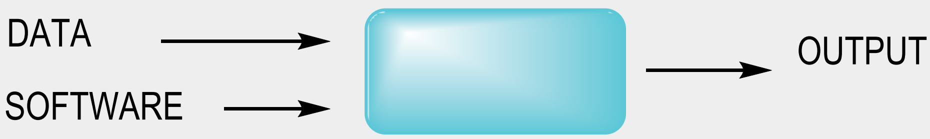
Bilim ve Teknik (Science and Technology magazine), June 2019

Hüseyin Gazi Topdemir

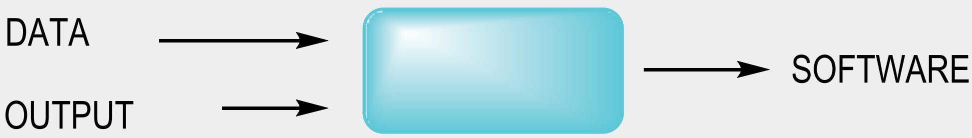
A LIGHT ON DARK REACTIONS

You may have heard that Edison tried thousands of different materials, including human hair, until he found a long-lasting filament for light bulbs. For scientists trying to synthesize new crystals, the situation is not more comforting. Approaches based on trial and error take both time and effort; almost all of the unsuccessful attempts remain confined to the laboratory and dusty notebooks.

Conventional programming



Artificial learning



The laboratory notebooks of scientists trying to synthesize new crystals contain many trials that have yielded little or failed completely. Many changes are made until the chemicals necessary for obtaining the desired product are determined and the physical conditions of the reactions are optimized, and the experiments are repeated many times. Sometimes experiments are successful and sometimes they come to nothing, and laboratory notebooks are filled up and put aside.

Scientific articles mostly report successes, like the biographies of successful people. The unsuccessful results compared to the findings shared in articles are like the hidden part of an iceberg. This information often remains in the minds of scientists as to what works and what does not. It cannot be transferred from one research group to another.

The Dark Reactions Project, which was on the cover of the May 2016 issue of the journal Nature, provided a glimpse of the data that remained in the dark and did not enter the articles. The founders of the project, Haverford College researchers, aimed to accelerate the synthesis of new inorganic–organic hybrid crystals by evaluating the data of experiments with poor or no results.

They used artificial learning algorithms, which are often used in the solution of such complex problems.

The rules for organizing and evaluating data in traditional software are coded in detail. The software is deterministic and the purpose of software development is automation. If the data change over time, the programmer updates these rules to keep the program alive. Software based on artificial learning algorithms examines the data and finds the rules between inputs and outputs.

Pedro Domingos, a researcher at the University of Washington, likens artificial learning algorithms to seeds, data to fertilizer, and programs to plants. The task of the programmer is just like that of a gardener to select algorithms suitable for the purpose and develop the program by applying it to the data sets. As the amount of data encountered by the software increases and diversifies, its predictive power also increases. Just as a chemist working in a laboratory for many years gains experience, the more information about the experiment, the higher the success rate of the software.

In the Dark Reactions project, software has been developed to learn which chemical reactions give crystals in which cases and in which cases they do not. Approximately 4000 successful and unsuccessful reactions were used for this. The rate of estimating whether the developed software will form crystals is quite high: the model correctly predicted the result of the reactions 79% of the time when the chemicals and reaction conditions used in the synthesized crystals were given as input. The researchers also tried the model on vanadium selenite crystals, which had not been previously synthesized. These crystals are compounds formed by vanadium, selenium, and oxygen atoms with small organic molecules, such as amines. In the testing of 500 crystals, the predictive power of a chemist with 10 years of experience in crystal synthesis was 78%, while the artificial learning models were 89% successful. This success shows the role that artificial learning techniques can play in finding new compounds and materials.

Artificial learning techniques provide important advantages especially for scientists dealing with complex data, but they also have disadvantages. The most important of these is that the software does not explicitly reveal the relationships between variables and targeted features and so it is difficult to understand what the machine has learned in a sense. In this case, although the software has a high predictive power, it does not help scientists develop different hypotheses. The Haverford researchers used a decision tree as a solution to this. The decision tree developed is a model of artificial learning that people can understand. With questions such as whether there is oxygen in the crystal in question and whether the acidity level is less than 3 or larger, experiment results can be estimated and different hypotheses can be developed by going along different paths on the decision tree.

The Dark Reactions project is a new source of hope for experiments that were produced in crystal synthesis studies but remained in the dark. If you have failed reactions and want to contribute to the project, you can register at https://darkreactions.haverford.edu/ and add your reactions to the database. Thus, you will shed light on studies that remain in the dark.

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Bilim ve Teknik (Science and Technology magazine), February 2017

Şule Atahan Evrenk

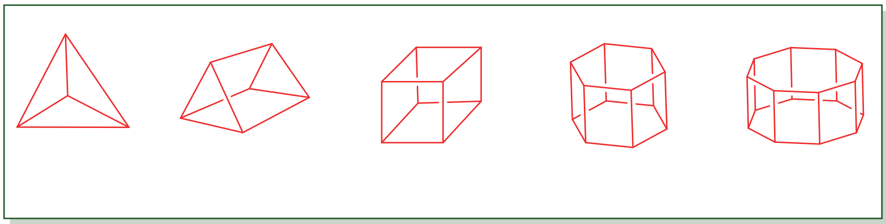
TODAY'S PROBLEM AND YESTERDAY'S ANSWER

Problem 8.

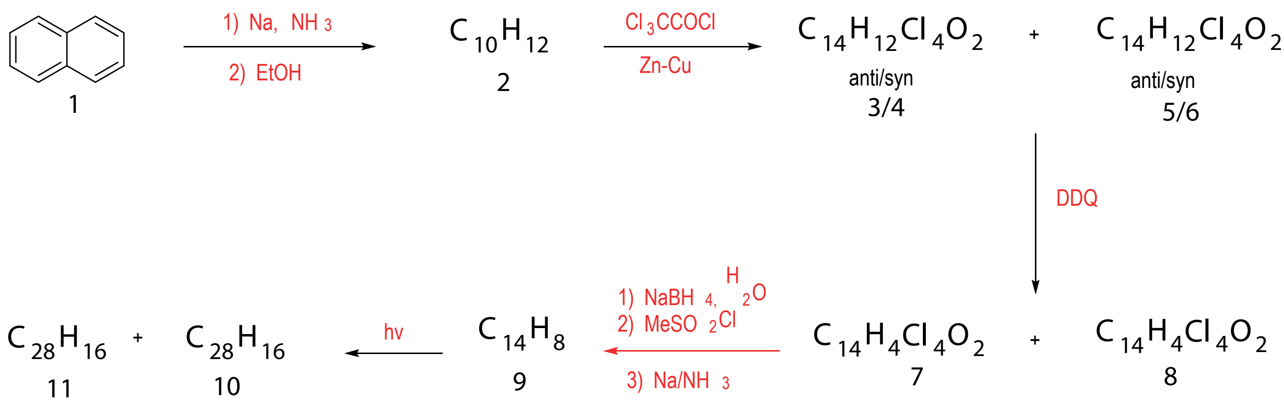
A dream of a Chemistry Olympiad student

The synthesis of lattice-shaped molecules such as **A-E** with uniform geometry has attracted the attention of researchers working in organic chemistry for many years.

Arif Daştan

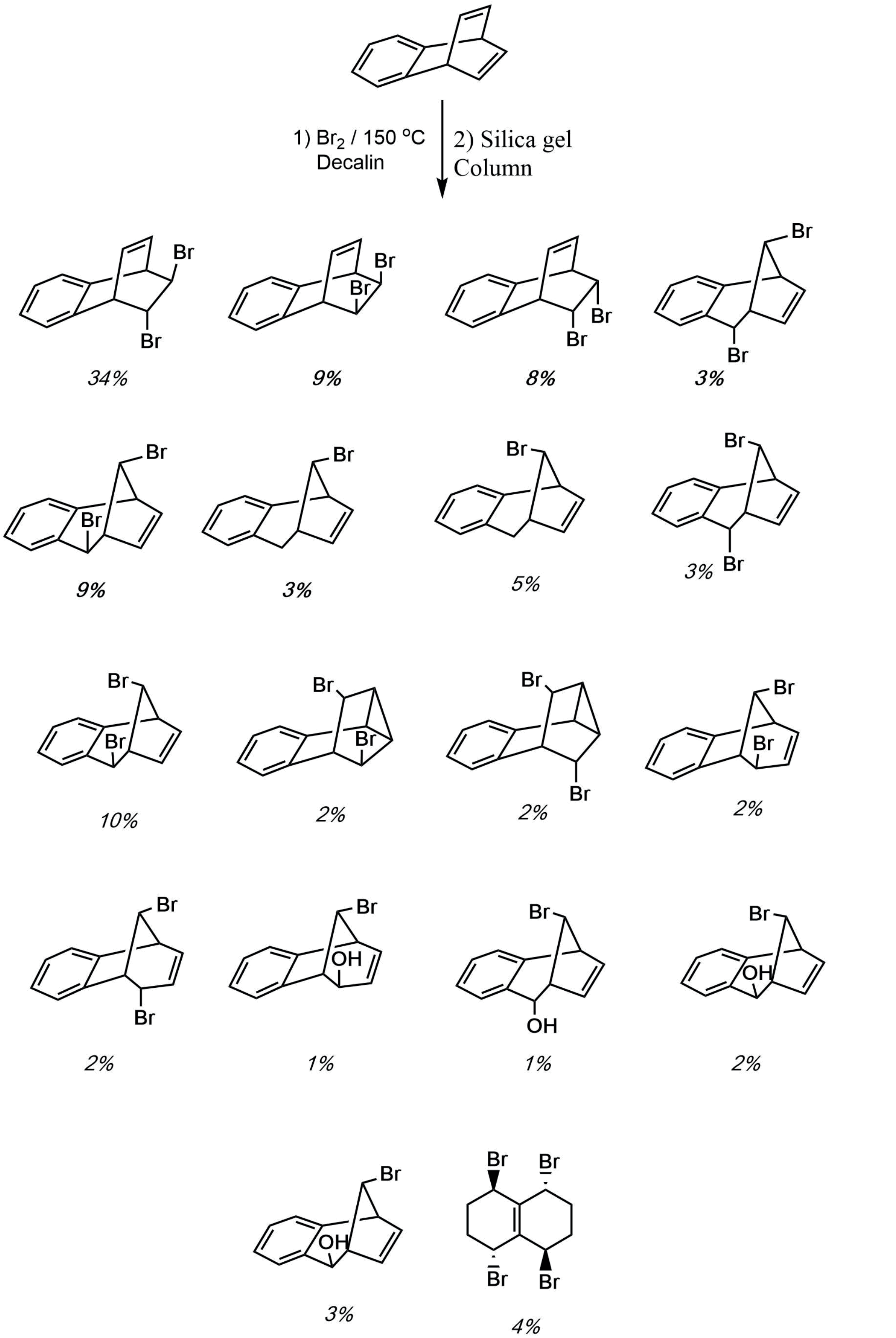


A Chemistry Olympiad student, İbiş, dreams of the synthesis of such a molecule in a lattice structure. For this purpose, İbiş is designing the following synthesis plan. He selects naphthalene (**1**) as its starting molecule. He plans the synthesis of **2** hydrocarbons of formula $C_{10}H_{12}$ by treating naphthalene (**1**) with sodium metal at low temperature (-78 °C) in liquid ammonia and then adding ethyl alcohol to the reaction medium. İbiş predicts that four isomers will be formed in structures **3-6** with the formula $C_{14}H_{12}Cl_4O_2$ by reacting the hydrocarbon **2** with Zn-Cu and trichloroacetyl chloride reagents. The reaction of the isomer mixture (**3-6**) with DDQ is intended to form two isomers (**7/8**) with the formula $C_{14}H_4Cl_4O_2$. The reaction of these two isomers (**7** and **8**), $NaBH_4/H_2O$, methanesulfonyl chloride, and sodium metal in liquid ammonia is expected to result in the formation of a molecule **9** with the formula $C_{14}H_8$. From the photochemical reaction of hydrocarbon **9**, İbiş's dream is to form hydrocarbon number **10** in the lattice structure, as well as isomeric hydrocarbon **11** with anti-configuration.



Find the structures of molecule **10** in the dream of the Chemistry Olympiad student İbiş and the isomer **11** that would be formed from this reaction plan.

Solution Problem 7.

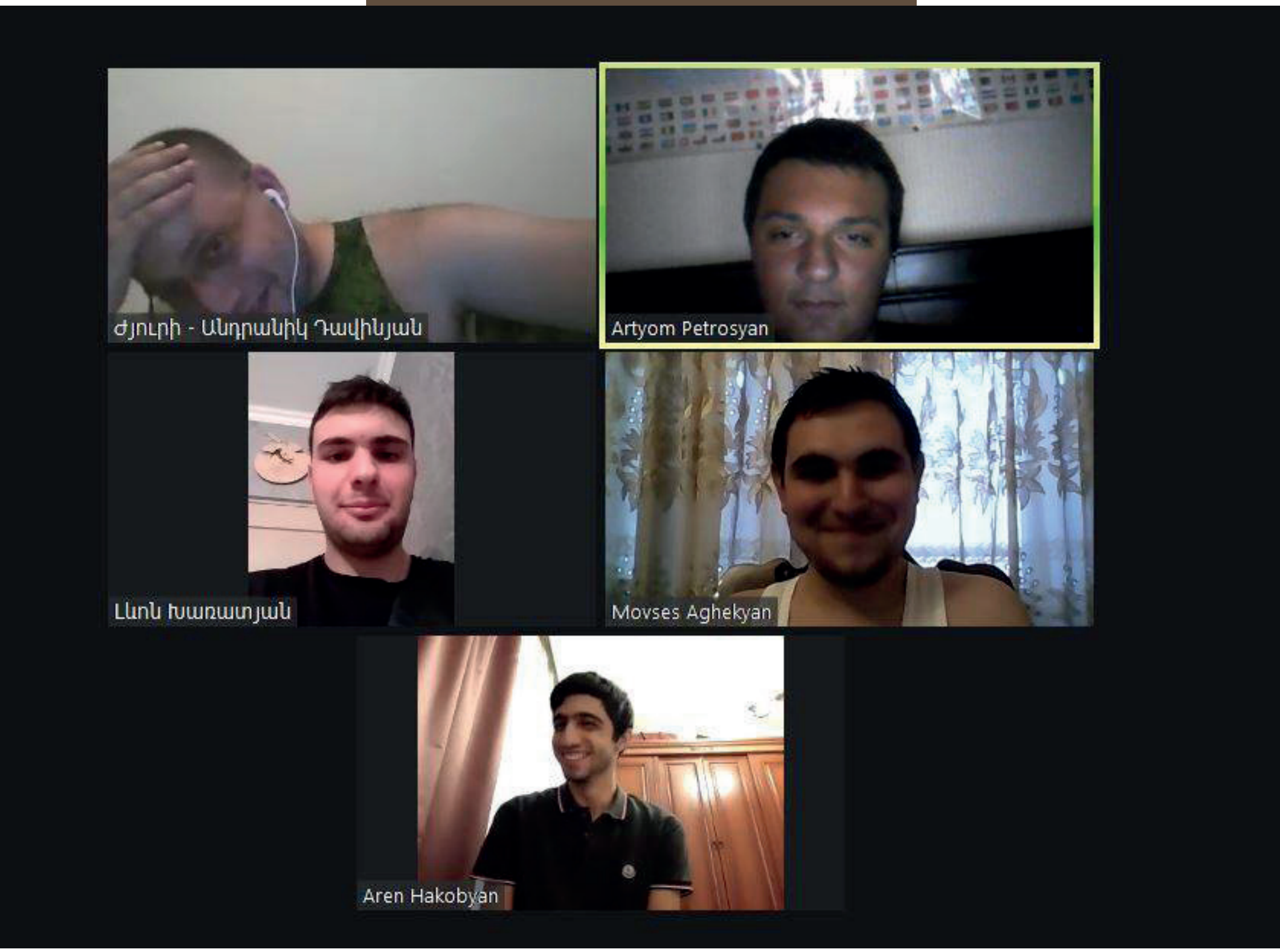


Dastan, A., Balci, M. et. al. Tetrahedron 1994, 50, 10555-10578.

NEWS FROM NATIONAL TEAMS OF COUNTRIES

ARMENIA

We are just discussing preparatory problems.



CHINESE TAIPEI

Room F322 is the room for the Chinese Taipei team.

NETHERLANDS

Picture of the theoretical exam of the Dutch team.

PAKISTAN

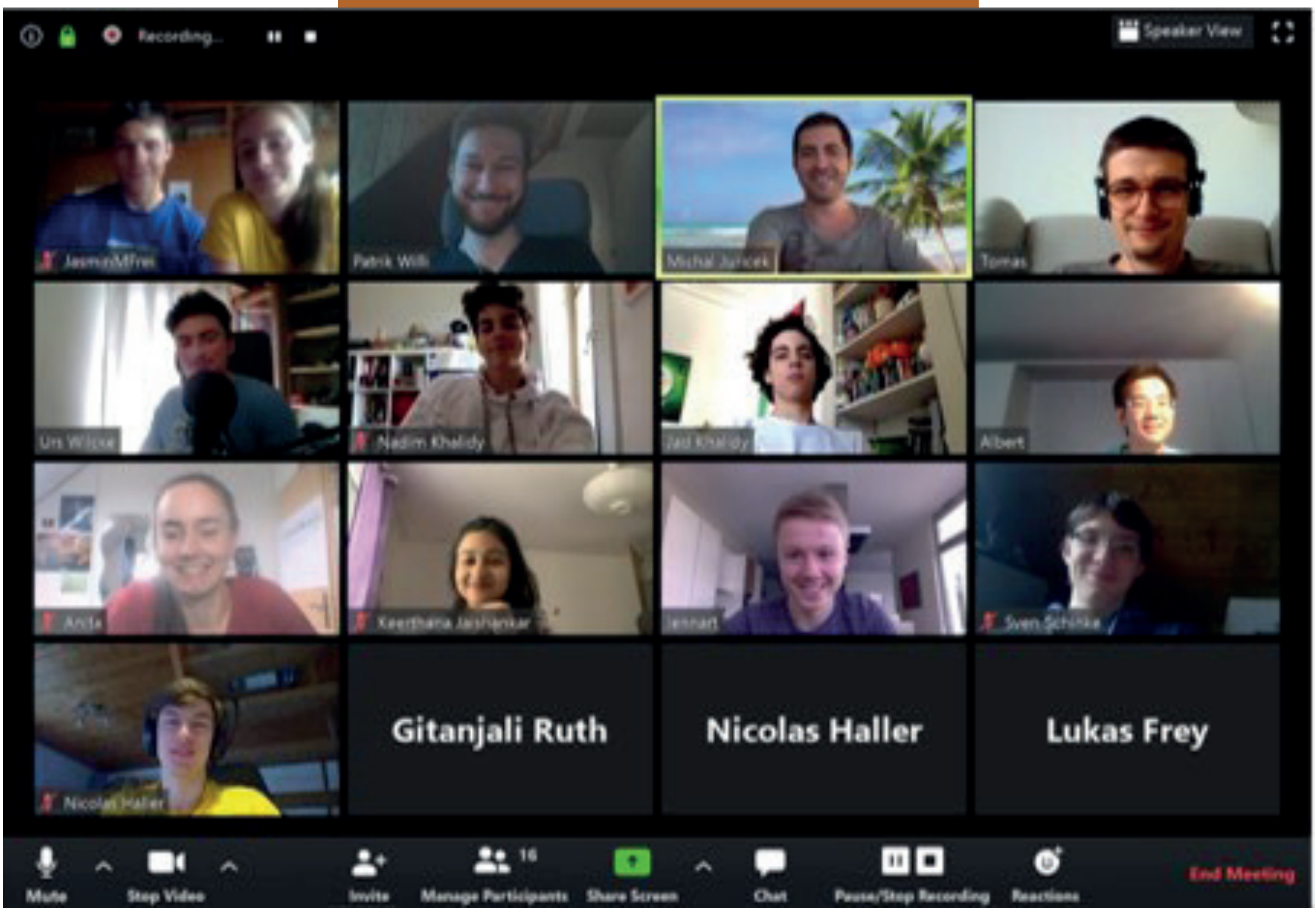
Group Photo with 50 top student out of 5000 thousand.

SINGAPORE

The only possible mode for training the team - Zoom!

SWITZERLAND

Swiss preparatory weekend at the end of March hosted by the University of Zurich.



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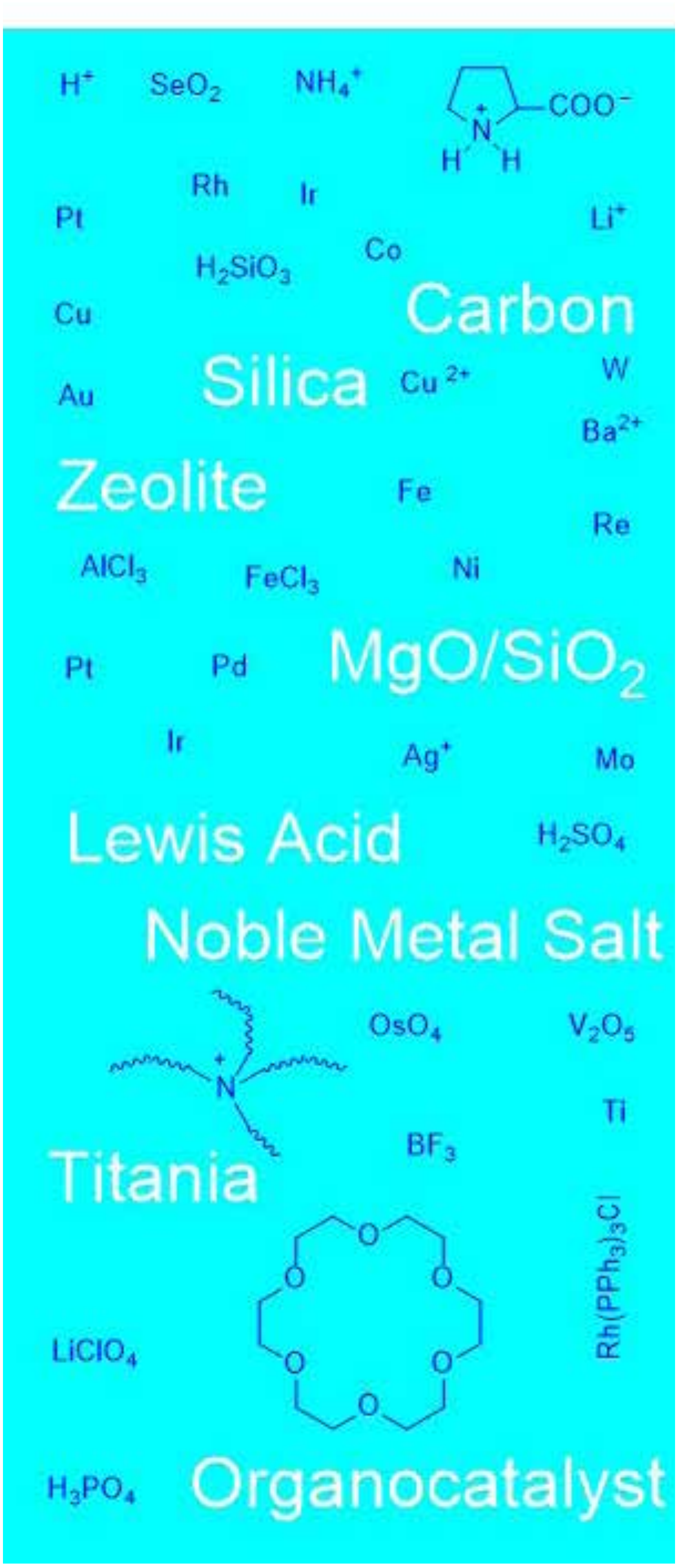
52nd IChO 2020
INTERNATIONAL CHEMISTRY OLYMPIAD

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.

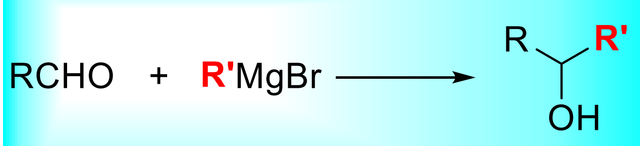
Organometallic compounds are widely used both stoichiometrically and as catalysts to increase the rates of organic reactions, where target molecules include polymers, pharmaceuticals, and many other types of practical products.

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

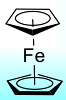
1963 Nobel Prize: Karl Ziegler and Giulio Natta

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.

$$n\ CH_2{=}CHR \xrightarrow{\text{Cat.}} [\text{-}CH_2\text{-}CHR]n$$

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).



Ferrocene

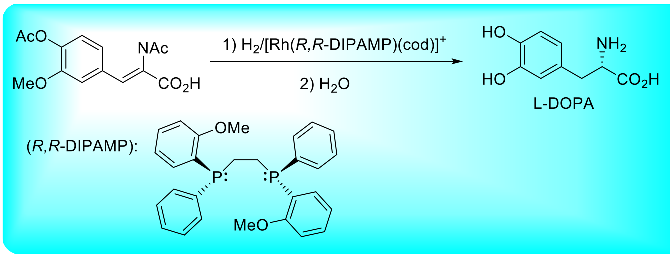
1981 Nobel Prize: Roald Hoffmann and Kenichi Fukui

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

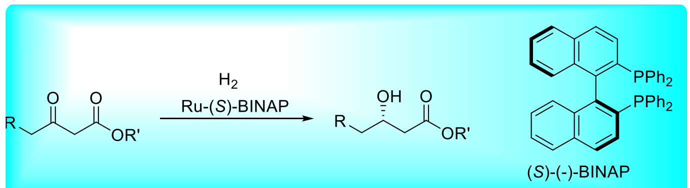
2001 Nobel Prize: W. S. Knowles, R. Noyori, and Karl Barry Sharpless

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".

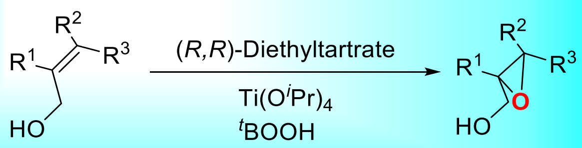
Knowles developed an enantioselective hydrogenation step for the production of L-DOPA—a naturally occurring compound, a psychoactive drug—utilizing a chiral rhodium complex, when he was working for the Monsanto Company. This was the first application of enantioselective metal catalysis to industrial-scale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



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



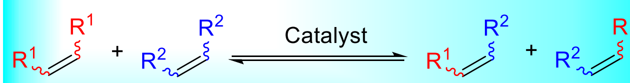
One of Sharpless's most groundbreaking discoveries is named after him, Sharpless epoxidation, in which it is possible to synthesize enantiomerically pure epoxides from allyl alcohols.



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

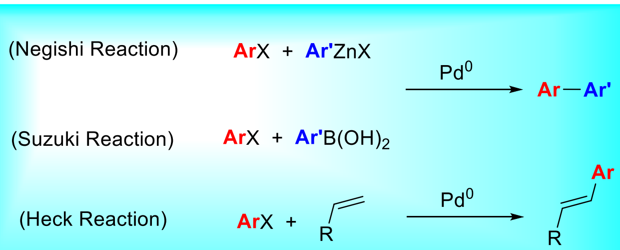
For the development of metal-catalyzed alkene metathesis.

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

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.

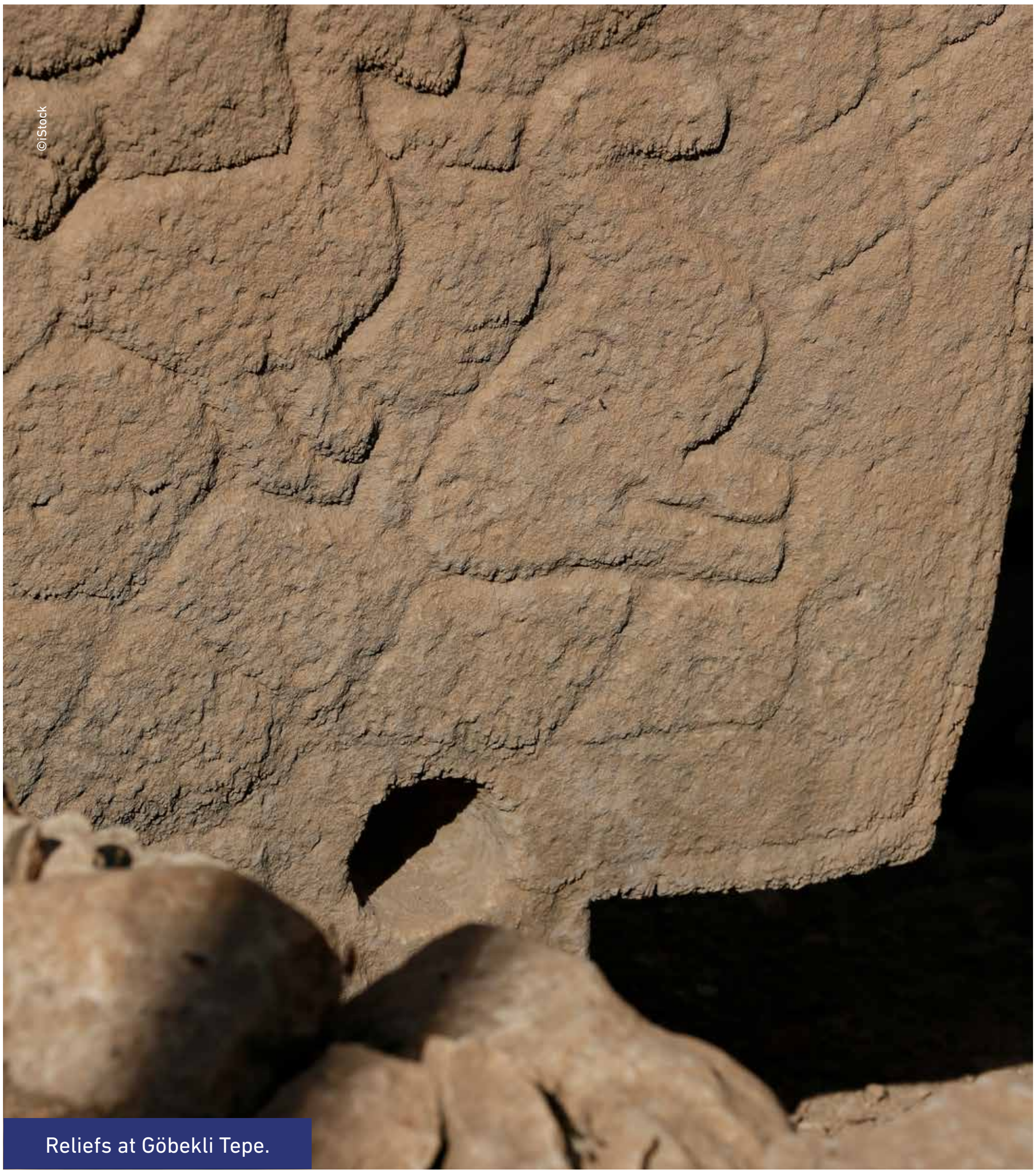
According to scientists' evaluations, these crowded groups of people that gathered at Göbekli Tepe for worship, as well as exhibiting advanced social activities such as socializing, organizing, exchanging information, and exchanging goods, created the first food production and storage needs in the history 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.

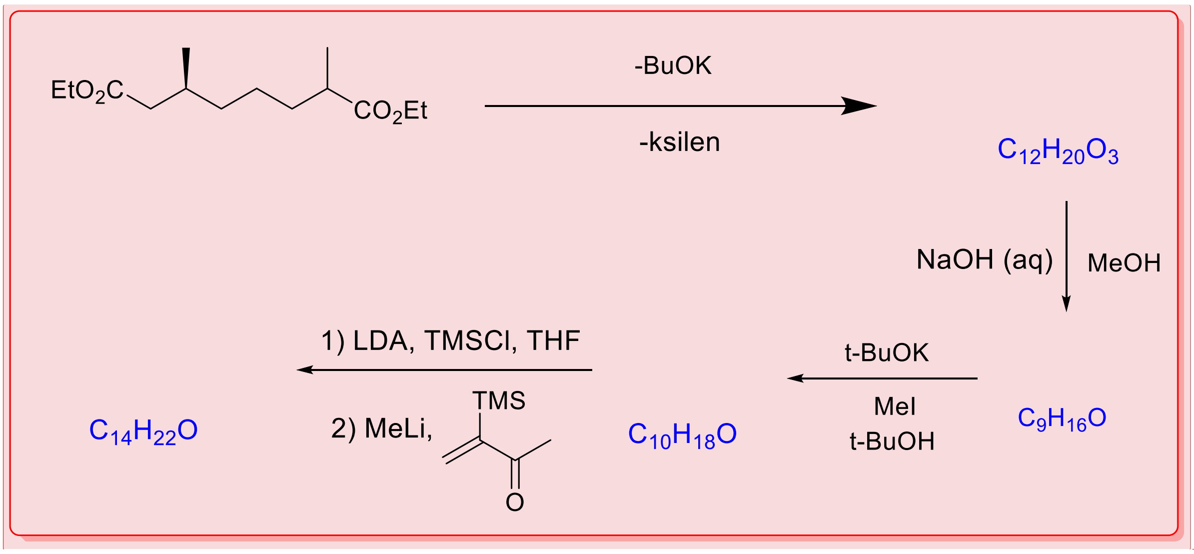
Pheromones are chemical scents that insects use for communication. They are organic compounds with a different structure for each type of insect that are secreted by female insects to allow the male to find the female. We can also describe pheromones as perfumes that females secrete in order to attract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

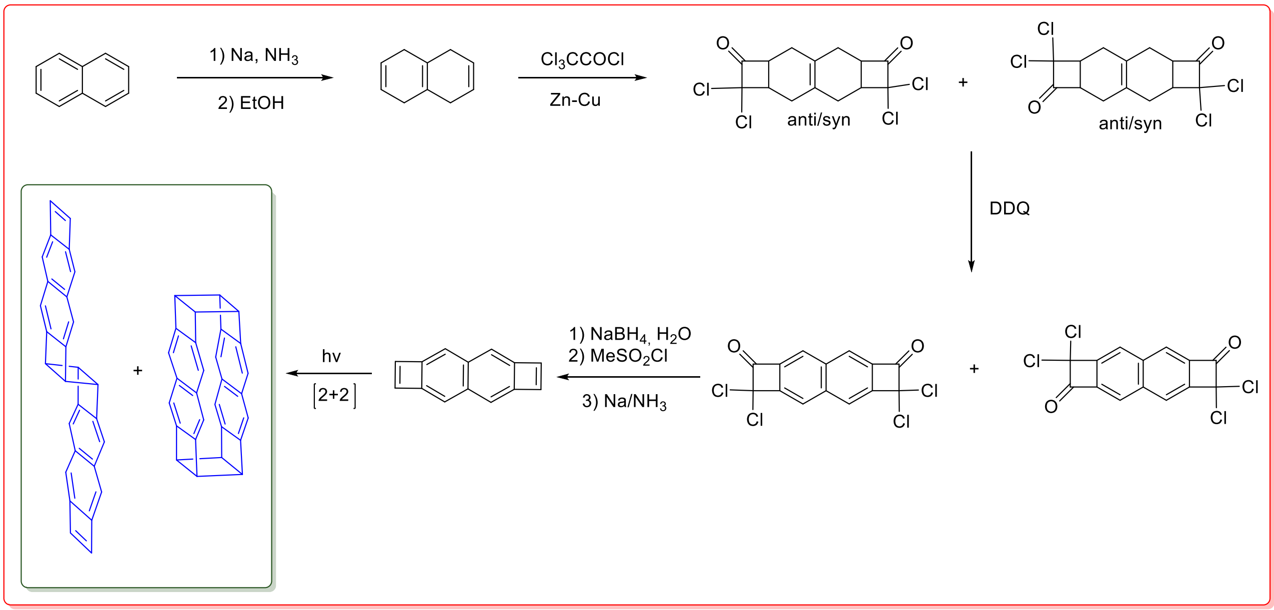
Arif Daştan

Problem

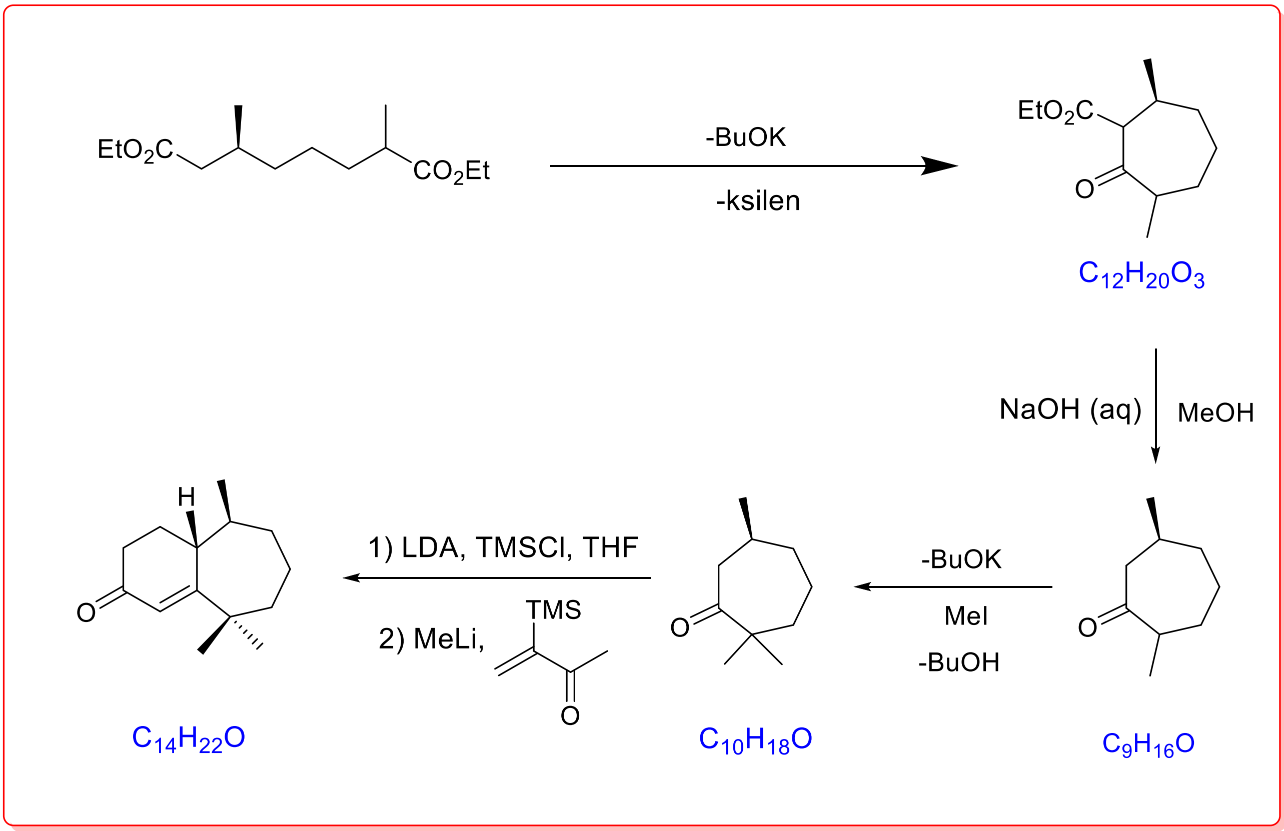
The molecule shown below with the symbol **E** is the pheromone of the *Aphthona flava* vegetable pest from the beetle class. The total synthesis of this natural product, isolated from the female of *Aphthona flava*, in the laboratory with molecule **A** consists of the reaction steps shown below. Draw 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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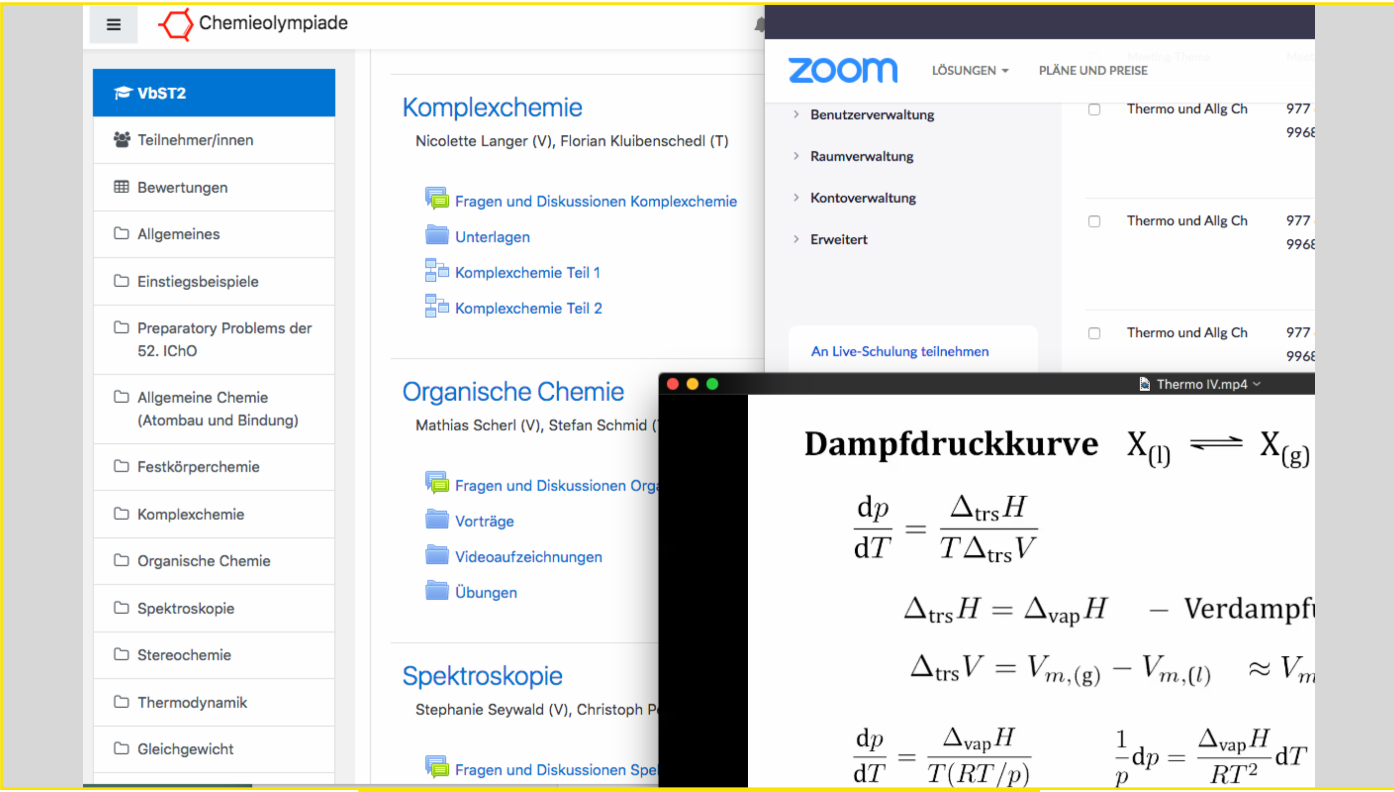

AUSTRIA

Moodle, Zoom and mp4 - Austrian Preparation with COVID 19

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COUNTRIES

BULGARIA

Georgi, Teodor, Pavel, Damyan

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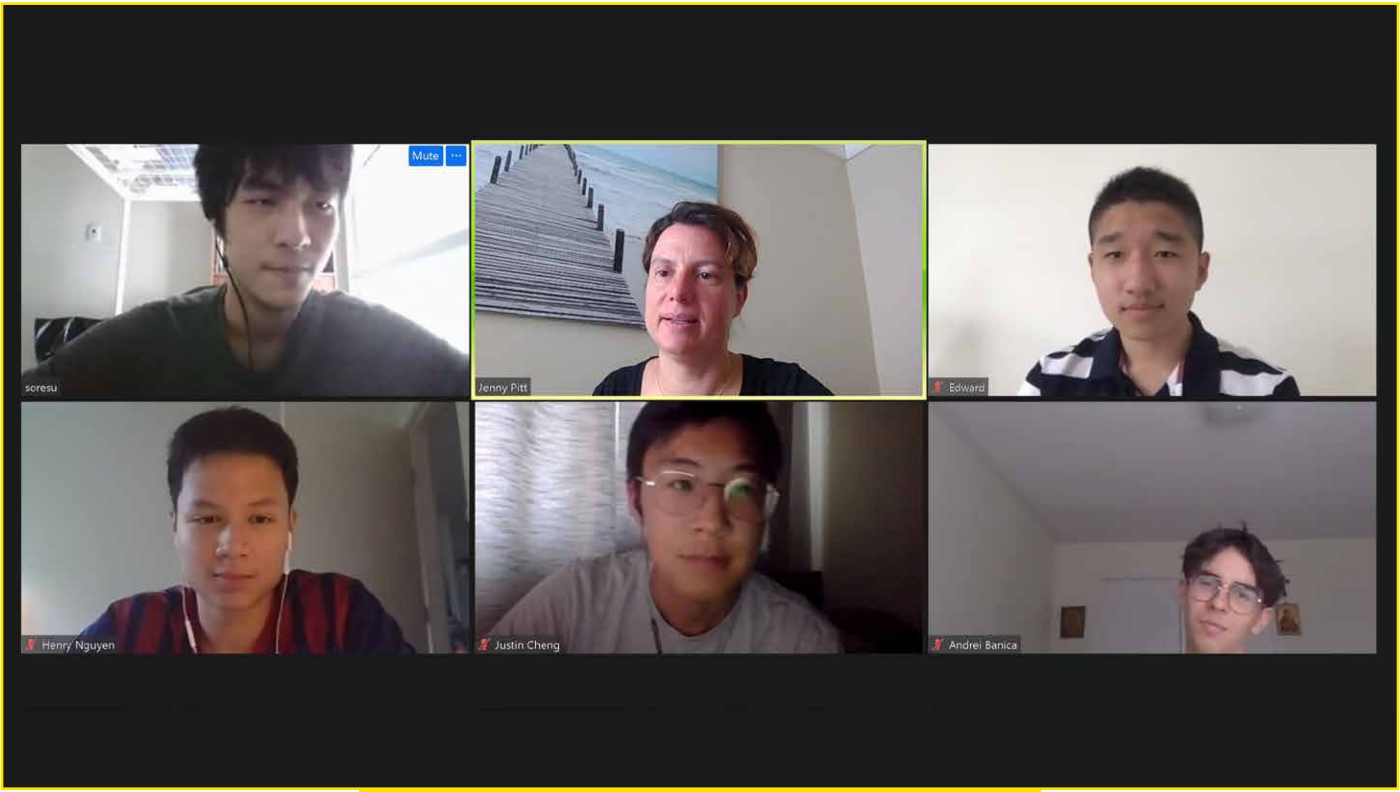
COUNTRIES



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

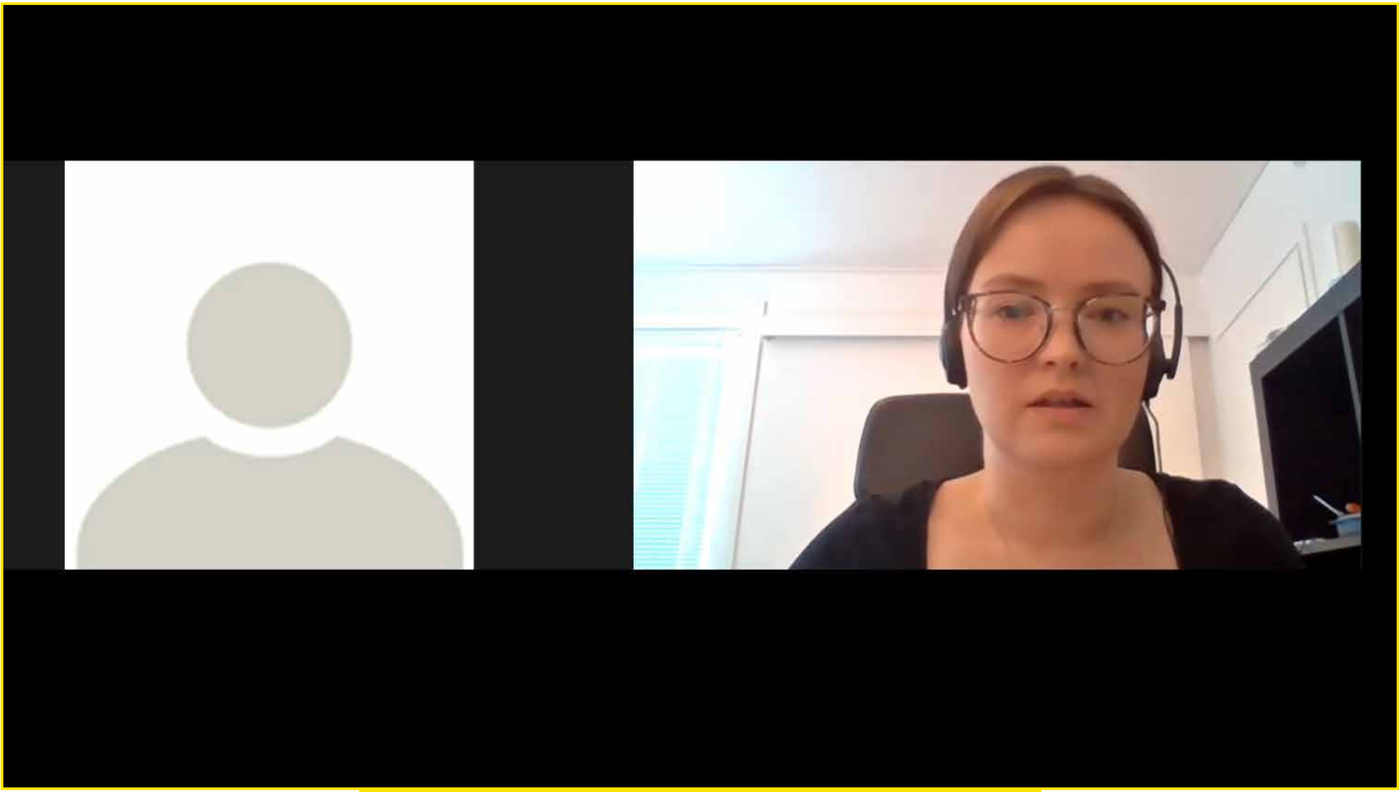
A day in lab

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 COUNTRIES



FINLAND

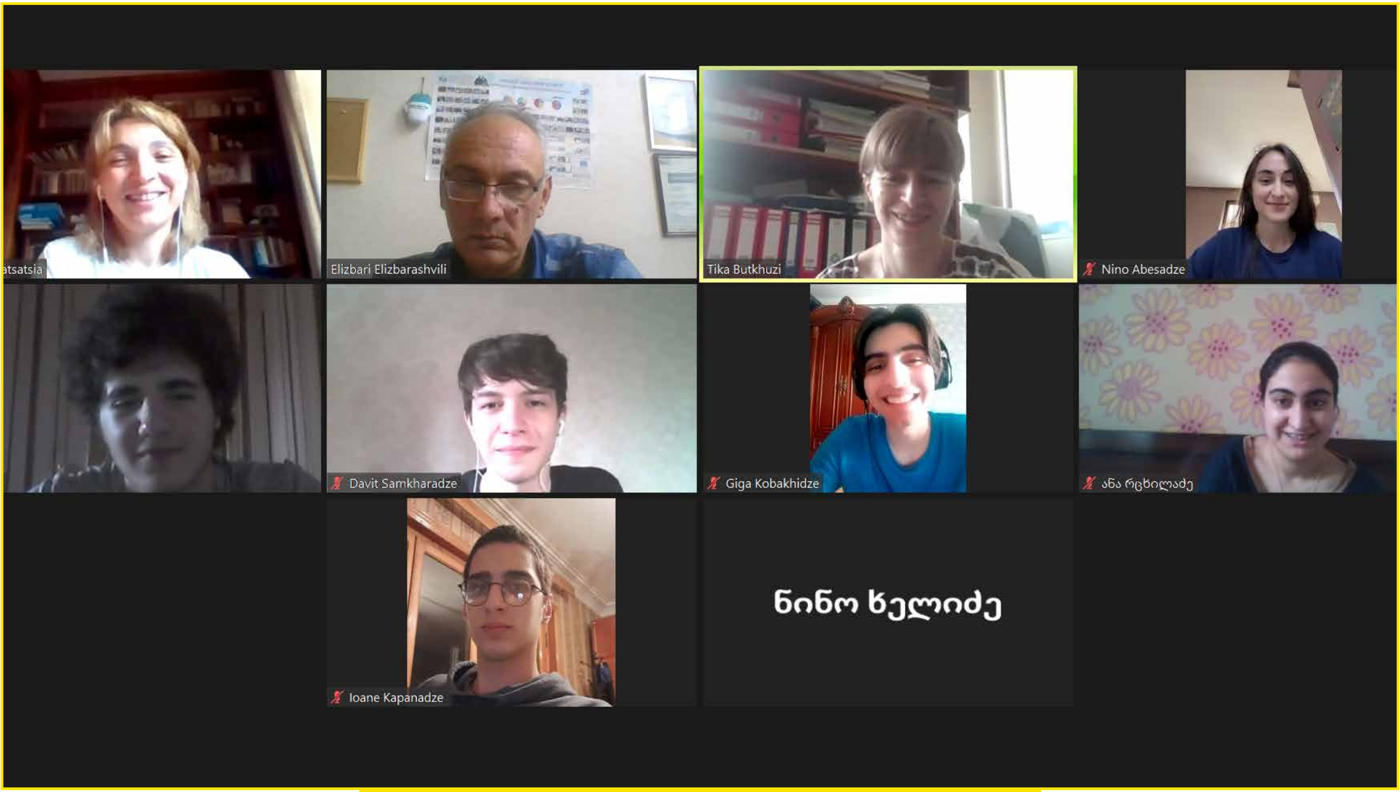
National preparations for IChO in Finland 2020

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 COUNTRIES

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

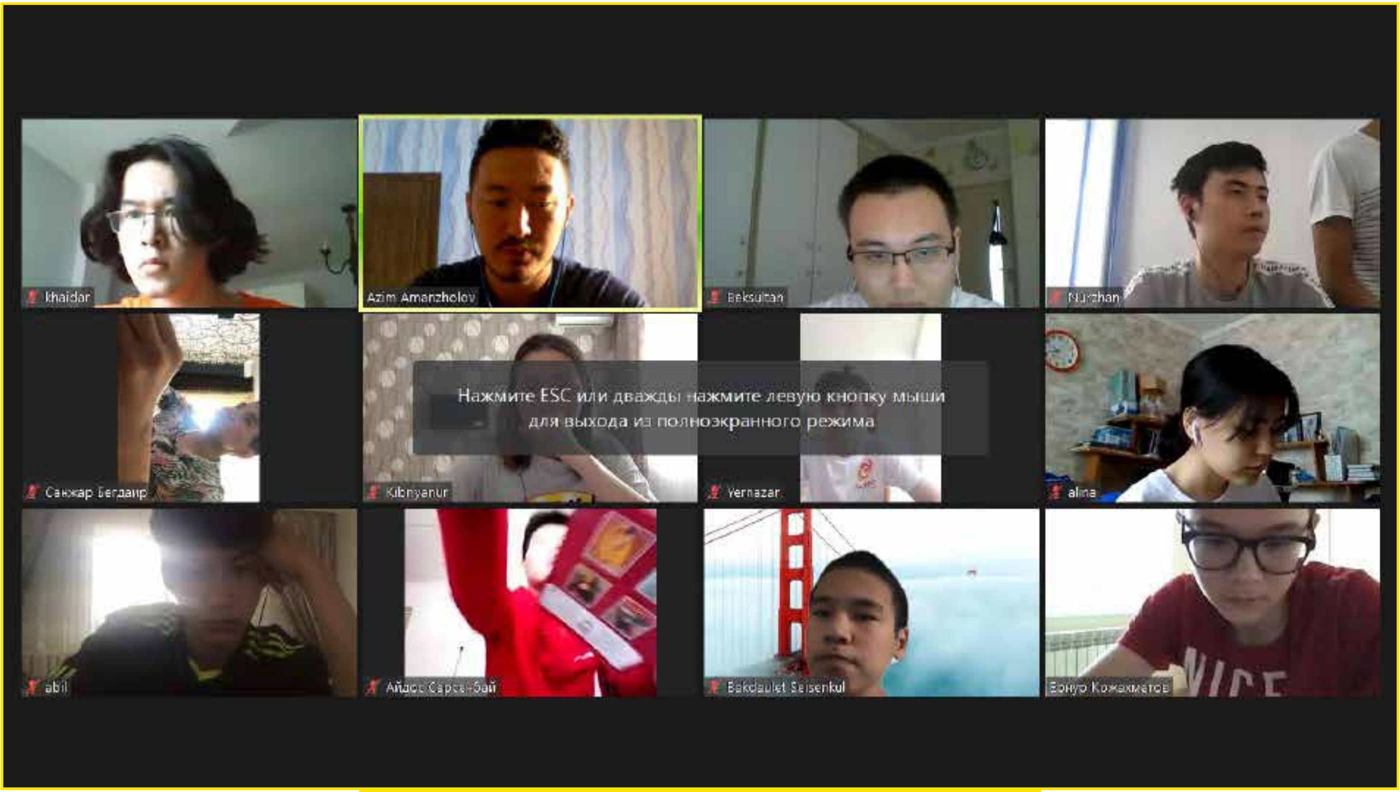
A quick coffee break between the Round 1 examinations!

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

JAPAN

Scene of domestic qualifying.

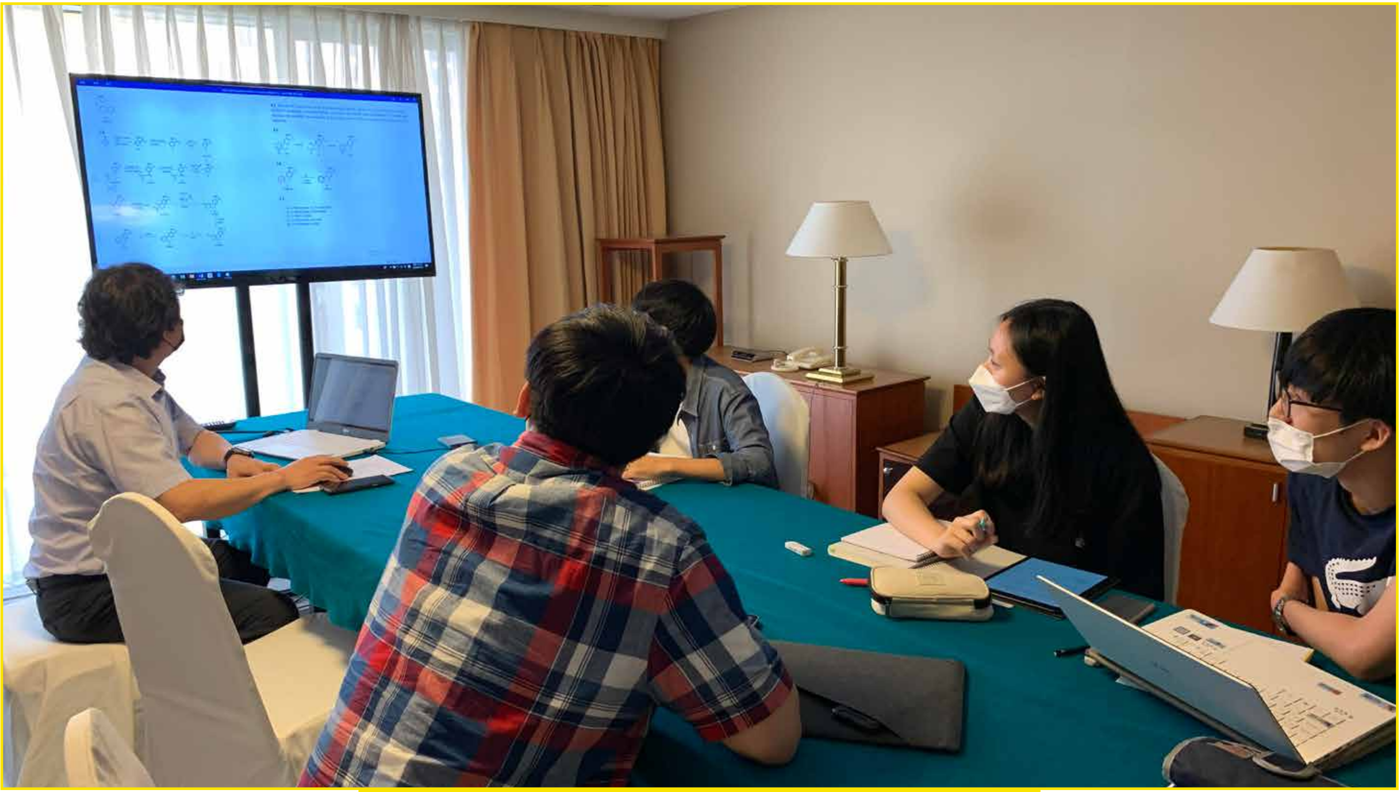
NEWS FROM NATIONAL TEAMS OF COUNTRIES



KAZAKHSTAN

Candidates to national team and was prepared in too strong condition

NEWS FROM NATIONAL TEAMS OF COUNTRIES



KOREA

This is a photo of intensive training for IChO.

NEWS FROM
NATIONAL TEAMS OF
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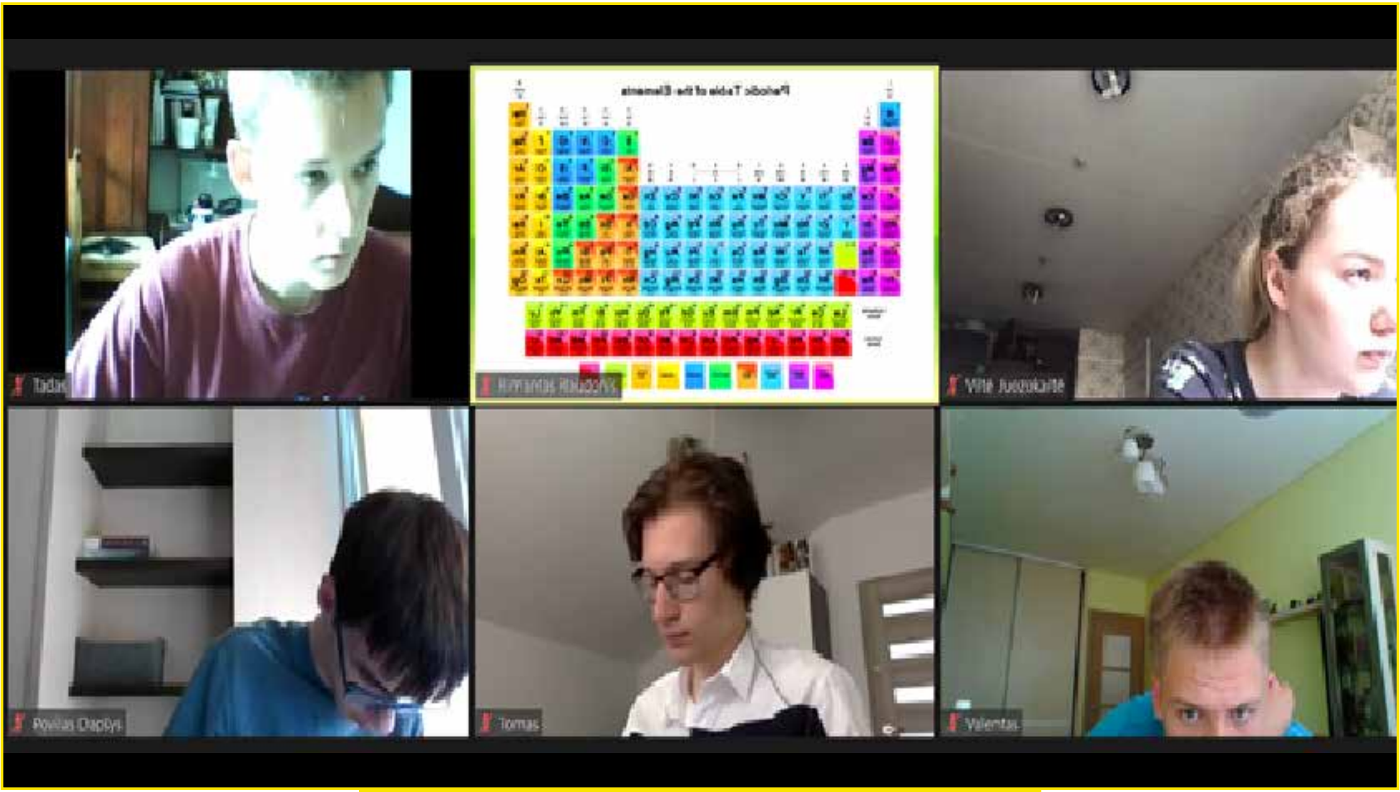


LITHUANIA

Olympiad during pandemic

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

MEXICO

Mexican selection training

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

PHILIPPINES

Philippine National Chemistry Olympiad

NEWS FROM
NATIONAL TEAMS OF
COUNTRIES

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

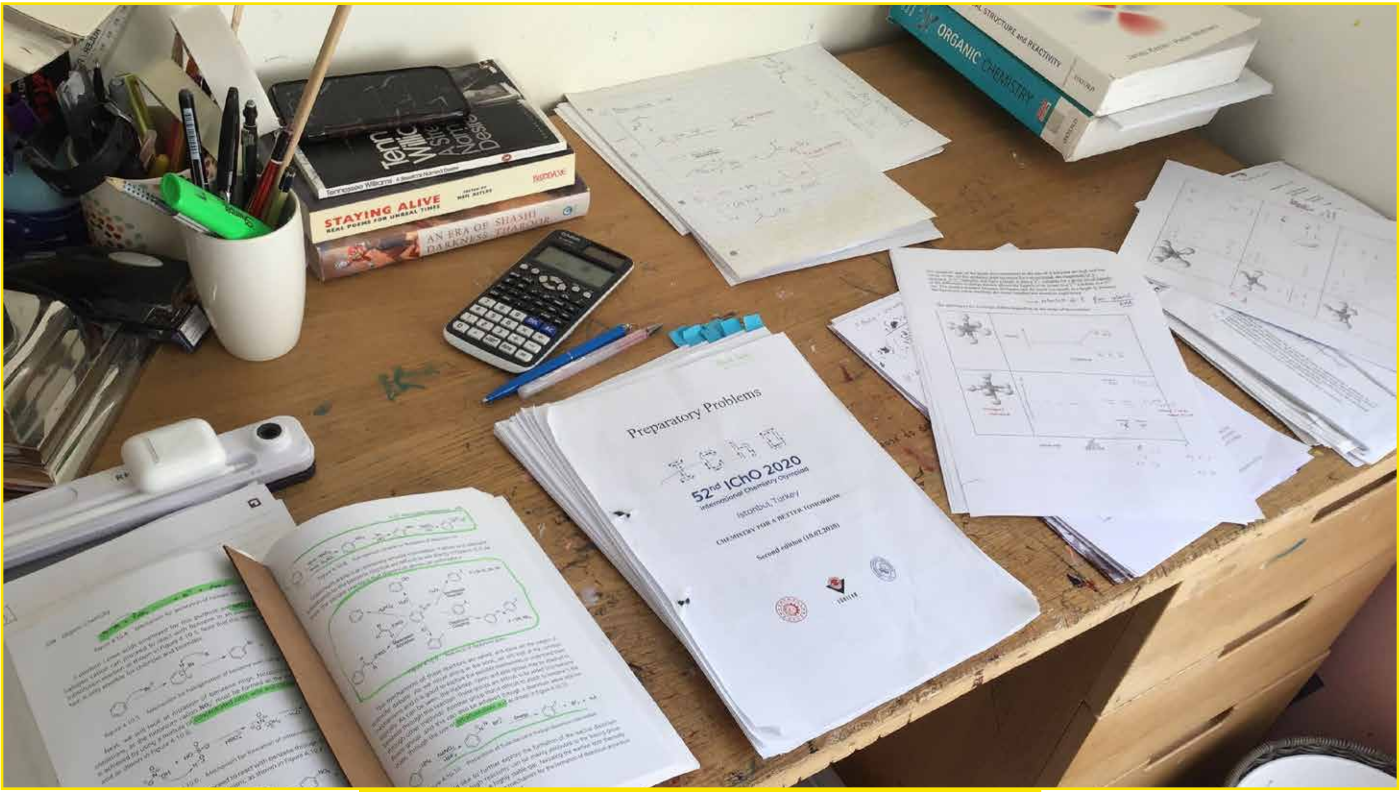
Ready for the Competition. Thailand Fighting.

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

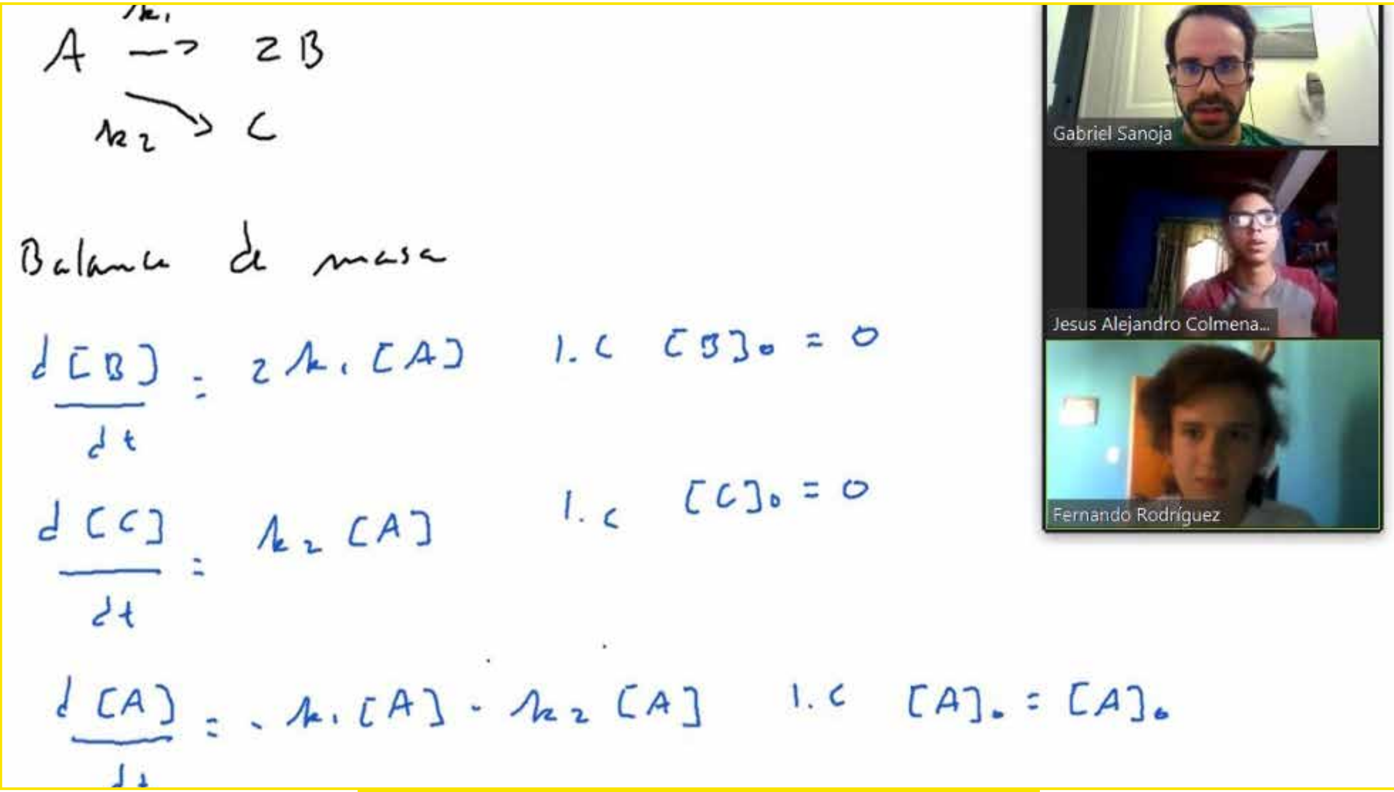
This the Uruguayan delegation which has been preparing for IChO by a digital way

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 NATIONAL TEAMS OF COUNTRIES

VIETNAM

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

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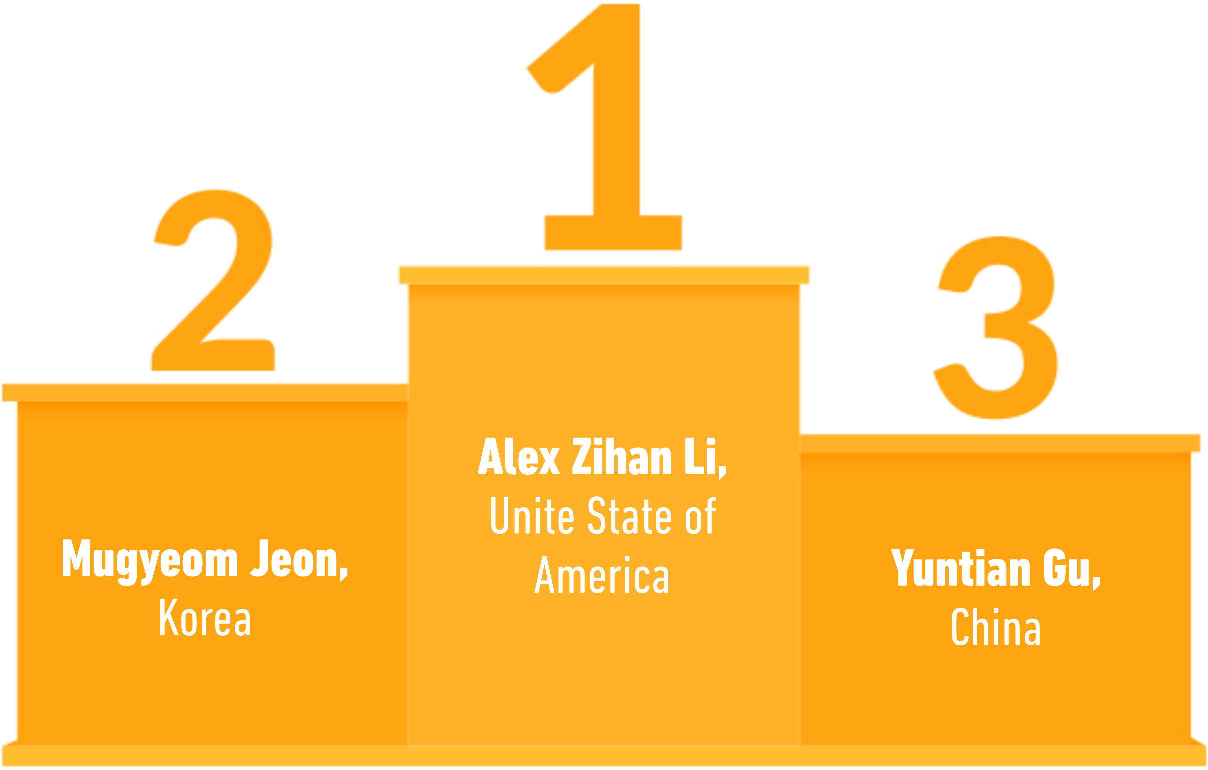
52nd IChO 2020

International Chemistry Olympiad

Istanbul, Turkey

IChO 2020 RESULTS

Best Of IChO



GOLD MEDAL

Rank	Name	Surname	Country	Total	Medal
1	Alex Zihan	Li	United States of America	99,07	gold
2	Mugyeom	Jeon	Korea	98,60	gold
3	Yuntian	Gu	China	98,07	gold
4	Zhuo Yang	Zhang	China	97,07	gold
5	Dang Hai	Ly	Vietnam	96,97	gold
6	Letian	Li	China	96,55	gold
7	Şebnem	Gül	Turkey	96,48	gold
8	Alec Chen	Zhu	United States of America	95,98	gold
9	Duong Hoang	Nguyen	Vietnam	94,08	gold
10	Mohammad Shahabaddin	Daneshvar	Iran	93,51	gold
11	Jan	Oboril	Czech Republic	93,23	gold
12	Ananthan	Sadagopan	United States of America	92,98	gold
13	Agustin Alejandro	Lorusso Notaro Francesco	United Kingdom	92,71	gold
14	Sean	Leong	Singapore	92,62	gold
15	Anh Quoc Trung	Pham	Vietnam	92,50	gold
16	Heng-Jui	Chang	Chinese Taipei	92,42	gold
17	Junha	Hong	Korea	92,15	gold
18	Deniz	Güner	Turkey	92,15	gold
19	Ilia Dmitrievich	Chaika	Russian Federation	92,11	gold
20	Richard Yanzhou	Huang	Australia	92,01	gold
21	Shih Peng	Huang	Chinese Taipei	91,99	gold
22	Trang Minh Thi	Dam	Vietnam	91,38	gold
23	Charles Jordi	Windle	Singapore	91,31	gold
24	Anugrah George	Chemparathy	United States of America	91,29	gold
25	Jovan	Liau	Singapore	90,92	gold
26	Roi	Peer	Israel	90,35	gold

SILVER MEDAL

Rank	Name	Surname	Country	Total	Medal
27	Meng-Fu	Chen	Chinese Taipei	89,89	silver
28	Tomasz Jan	Slusarczyk	Poland	89,85	silver
29	Junha	Park	Korea	89,61	silver
30	Teng Wei	Ngwan	Singapore	89,59	silver
31	Mirakbarov Xodjiakbar O G Li	Mirumid	Uzbekistan	89,27	silver
32	Haonan	Sun	China	88,91	silver
33	Jan	Vavrin	Czech Republic	88,90	silver
34	Ygor De Santana	Moura	Brazil	88,73	silver
35	Evgeniy Yurievich	Epifanov	Russian Federation	88,67	silver
36	Chien-Yi	Wu	Chinese Taipei	88,34	silver
37	Nikita	Zoglo	Estonia	88,23	silver
38	Magdalena	Lederbauer	Austria	87,02	silver
39	Worawit	Tangamornchaipattana	United Kingdom	86,95	silver
40	Maximilian	Mittl	Germany	86,43	silver
41	Mohammadaryan	Taghvaeearabi	Iran	86,20	silver
42	Kamil	Kubanychbek	Kyrgyzstan	85,44	silver
43	Vasilisa Vadimovna	Kislitsyna	Russian Federation	84,98	silver
44	Ayça Melis	Keskin	Turkey	83,95	silver
45	Alexander Ramsey	Thow	United Kingdom	83,34	silver
46	Ron	Shprints	Israel	83,31	silver
47	Akito	Ai	Japan	83,23	silver
48	Maximilian	Spitaler	Austria	82,66	silver
49	David	Benko	Hungary	82,49	silver
50	Bar	Sheffer	Israel	81,80	silver
51	Levon	Kharatyan	Armenia	81,15	silver
52	Dilshodakhon Kamolkhon Kizi	Isaeva	Uzbekistan	81,04	silver
53	Minjeong	Lee	Korea	80,45	silver
54	Martin	Brokes	Slovakia	80,37	silver
55	Filip	Koldzic	Serbia	80,35	silver
56	Ayşe İrem	Durmuş	Turkey	80,29	silver
57	Wasin	Tiarawut	Thailand	80,20	silver
58	Rtvik	Patel	United Kingdom	80,00	silver
59	Yuma	Yoshida	Japan	79,72	silver
60	Ramin	Assempour	Iran	79,61	silver
61	Zarko	Ivkovic	Serbia	79,42	silver
62	Michael Cole Moises	Tantoco	Philippines	79,27	silver
63	Viktor Gennadievich	Nosov	Russian Federation	79,16	silver
64	Filip	Hulek	Czech Republic	78,99	silver
65	Chananthorn	Arssiri	Thailand	78,51	silver
66	Ivan Candra	Gunawan	Indonesia	78,49	silver
67	Jirapat	Rujirayuk	Thailand	78,48	silver
68	Khanim	Yagublu	Azerbaijan	78,43	silver
69	Frederik Laurin	Walter	Germany	78,40	silver
70	Abhichaya	Tungwongkitsiri	Thailand	78,39	silver
71	Jovan	Markovic	Serbia	77,98	silver
72	Rinako	Hayashi	Japan	77,97	silver
73	Reo	Shibayama	Japan	77,92	silver
74	Mark	Soesanto	Indonesia	77,49	silver
75	Damyan Stoyanov	Frantzov	Bulgaria	77,30	silver
76	Filipp	Petuhhov	Estonia	77,08	silver

BRONZE MEDAL

Rank	Name	Surname	Country	Total	Medal
77	Michal Piotr	Lipiec	Poland	75,47	bronze
78	Linus Albert	Schwarz	Germany	75,40	bronze
79	Caleb Hsien-Yen	Hsiung	Australia	75,03	bronze
80	Kevin Arturo	Urrutia Alvarez	El Salvador	74,89	bronze
81	Amir	Mahboubi	Iran	74,75	bronze
82	Hung	Nguyen	Canada	74,13	bronze
83	Pedro Yudi	Honda	Brazil	73,80	bronze
84	Khaidar	Kairbek	Kazakhstan	73,38	bronze
85	Azhdar	Farzullazade	Azerbaijan	73,00	bronze
86	Steven	William	Indonesia	72,93	bronze
87	Osama	Alali	Saudi Arabia	72,73	bronze
88	Uvindu Praveen	Sumanasekara	Sri Lanka	72,63	bronze
89	Thiago Jose Veloso	De Souza	Brazil	71,65	bronze
90	Pavel Atanasov	Nikolov	Bulgaria	71,11	bronze
91	Istvan David	Ficsor	Hungary	70,62	bronze
92	Adam Szymon	Sukiennik	Poland	70,27	bronze
93	Fernando Juan Jose	Rodriguez	Venezuela	70,01	bronze
94	Abilmansur	Muzhubayev	Kazakhstan	69,68	bronze
95	Nathan Wayne Fontanilla	Ariston	Philippines	69,08	bronze
96	Kamil	Mambetov	Kyrgyzstan	68,73	bronze
97	Teodor Svilenov	Maslyankov	Bulgaria	68,43	bronze
98	Stefan Marcus Ang	Ong	Philippines	68,27	bronze
99	Samuel	Novak	Slovakia	68,08	bronze
100	Andrej	Kovacs	Slovakia	67,86	bronze
101	Shahzod	Nazirov	Tajikistan	67,60	bronze
102	Davi Medeiros Fortunato	Catanhede	Brazil	67,50	bronze
103	Wojciech Jan	Michalski	Poland	66,81	bronze
104	Vasilije	Pantelic	Serbia	66,21	bronze
105	Ioannis	Karageorgiou	Greece	66,03	bronze
106	Dzonatans Miks	Melgalvis	Latvia	66,01	bronze
107	Nursultan	Soodonbekov	Kyrgyzstan	65,73	bronze
108	Bakdaulet	Seysenkul	Kazakhstan	65,67	bronze
109	Filips	Ecis	Latvia	65,58	bronze
110	Arulanantham	Abbinanthan	Sri Lanka	65,46	bronze
111	Ursa	Konda	Slovenia	65,24	bronze
112	Aleksandar	Trajkovski	North Macedonia	64,75	bronze
113	Jakub	Schimmer	Czech Republic	64,71	bronze

BRONZE MEDAL

Rank	Name	Surname	Country	Total	Medal
114	Povilas	Dapsys	Lithuania	64,61	bronze
115	Anete Patricija	Raiskuma	Latvia	63,57	bronze
116	Ward	Yahya	Israel	63,05	bronze
117	Bulcsu	Fajszi	Hungary	61,77	bronze
118	Rifqi Naufal	Abdjul	Indonesia	61,76	bronze
119	Tom Erik	Steinkopf	Germany	61,40	bronze
120	Mohammad	Bilal	Syria	61,33	bronze
121	Kibriyanur	Abdugafarova	Kazakhstan	61,18	bronze
122	Artyom	Petrosyan	Armenia	61,10	bronze
123	Karam	Khaddour	Syria	60,81	bronze
124	Maciej Krzysztof	Swiatek	Austria	60,75	bronze
125	Gerardo Manuel	Ramirez Valladares	El Salvador	60,47	bronze
126	Andrei Mihai	Banica	Canada	60,21	bronze
127	Abdulaziz	Aljuaid	Saudi Arabia	59,77	bronze
128	Edvards Mikelis	Mezciems	Latvia	59,66	bronze
129	Ghayrat	Samiev	Tajikistan	58,66	bronze
130	Eyad	Alsalhi	Saudi Arabia	58,17	bronze
131	Jasmin Maria	Frei	Switzerland	58,08	bronze
132	Justin Qi Hua	Cheng	Canada	57,49	bronze
133	Ravindu Sanwara	Rathnayake	Sri Lanka	57,43	bronze
134	Mohammad	Alhudaithi	Saudi Arabia	57,24	bronze
135	Sariena	Ye	Australia	57,19	bronze
136	Laurens	Smulders	Netherlands	56,90	bronze
137	Nicholas Jiawei	Wu	Australia	56,82	bronze
138	Georgi Neliyanov	Nedyalkov	Bulgaria	56,51	bronze
139	Matus	Tomc□o	Slovakia	56,28	bronze
140	Abraham	Antonio Pineda	Mexico	56,17	bronze
141	Firdavs	Sobirov	Uzbekistan	56,16	bronze
142	Istvan Attila	Garamvolgyi	Hungary	56,08	bronze
143	Humberto	Tovar Salazar	Mexico	55,79	bronze
144	Lukas	Rost	Austria	55,54	bronze
145	Valentas	Olikauskas	Lithuania	55,29	bronze
146	Adam	Modic	Slovenia	54,54	bronze
147	Patrik	Znidarsic	Slovenia	54,33	bronze
148	Aleksandr	Beditski	Estonia	54,31	bronze
149	Ron Angelo Atienza	Gelacio	Philippines	53,64	bronze

HONORABLE MENTION

Rank	Name	Surname	Country	Total	Medal
150	Akobir Azamat Ogli	Narzullaev	Uzbekistan	52,36	honorable mention
151	Lennart Eneas	Horn	Switzerland	52,01	honorable mention
152	Konstantinos	Karakaras	Greece	51,83	honorable mention
153	Jorge	Garcia Ponce	Mexico	51,53	honorable mention
154	Axel	Dian	France	51,24	honorable mention
155	Nikolaos	Tsakiris	Greece	51,18	honorable mention
156	Mathieu	Salzburg	France	50,13	honorable mention
157	Thomas	Arkwright	France	48,49	honorable mention
158	Hasan	Abdul Rahman	Syria	48,12	honorable mention
159	Marcelo Josue	Escalante Barrera	El Salvador	47,58	honorable mention
160	Emile Norbert	Eeckhoudt	Belgium	47,17	honorable mention
161	Darko	Stojchev	North Macedonia	46,81	honorable mention
162	Tadas	Danilevicius	Lithuania	46,12	honorable mention
163	Tomas	Kvietkauskas	Lithuania	45,91	honorable mention
164	Shakindi Vihangana	Mahanaida Badalgei	Sri Lanka	44,60	honorable mention

Rank	Name	Surname	Country	Total
165	Sajjan	Raja	Pakistan	44,14
166	Edward	Chen	Canada	43,91
167	Ali	Alhasan	Syria	43,70
168	Nino	Abesadze	Georgia	42,50
169	Altti Olavi Juhanpoika	Makela	Finland	42,23
170	Alfredo Alessandro	Martinez Jimenez	El Salvador	42,14
171	Jens Peter	Nielsen	Denmark	41,63
172	Anne-Sophie Denise	Tilleman	Belgium	41,58
173	Ioane	Kapanadze	Georgia	41,14
174	Michael Ciaran	Gadaloff	Ireland	38,28
175	Samuel Joonatan	Klaver	Finland	38,06
176	Pascal Damain	Ojochide	Nigeria	37,67
177	Augusto	Palotti Amado	Uruguay	37,27
178	Ceri Jean	Arnott	Ireland	37,02
179	Wamiq Ali	Shaikh	Pakistan	36,97
180	Dimitrios-Polykarpos	Karakostas	Greece	36,20
181	Daniel Alexander	Isler	Switzerland	35,73
182	Ivana Sofia	Espinoza Bojorquez	Mexico	35,01
183	Said	Gasimov	Azerbaijan	34,60
184	Muhammad Hazim Bin	Saleem	Pakistan	34,54
185	Joao Pedro	Bonito Caldeira	Portugal	34,29
186	Jesus Alejandro	Colmenares	Venezuela	33,92
187	Ravshanoy	Mu	Tajikistan	33,86
188	Joseph Michael	Martyn	Ireland	33,59
189	Leonid	Sajkov	North Macedonia	33,56
190	Auriel	Guarino	Ireland	32,38
191	Dante	Breitwiller	France	32,29
192	Örn Steinar	Sigurbjörnsson	Iceland	31,26
193	Simon	Pitte	Belgium	31,13
194	Pascal	Otjens	Netherlands	30,05

Rank	Name	Surname	Country	Total
195	Agustin Marcelo	Di Salvatore Vomero	Uruguay	29,68
196	Danijel	Aleksic	Montenegro	29,13
197	Mihail	Trajkov	North Macedonia	29,04
198	Salman	Huseynov	Azerbaijan	28,49
199	Netta Karoliina	Karjalainen	Finland	28,41
200	Gagok	Tadevosyan	Armenia	28,36
201	Henrik Elias	Solheim	Norway	28,03
202	Jerome	Mayolet	Belgium	27,35
203	Blaz	Frelih	Slovenia	27,16
204	Wanjing	Li	Norway	26,85
205	Mathias Abildgaard	Alminde	Denmark	26,83
206	Thomas Svava	Mortensen	Denmark	25,99
207	Birta Rakel	Oskarsdottir	Iceland	25,57
208	Casper	Tops	Netherlands	24,71
209	Beatriz	Crisostomo Valerio Figueiredo	Portugal	24,25
210	Avtandil	Giorgadze	Georgia	24,02
211	Amna	Qaisar	Pakistan	23,42
212	Nursultan	Raimjanov	Kyrgyzstan	22,83
213	Miguel	Rodrigues Carrilho Borges	Portugal	21,78
214	Valentijn	Tromp	Netherlands	21,29
215	Oluwasola Mervelous	Olurankinse	Nigeria	20,50
216	Albert	Shang	Switzerland	20,44
217	Pavle	Dzuverovic	Montenegro	19,64
218	Solange Alejandra	Montero Gelves	Uruguay	18,42
219	Andrija	Djurovic	Montenegro	18,28
220	Kristin Sif	Daoadottir	Iceland	18,03
221	Emil Andsbjerg	Holm	Denmark	17,56
222	Aren	Hakobyan	Armenia	16,87
223	Ugonna Samuel	Umeh	Nigeria	15,26
224	Candela Soledad	Gomez Da Costa Leites	Uruguay	14,41
225	Baldur	Daoason	Iceland	14,13
226	Samu Matias	Huovinen	Finland	11,89
227	Ana Leonor	Alves Banquart Leitao	Portugal	10,62
228	Vuk	Ljumovic	Montenegro	9,40
229	Mukhammadzhon	Otakhonov	Tajikistan	9,18
230	Nino	Khelidze	Georgia	8,26
231	Joshua Omachonu	Abdullahi	Nigeria	8,01

ITU Green Campus

67th in the World, 32nd in Europe in UI GreenMetric Rankings

ITU, with its 140,000 global alumni, disseminates a strong global brand of excellence and prestige. Around the world, ITU alumni hold important roles, as decision-makers and leading strategists; from presidents, to prime ministers, to ministers, to heads of global engineering and financial corporations. Moreover, our alumni can be found, leading on the communication and health sectors, internationally and at home.

ITU stretches across five campuses located in the financial, cultural, and historic districts of the city of Istanbul. Ayazağa is the main campus of ITU, located in Maslak, the finance district of Istanbul. At UI GreenMetrics Rankings, Ayazağa Campus is ranked in the top 100 universities in the world. Our green campus is 67th in the world and the 32nd in Europe. A pond fed by rainwater provides a calm walking, riding and running area for campus residents. Moreover, the campus waste is recycled into clean energy through the "Sustainable Energy Base" project. The sustainable life model is an example of Istanbul with all its infrastructure.

Historical city campuses (Taşkışla, Maçka, and Gümüşsuyu) offer a unique environment for students to develop social and communicative skills while enjoying an urban cultural experience. The Tuzla Campus is located on the Anatolian side of the city and is at the seafront.

Dormitories on-campus supply accommodation for over 4500 students. ITU dorms are located in convenient locations allowing students to enjoy campus life. On-campus, various cafeterias provide both affordable and healthy meal options for students. All facilities provide access to campus services and are within close proximity to popular venues around Istanbul. The University has a multitude of athletics and social opportunities: tennis courts, gymnasiums, and an Olympic swimming pool. ITU has over 60 male and female teams competing in various levels in the university and national leagues. ITU campuses are bike-friendly with a bike-sharing system, 6 km bike road and the right of way for bikes.

With over 200 active student clubs and organizations on campus, plus varied resources of cosmopolitan Istanbul, student life at ITU is vibrant, educational, interactive and fun.

Transportation

All İTÜ campuses are located at points that offer public transportation alternatives. There are İTÜ stops between the routes; there are 8 bus lines in Europe and 2 bus lines in Anatolia. İTÜ metro stop is located in front of the main campus in Ayazağa, and Taşkışla and Gümüşsuyu campuses can be reached within a few minutes' walks from Taksim metro station. Taksim - Maçka cable car line is the transportation option between Taşkışla and Maçka campuses.

Istanbul is a metropolitan city and there are buses, trains, and tubes (metro) to and from İTÜ and other areas in the city until late hours.

There are two major airports in İstanbul.

From Istanbul Airport:

By HAVAIST shuttle;

It would be best to take the HAVAIST Airport Shuttle, which is the most convenient way to travel to the city center. Once you arrived in Taksim, you can take the metro to get to İTÜ Ayazağa station. Follow the İTÜ signs and you will find yourself at the entrance of İTÜ.

By taxi;

When you arrive at the airport you may take a cab to the Ayazağa Main Campus.

From Sabiha Gökçen Airport:

Sabiha Gökçen airport is the furthest and second major from the City.

By HAVABUS shuttle;

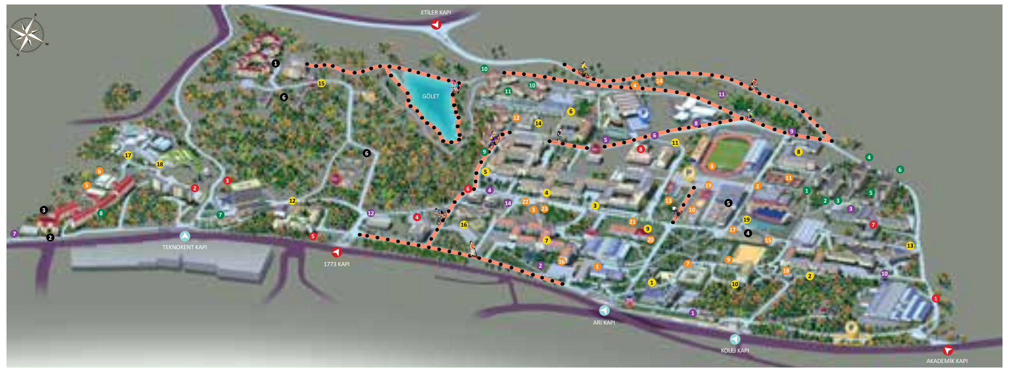
As mentioned above, you can take the HAVABUS airport shuttle at the airport exit gate to arrive in the city center, Taksim Square. Once you arrived in Taksim, you can take the metro to get to İTÜ Ayazağa station. Follow the İTÜ signs and you will find yourself at the entrance of İTÜ.

By taxi;

When you arrive at the airport you may take a cab.

Rent a Car

If you have an international driver's license, you can rent a car at Airport Car Rental Agencies.



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ISTANBUL TECHNICAL UNIVERSITY

IChO

52nd IChO 2020

REPUBLIC OF TURKEY MINISTRY OF INDUSTRY AND TECHNOLOGY

İTÜ

TÜBİTAK

ITU at a Glance

Founded in 1773 as a milestone in Turkey's modernization, Istanbul Technical University (ITU) has been leading technological progress. We've been shaping modern Turkey for more than 245 years with the motto "Pioneer through the Ages". ITU has been dedicated to education, research, knowledge generation, and innovation while preserving cultural and scientific heritage since its foundation.

ITU, the fourth oldest technical university of Europe and the World is devoted to developing a community of scientists, engineers, architects, and artists who can make a difference beyond borders. Our graduates have been decision-makers in Turkey and around the world, launching new institutions and enterprises. ITU acts as a hub bridging international cooperation with leading institutions, and creates the necessary environment for economic and technical growth. With 140.000 graduates, 40.000 students and 2.000 academicians, Istanbul Technical University pursue its mission by developing engineering and "social innovation" as a service to the nation and the world.

Education

Istanbul Technical University provides a technological & society focused education to **more than 40.000 undergraduate and graduate students** with **more than 2000 academicians** in fields ranging from engineering, architecture, and design to economics and music & performance arts. At ITU, we act in a multilayered and creative environment of learning and research in **14 faculties** across **5 campuses**. There are **67 undergraduate and 179 graduate programs**.

Through more than 140 international agreements including Erasmus, Athens, T.I.M.E. ITU offers its students to study at a global scale with its international engagements.

One aspect of globalization at ITU is to maintain international accreditation of its teaching quality, provided by the institutions below:

Fundamentals of Engineering and Professional Engineering exams, accredited by NCEES, the only eligible university to hold the exams in Turkey.

25 engineering programs accredited by the Accreditation Board for Engineering and Technology (ABET).

Maritime College accredited by IMO/EMSA.

Architecture Program obtained International Recognition from NAAB.

School of Foreign Languages accredited by Commission on English Language (CEA).

Landscape Architecture Program accredited by IFLA.

Research, Innovation & Impact

Istanbul Technical University is among the most qualified research-oriented universities in Turkey. Its objective is providing smart solutions to issues at a regional and global scale by generating new ideas, developing perspectives and creating values through research & innovation.

Entrepreneurship Ecosystem

Active in ITU Ayazağa Campus, ITU ARI Teknokent was founded on an area of **1,655,000 m²** with **10 buildings,** enabling over **2700 successful R&D projects** (**180+** of which are patented) and **$340 million exports** to contribute to the national economy.

Today at ITU ARI Teknokent, **300 R&D companies** that have reached a total of **$610 million** turnovers with over **7800 employees** to develop more than **600 projects** annually.

ITU ARI Teknokent carries out various programs for companies and entrepreneurs under its roof to achieve its objectives, including:

- **ITU ÇEKİRDEK**, the world's 3rd and Europe's 2nd early-stage Incubation Center for entrepreneurs that want to turn their ideas into commercializable products or services.
- **ITU MAGNET**, Advanced-Level Entrepreneurship Center for entrepreneurs and start-ups that succeeded in turning their ideas into products,
- **ITU INNOGATE**, International Accelerator for companies that are to introduce their products to the global market,
- **ITUNOVA TTO**, the technology transfer interface of ITU that aims for commercialization and protection of the academic data and providing multi-purpose support to help them succeed.

ITU ARI Teknokent goes on working to be a techno-park that **establishes ecosystems and creates value.**